IBC Chapter 17: Special Inspections & Testing

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Seminar Format

1. Introduction
2. The “Who”
3. The “What”
4. The “Where”
5. The “When”
6. The “How”
7. Miscellaneous

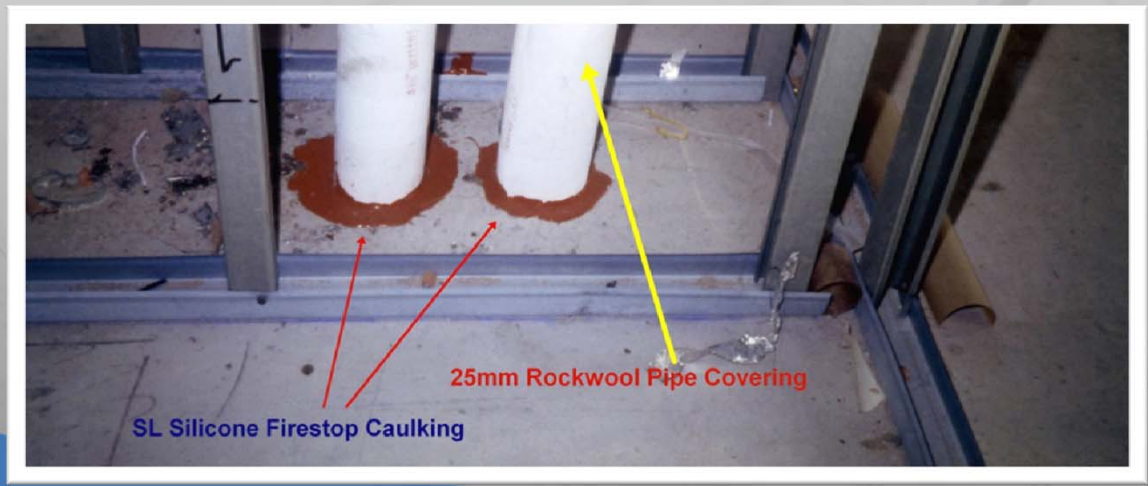
PART 1
Introduction

Introduction

- Inspections for structural components included in the first edition of the UBC (1927)
- The term “Special Inspections” first appeared in the 1961 edition of the UBC.
- BOCA first introduced special inspection requirements in 1988.
- The 2000 IBC merged the UBC and BOCA special inspection provisions into Chapter 17.
- **Special inspection requirements keep growing…**

Introduction

- Initially special inspections were **limited to structural components**.
- The 1996 BOCA code began requiring special inspections of non-structural items.
- The list of **non-structural items keeps growing** with every code cycle.



Introduction

- **IBC Chapter 17** has been completely re-organized.
- ** - The text or Table immediately following it has been relocated in the 2012 IBC.

Description	2009 IBC	2012 IBC
Statement of Special Inspections	1705.1	1704.3
Contractor Responsibility	1709.1	1704.4
Structural Observations	1710.1	1704.5
Special Cases	1704.15	1705.1.1
Vertical Masonry Foundation Elements	1704.11	1705.4.2
Special Inspections for Wind Resistance	1706.1	1705.10
Special Inspections for Seismic Resistance	1707.1	1705.11
Testing and Qualification for Seismic Resistance	1708.1	1705.12

Introduction

- **Key Terminology** (see IBC 202)
  - Approved Agency
  - Approved Fabricator
  - Certificate of Compliance
  - Fabricated Item
  - Special Inspection
    - Continuous Special Inspection
    - Periodic Special Inspection
  - Structural Observation
  - Designated Seismic System**

Introduction

- **Designated Seismic Systems** (IBC 202)
  - "Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor, I_p, is greater than 1 in accordance with Section 13.1.3 of ASCE 7."
  - What are **nonstructural components**?
  - Definition not provided in the IBC or ASCE 7.
  - Chapter 13 of ASCE 7 makes reference to architectural, mechanical, and electrical components

Introduction

- **Designated Seismic Systems** (cont.)
  - Nonstructural architectural, electrical or mechanical systems or components having an importance factor (I_p) > 1.0.
  - I_p=1.5 if any of the following exist…
    - Required to function for life-safety purposes after an earthquake.
    - Contains hazardous materials.
    - In or attached to a Risk Category IV structure and it is required for continued operation.

Introduction

- **Designated Seismic Systems** (cont.)
  - IBC 1705.12.3: "The registered design professional shall specify on the construction documents the requirements for certification… for nonstructural components and designated seismic systems."
  - In accordance with ASCE 7-10, Section 13.2

Introduction

Designated Seismic Systems (cont.)

- OSHPD allows components that are termed “rugged” as being exempt from certification.
- Applies to factory assembled components only.
  - Valves
  - Pneumatic operators
  - Hydraulic operators
  - Motors & motor operators
  - Horizontal & vertical pumps
  - Air compressors
  - Refrigerators & freezers
  - Elevator cabs
  - Underground tanks

PART 2

The “Who”

The "Who"

- Who are the major players?
  - Registered Design Professional
  - Owner
  - Contractor
  - Building Official
  - Special Inspector

The "Who"

- **Registered Design Professional:** Responsible for preparing "Statement of Special Inspections" (SSI).
- Who is the Registered Design Professional?
  - Architect?
  - Structural Engineer?
  - Mechanical Engineer?
  - Electrical Engineer?
  - Special Inspector?
- There may be more than one per discipline.

The "Who"

- **The Owner :** Responsible for engaging the Special Inspection and Testing Agencies.
- The Owner is responsible for the cost of the inspection and testing program.

The "Who"

- **The Contractor:** Responsible for providing a written statement of responsibility to the Building Official and the Owner prior to commencing work on structural system or component (IBC 1704.4).
- "The special inspection program does not relieve the Contractor of his or her responsibility to perform Quality Control." – *CASE, Guide to Special Inspection & Quality Assurance.*

The "Who"

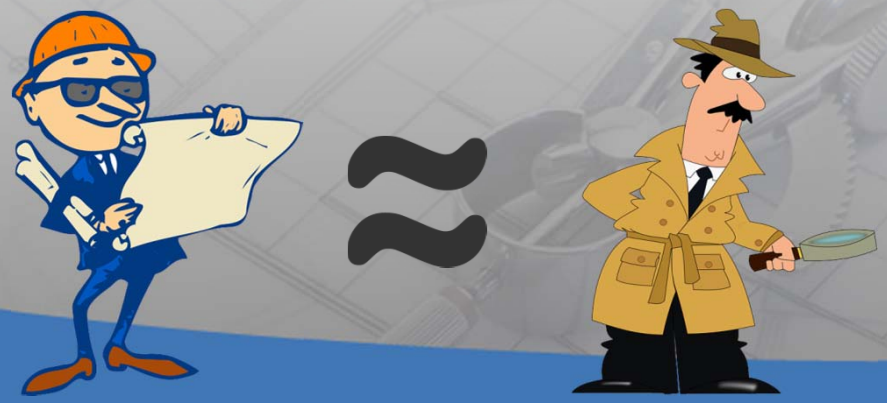
- **The Building Official:** Should…
  - Review the SSI and verify that all mandated inspections and tests are included.
  - Verify that the Special Inspector/Agency are qualified to perform their roles.
  - Review the qualifications of fabricators seeking exemption from shop inspections per IBC 1704.2.5.
  - Review inspection and testing reports and take appropriate actions if identified deficiencies are not corrected.

The "Who"

- **The Special Inspector:**
  - Should know and understand the scope of the SSI.
  - Verify that work complies with the approved construction documents.
  - Must notify the Contractor of any deficiencies that require corrective action.
  - Has no control over the Contractor's means and methods.
  - Does not have the authority to stop the work.
  - Shall not direct the Contractor as to how to correct a deficiency. That is the responsibility of the Registered Design Professional.

The "Who"

- **The Special Inspector (cont.):**
  - IBC 1704.2.1: EOR and their personnel are allowed to act as the "special inspector for the work designed by them, provided they qualify as special inspectors."
  - "The (Engineer of Record) should serve as the Special Inspector whenever possible and practical." – *CASE, Guide to Special Inspection & Quality Assurance.*



PART 3

The "What"

The "What"

- **Structural** special inspections include…
  - Fabricators (IBC 1704.2.5)**
  - Special cases (IBC 1705.1.1)**
  - Steel construction (IBC 1705.2)*
  - Concrete construction (IBC 1705.3)
  - Masonry construction (IBC 1705.4)*
  - Wood construction (IBC 1705.5)
  - Soils (IBC 1705.6)
  - …

The "What"

- **Structural** special inspections (cont.)
  - Driven deep foundations (IBC 1705.7)
  - Cast-in-place deep foundations (IBC 1705.8)
  - Helical pile foundations (IBC 1705.9)
  - High Wind (IBC 1705.10)
    - Structural wood, cold-formed steel, wind-resisting components (i.e. roof & wall cladding)
  - High Seismic (IBC 1705.11)*
    - Structural steel, structural wood, cold-formed steel, seismic isolation systems

The "What"

- **Non-structural** special inspections include…
  - Sprayed fire-resistant materials (IBC 1705.13)
  - Intumescent fire-resistant coatings (IBC 1705.14)
  - Exterior insulation & finish systems (IBC 1705.15)
  - Fire-resistant penetrations & joints (IBC 1705.16)
  - Smoke control (IBC 1705.17)
  - High Seismic (IBC 1705.11)
    - Designated seismic systems, architectural components, access floors, MEP components, storage racks

The "What"

- **Fabricator Approval** (IBC 1704.2.5):
  - We are talking about off-site fabrications of "structural load carrying members or assemblies".
  - What is the benefit of becoming an **"approved"** fabricator?
  - How does one become and approved fabricator?
  - What jurisdictions maintain a current list of "approved" fabricators?
  - If "approved", a **certificate of compliance** must be provided to the building official (see IBC 1704.2.5.2).

The "What"

- **Special Cases** (IBC 1705.1.1):
  - Items that are "in the opinion of the building official, unusual in nature".
  - This includes…
    - Alternative materials and systems
    - Unusual design applications
    - Specific Manufacturer requirements
  - What are some examples of special cases?

PART 4

The "Where"

The "Where"

- Where special inspections are required a **"Statement of Special Inspections"** must be submitted (IBC 107.1, IBC 1704.2.3, and IBC 1704.3).
- This shall include…
  - Materials, systems and components requiring inspection or testing.
  - Type or extent of each special inspection.
  - Type or extent of each test.
  - Additional items per 1705.10, 1705.11, and 1705.12
  - Identify either continuous or periodic inspection.

The "Where"

- The IBC provides us with example schedules…

TABLE 1704.4
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD[a]	IBC REFERENCE
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	—	X	ACI 318: 3.5, 7.1-7.7	1913.4
2. Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b.	—	—	AWS D1.4 ACI 318: 3.5.2	—
3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased or where strength design is used.	X	—	ACI 318: 8.1.3, 21.2.8	1911.5, 1912.1
4. Inspection of anchors installed in hardened concrete.	—	X	ACI 318: 3.8.6, 8.1.3, 21.2.8	1912.1
5. Verifying use of required design mix.	—	X	ACI 318: Ch. 4, 5.2-5.4	1904.2.2, 1913.2, 1913.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1913.10

The "Where"

- Several past IBC examples have been removed.

TABLE 1705.2.2
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL

VERIFICATION AND INSPECTION	CONTINUOUS		PERIODIC	REFERENCED STANDARD[a]
1. Material verification of cold-formed steel deck:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—		X	Applicable ASTM material standards
b. Manufacturer's certified test reports.	—		X	
2. Inspection of welding:				
a. Cold-formed steel deck:				
1) Floor and roof deck welds.	—		X	AWS D1.3
b. Reinforcing steel:				
1)Verification of weldability of reinforcing steel other than ASTM A 706.	—		X	
2) Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.		X	—	AWS D1.4 ACI 318: Section 3.5.2

PART 5

The “When”

The "When"

- There are still several instances when special inspections are not required.
- IBC 1704.2: Exceptions include…
  - B.O. waives the requirement as work is deemed **minor in nature** (IBC 1704.2).
  - **Group U** occupancies that are accessory to a residential occupancy.
  - **"Conventional"** cold-formed or wood light-framed construction.

The "When"

- Other Exceptions:
  - **Approved Fabricators** (IBC 1704.2.5.2)
  - **Concrete Construction** (IBC 1705.3)
    - Isolated spread footings for buildings 3-stories or less.
    - Continuous footings for buildings 3-stories or less where…
      - Supporting light-framed walls, or…
      - Design considers a compressive strength of 2,500psi.
    - Nonstructural concrete slabs and other flatwork.
    - Foundation walls per IBC Table 1807.1.6.2.

The "When"

- Other Exceptions:
  - **Masonry Construction** (IBC 1705.4)
    - Empirically designed masonry.
    - Masonry foundations per IBC prescriptive tables.
    - Fireplaces/chimneys constructed per IBC 2111-2113.
  - **Wood/ Cold-formed Construction**
    - Trusses spanning < 60-feet (IBC 1705.5.2 & 1705.2.2.2)
    - Diaphragm or wall nailing ≤ 4"o.c. (IBC 1705.11)
    - Gypsum or fiberboard sheathing (IBC 1705.11.3)

The "When"

- Other Exceptions:
  - **Soils** (IBC 1705.6)
    - If < 12-inch depth of structural fill (IBC 1803.5.8)
      - This still requires special inspection for in-place dry density of ≥ 90%.
  - **High Wind** (IBC 1705.10)
    - Exposure 'B' & V_{asd} ≥ 120mph ***(V_{ult} ≥ 155mph)***
    - Exposure 'C or D' & V_{asd} ≥ 110mph ***(V_{ult} ≥ 140mph)***

The "When"

- Other Exceptions:
  - **High Seismic** (IBC 1705.11)
    - Light-frame construction & SDS ≤ 0.5g & height ≤ 35-ft
    - Concrete or Masonry & SDS ≤ 0.5g & height ≤ 25-ft
    - Detached 1- or 2-family residence no more than 2-stories & having limited structural irregularities.
    - Structures & DSS in SDC 'B' or less
    - Architectural components, storage racks, and non-DSS nonstructural components in SDC 'C' or less

PART 6

The "How"

The "How"

- How do we create a project-specific SSI?
- **Example Projects** (SDC 'D', V_{ult} = 115mph)**:**
  - Example #1 – Single-story masonry retail building
  - Example #2 – 2-story wood-framed residence
  - Example #3 – 2-story wood-framed residence
  - Example #4 – 4-story steel-framed office building
  - Example #5 – Single-story prefab warehouse

The "How"

- **Keep in mind the following:**
  - Fabricated items
  - Special cases
  - Steel construction
  - Concrete construction
  - Masonry construction
  - Wood construction
  - Soils
  - Deep foundations
  - Special Wind/Seismic

The "How"

- **Example #1 – Single-story masonry retail building**
  - What items require special inspections?
  - This is what was actually provided…

> Special Inspection: Special inspection is required in accordance with IBC 1701.
>
> A. All concrete masonry units and reinforcing.
> B. Field welding.
> C. Epoxy bolts.

The "How"

- **Example #1 – Single-story masonry retail building**
  - Plan Review Comment #1:

> The "special inspection" portion of sheet Sxxx does not meet the requirements for a "Statement of Special Inspections" as required by IBC 1704.3. Not only should the items requiring special inspection/testing be noted, but the extent of the inspections/tests should be defined and the frequency (i.e. continuous or periodic) noted. Additional items requiring special inspection for this project may include soils, concrete, etc. Please address.

The "How"

- **Example #1 – Single-story masonry retail building**
  - The initial response/revisions provided follows…

Special Inspection: Special inspection is required in accordance with IBC 1701.

A. All concrete masonry units and reinforcing, level II, periodic.

B. Field welding. Periodic.

C. Epoxy bolts if apply. During installation.

D. Inspection of soil as noted on soil report. Periodic.

The "How"

- **Example #1 – Single-story masonry retail building**
  - See **Handout #1** for an example of what we should be providing in regards to a Statement of Special Inspections.

The "How"

- **Example #2 – 2-story wood-framed residence**
  - What items require special inspections?

The "How"

- **Example #3 – 2-story wood-framed residence**
  - What items require special inspections?

The "How"

- **Example #4 – 4-story steel-framed office building**
  - What items require special inspections?

The "How"

- **Example #5 – Single-story steel prefab warehouse**
  - What items require special inspections?

PART 6
Miscellaneous

Miscellaneous

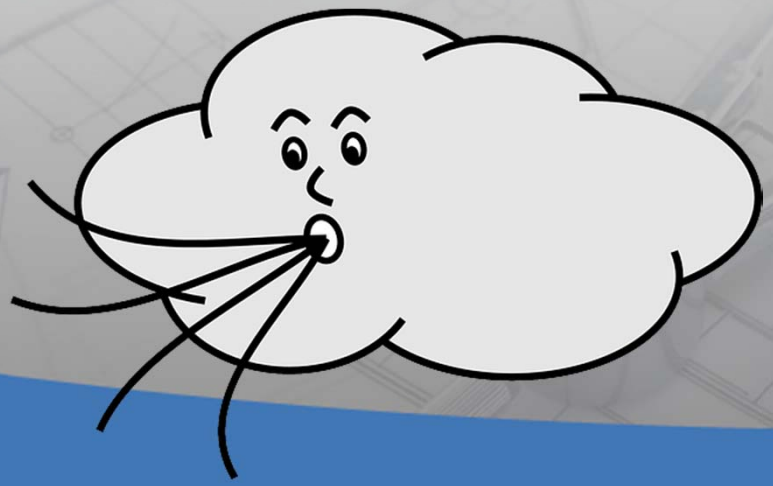
1. Structural Observations
2. Sample Documents
3. Conflicts of Interest
4. Evaluation Reports

Miscellaneous

- **Structural Observations** (IBC 1704.5.1):
  - SDC 'D or above' and…
    - All **Risk Category III or IV** Structures
    - All buildings greater than **75'** above the base.
    - Risk Category I or II buildings greater than two stories and located within **SDC 'E** or above'.
    - When designated by the registered design professional.
    - When specifically required by the B.O.

Miscellaneous

- **Structural Observations** (IBC 1704.5.2):
  - V_{asd} > 110mph *(V_{ult} > 140mph)* and…
    - All **Risk Category III or IV** Structures
    - All buildings greater than **75'** above the base.
    - When designated by the registered design professional.
    - When specifically required by the B.O.



Miscellaneous

- **Structural Observations** (cont.):
  - Performed by the registered design professional.
  - Includes:
    - A **written statement** provided to B.O. identifying the frequency and extent of the structural observations.
    - A **final report** sent to the B.O. stating that the requisite site visits have been made and report any deficiencies that have not yet been resolved.

Miscellaneous

- **Structural Observations** (cont.):
  - How do you determine what requires observation?
  - The code does not specify, but SEAONC lists…
  - **Foundations:**
    - **When:** During early stages of concrete work, at the engineer's discretion thereafter.
    - **What:** Footing layout, anchor bolts & dowels, formwork, reinforcing steel coverage/splicing/ congestion, utility penetrations, construction joints.

Miscellaneous

- **Structural Observations** (cont.):
  - **Steel Framing:**
    - **When:** After initial erection of the first section for large projects and after installation of most steel for smaller projects, at the engineer's discretion thereafter.
    - **What:** Frame joints & protected zones, trusses or long-span members, penetrations, complex connections, column splices.

Miscellaneous

- **Structural Observations** (cont.):
  - **Wood Framing:**
    - **When:** During rough framing; prior to covering nailing of diaphragm and shear wall nailing.
    - **What:** Member sizes, spacing & grade, diaphragm & shear wall nailing, drags & collectors, sole plate and double top plate nailing, connections, notches/holes in members.

Miscellaneous

- **Structural Observations** (cont.):
  - **Concrete Construction:**
    - **When:** During the early stages of concrete work, at the engineer's discretion thereafter.
    - **What:** Formwork, sleeves & blockouts, reinforcing cover/splicing/congestion, PT tendon layout, embedded items, quality of surface finish.

Miscellaneous

- **Structural Observations** (cont.):
  - **Masonry Construction:**
    - **When:** Early during the layup of wall, prior to first grout pour, and the engineer's discretion thereafter.
    - **What:** Wall materials, reinforcing steel size/position, sleeves/openings/blockouts, lintels/jambs, embedded items, grout space & cleanouts.

Miscellaneous

- **Structural Observations** (cont.):
  - **SEAONC** also lists the following strategies…
    - Walk the jobsite.
    - Be open to the unexpected.
    - Look at other building systems (i.e. Architectural, MEP)
    - Common problems on similar projects.
    - Look for field fixes.
    - Work associated with RFI's.
    - Complicated detailing items.
    - Spot check dimensions, spacing or other features.

Miscellaneous

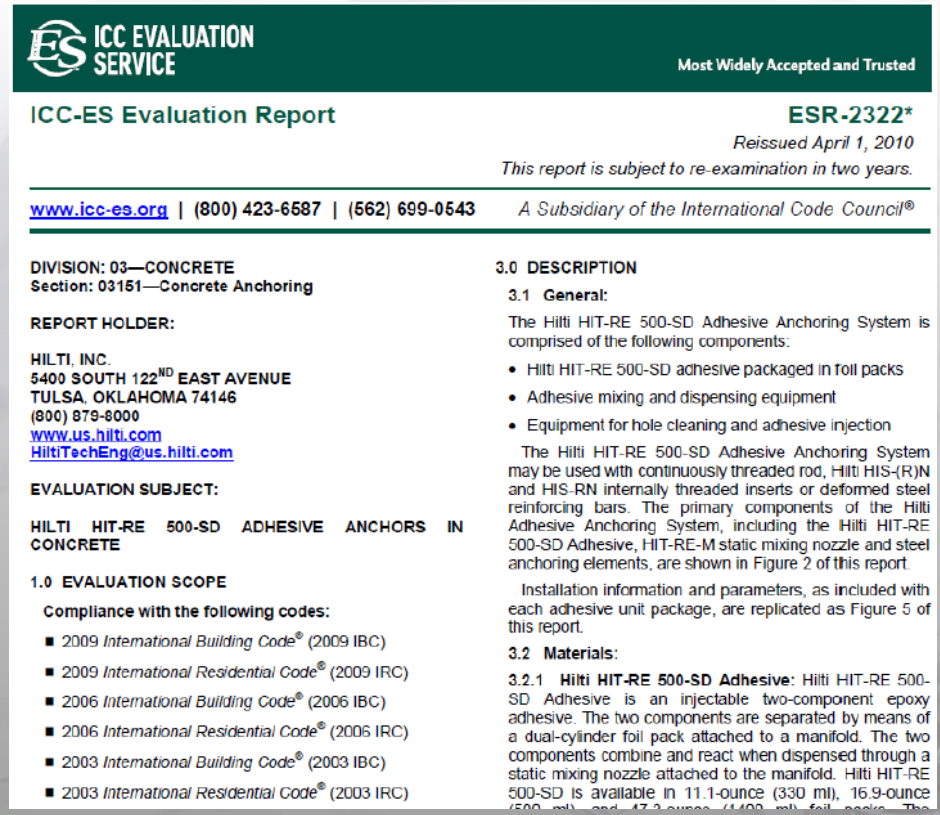
- **Sample Documents:**
  - Special Inspection Agreement – **Handout #2**
  - Fabricator's Certificate of Compliance – **Handout #3**
  - Structural Observation Agreement – **Handout #4**
  - Others provided in 2012 Edition of ICC's "Special Inspection Manual".

Miscellaneous

- Potential **Conflicts of Interest**:
  - When Contractor hires Special Inspectors.
  - What about when the Contractor is the Owner?
  - What if Special Inspector is hired by the owner, yet is employed by the Contractor on another project?
  - "Inspectors and testing agencies are required to disclose to the Building Official any potential conflicts of interest." – *CASE, Guide to Special Inspection & Quality Assurance.*
  - It is not a conflict of interest for the engineer of record to serve as the Special Inspector (U.S. House Subcommittee).

Miscellaneous

- **ICC-ES Reports:** Approved Criteria: AC01 – AC459



ICC EVALUATION SERVICE

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ICC-ES Evaluation Report

ESR-2322*

Reissued April 1, 2010

This report is subject to re-examination in two years.

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DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

REPORT HOLDER:

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EVALUATION SUBJECT:

HILTI HIT-RE 500-SD ADHESIVE ANCHORS IN CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 *International Building Code®* (2009 IBC)
- 2009 *International Residential Code®* (2009 IRC)
- 2006 *International Building Code®* (2006 IBC)
- 2006 *International Residential Code®* (2006 IRC)
- 2003 *International Building Code®* (2003 IBC)
- 2003 *International Residential Code®* (2003 IRC)

3.0 DESCRIPTION

3.1 General:

The Hilti HIT-RE 500-SD Adhesive Anchoring System is comprised of the following components:

- Hilti HIT-RE 500-SD adhesive packaged in foil packs
- Adhesive mixing and dispensing equipment
- Equipment for hole cleaning and adhesive injection

The Hilti HIT-RE 500-SD Adhesive Anchoring System may be used with continuously threaded rod, Hilti HIS-(R)N and HIS-RN internally threaded inserts or deformed steel reinforcing bars. The primary components of the Hilti Adhesive Anchoring System, including the Hilti HIT-RE 500-SD Adhesive, HIT-RE-M static mixing nozzle and steel anchoring elements, are shown in Figure 2 of this report.

Installation information and parameters, as included with each adhesive unit package, are replicated as Figure 5 of this report.

3.2 Materials:

3.2.1 Hilti HIT-RE 500-SD Adhesive: Hilti HIT-RE 500-SD Adhesive is an injectable two-component epoxy adhesive. The two components are separated by means of a dual-cylinder foil pack attached to a manifold. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold. Hilti HIT-RE 500-SD is available in 11.1-ounce (330 ml), 16.9-ounce (500 ml), and 47.2-ounce (1400 ml) foil packs. The

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Any Questions?

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