2007-2008 ICC CODE DEVELOPMENT CYCLE

ERRATA TO THE 2007/2008 PROPOSED CHANGES TO THE INTERNATIONAL CODES

1/17/08

The following errata to the monograph is a compilation of errata discovered since the publication of the monograph in December 2007. Note that this includes errata posted on the ICC web site on November 15, December 21, 2007 and January 17, 2008 and combines those errata into one package for each code change committee. Also, where there were errata to the hearing order, a new comprehensive hearing order has been included.

The errata are listed in Track 1 and Track 2 Hearing Order.

TABLE OF CONTENTS

2007/2008 ICC CODE DEVELOPMENT SCHEDULE

STEP IN CODE DEVELOPMENT CYCLE	DATE
DEADLINE FOR RECEIPT OF APPLICATIONS FOR CODE COMMITTEES	July 2, 2007
DEADLINE FOR RECEIPT OF CODE CHANGE PROPOSALS	August 20, 2007
PUBLICATION DATE FOR MONOGRAPH OF "PROPOSED CHANGES TO THE I-CODES"	December 18, 2007
CODE DEVELOPMENT HEARING (CDH)	**February 18-March 2, 2008** Palm Springs Convention Center Palm Springs, CA
PUBLICATION DATE FOR "REPORT OF THE PUBLIC HEARING"	April 24, 2008
DEADLINE FOR RECEIPT OF PUBLIC COMMENTS	June 9, 2008
PUBLICATION DATE OF PUBLIC COMMENTS "FINAL ACTION AGENDA"	August 15, 2008
FINAL ACTION HEARING (FAH)	**September 17-23, 2008** Minneapolis Convention Center Minneapolis, MN
ANNUAL CONFERENCES	**September 30- October 3, 2007** 2007 ICC Annual Educational Conference Grand Sierra Resort Reno, NV **September 14 – 23, 2008** 2008 ICC Annual Conference and FAH Minneapolis Convention Center Hotel TBD
RESULTING PUBLICATION	2009 Editions

Publication dates indicate approximate date when the printed copy of the document will be available. These documents will be posted on the ICC website approximately 4 weeks prior to availability of the printed version.

TRACK 1
INTERNATIONAL RESIDENTIAL CODE (Volume 2)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Revise G3-07/08, Part II to become G3-07/08, Part III on IRC B/E Hearing Order
Revise G4-07/08, Part II to become G4-07/08, Part III on IRC B/E Hearing Order
Remove RB28-07/08 from the IRC B/E Hearing Order

TENTATIVE ORDER OF DISCUSSION
Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL RESIDENTIAL CODE

BUILDING/ENERGY

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

IRC ENERGY
RE1-07/08
RE2-07/08, Part I
- EC10-07/08, Part II
- EC11-07/08, Part II
- EC3-07/08, Part II
- EC5-07/08, Part II
- EC7-07/08, Part II

RE4-07/08
RE5-07/08
RE6-07/08
RE7-07/08
- EC15-07/08, Part II
- EC18-07/08, Part II
- EC19-07/08, Part II
- EC20-07/08, Part II
- EC21-07/08, Part II
- EC22-07/08, Part II
- EC23-07/08, Part II
- EC25-07/08, Part II
- EC28-07/08, Part II
- EC34-07/08, Part II
- EC36-07/08, Part II
- EC37-07/08, Part II
- EC42-07/08, Part II
- EC43-07/08, Part II
- EC45-07/08, Part II
- EC47-07/08, Part II
- EC48-07/08, Part II
- EC49-07/08, Part II
- EC50-07/08, Part II
- EC51-07/08, Part II
- EC56-07/08, Part II
- EC57-07/08, Part II
- EC58-07/08, Part II
- EC59-07/08, Part II
- EC60-07/08, Part II
- EC62-07/08, Part II
- EC63-07/08, Part II
- EC64-07/08, Part II
- EC65-07/08, Part II

RE8-07/08
- FS177-07/08, Part III
- EC68-07/08, Part II
- EC69-07/08, Part II
- EC70-07/08, Part II
- EC71-07/08, Part II
- EC72-07/08, Part II
- EC74-07/08, Part II
- EC53-07/08, Part II
- EC78-07/08, Part II
- EC79-07/07, Part II
- EC80-07/08, Part II
- EC81-07/08, Part II
- EC83-07/08, Part II
- EC84-07/08, Part II
- EC96-07/08, Part II
- EC97-07/08, Part II
- RE3-07/08
- EC152-07/08, Part II

IRC BUILDING
- G105-07/08, Part II

RB1-07/08
- G2-07/08, Part II
- G3-07/08, Part ~~II~~ III
- G4-07/08, Part ~~II~~ III

RB2-07/08
RB3-07/08
- G5-07/08, Part II

RB4-07/08
RB5-07/08
RB6-07/08
- G6-07/08, Part III

RB7-07/08
RB8-07/08
RB9-07/08
RB10-07/08
- G12-07/08, Part IV
- G16-07/08, Part VII
- G17-07/08, Part VI
- RB230-07/08

RB12-07/08
- S79-07/08, Part II

RB13-07/08
- S15-07/08, Part II
- S82-07/08, Part II

RB14-07/08
RB15-07/08
RB16-07/08
RB17-07/08
RB18-07/08
RB19-07/08
- S50-07/08, Part II

RB20-07/08
RB21-07/08
RB22-07/08
RB23-07/08
RB24-07/08
RB25-07/08
RB26-07/08
RB27-07/08
- FS184 -07/08, Part II

~~RB28-07/08~~
- G178-07/08, Part II

RB29-07/08
- G106-07/08, Part II

RB30-07/08

RB31-07/08
RB32-07/08
RB33-07/08
RB34-07/08
RB35-07/08
RB36-07/08
RB37-07/08
RB38-07/08
RB39-07/08
RB40-07/08
RB41-07/08
RB42-07/08
RB43-07/08
RB44-07/08
RB45-07/08
E142-07/08, Part II
E143-07/08, Part II
E37-07/08, Part II
RB46-07/08
RB47-07/08
RB48-07/08
RB49-07/08
RB50-07/08
RB51-07/08
RB52-07/08
E57-07/08, Part II
E58-07/08, Part II
E59-07/08, Part II
E60-07/08, Part II
RB53-07/08
RB54-07/08
RB55-07/08
RB56-07/08
RB57-07/08
RB58-07/08
RB59-07/08
RB60-07/08
RB61-07/08
E85-07/08, Part II
S72-07/08, Part II
RB62-07/08
RB63-07/08
RB64-07/08
RB65-07/08
RB66-07/08
RB67-07/08
RB68-07/08
RB69-07/08
RB70-07/08
RB71-07/08
RB72-07/08
RB73-07/08
RB74-07/08
RB75-07/08
RB76-07/08
RB77-07/08
RB78-07/08
FS189-07/08, Part II
RB79-07/08
RB80-07/08
RB81-07/08
RB82-07/08
RB83-07/08
FS86-07/08, Part II
FS87-07/08, Part II
RB84-07/08
RB85-07/08
RB86-07/08
S219-07/08, Part II
RB87-07/08
RB88-07/08
RB89-07/08
RB90-07/08
RB91-07/08
RB92-07/08
RB93-07/08
RB94-07/08
RB95-07/08
RB96-07/08
RB97-07/08
RB98-07/08
RB99-07/08
RB100-07/08
G109-07/08, Part II
S154-07/08, Part II
S148-07/08, Part II
RB101-07/08
RB102-07/08
RB103-07/08
RB104-07/08
RB105-07/08
RB106-07/08
RB107-07/08
RB108-07/08
RB109-07/08
RB110-07/08
RB111-07/08
RB112-07/08
RB113-07/08
S155-07/08, Part II
RB114-07/08
RB115-07/08
RB116-07/08
RB171-07/08
RB117-07/08
RB118-07/08
RB119-07/08
RB120-07/08
RB121-07/08
S159-07/08, Part II
RB122-07/08
RB123-07/08
RB124-07/08
RB125-07/08
S215-07/08, Part II
RB126-07/08
RB11-07/08
RB127-07/08
RB168-07/08
RB182-07/08
RB209-07/08
RB128-07/08
RB129-07/08
RB130-07/08
RB131-07/08
S227-07/08, Part II
RB132-07/08
RB133-07/08
RB134-07/08
RB135-07/08
RB136-07/08
RB137-07/08
RB138-07/08
RB139-07/08
FS4-07/08, Part II
FS5-07/08, Part VI
RB140-07/08
FS147-07/08, Part II
RB141-07/08
RB142-07/08
RB143-07/08
RB144-07/08
RB145-07/08
RB146-07/08
RB147-07/08
RB148-07/08
RB149-07/08
RB150-07/08
RB151-07/08
RB152-07/08
RB153-07/08
RB154-07/08
RB155-07/08
RB156-07/08
RB157-07/08
RB158-07/08
RB159-07/08
RB160-07/08
RB161-07/08
RB162-07/08
RB163-07/08
RB164-07/08
RB165-07/08
RB166-07/08
RB167-07/08
RB169-07/08
RB170-07/08
RB172-07/08
RB173-07/08, Part I
RB174-07/08, Part I
S141-07/08, Part II
RB175-07/08
RB176-07/08
RB177-07/08
RB178-07/08
RB179-07/08
RB180-07/08
S232-07/08, Part II
RB181-07/08
RB183-07/08
RB184-07/08
RB185-07/08
RB186-07/08
RB187-07/08
RB188-07/08
RB189-07/08
RB190-07/08
RB191-07/08
RB192-07/08
RB193-07/08
RB194-07/08
RB195-07/08
RB196-07/08
RB197-07/08
RB198-07/08
RB199-07/08
RB200-07/08
RB201-07/08
FS175-07/08, Part II
FS182-07/08, Part II
FS174-07/08, Part II
RB202-07/08
RB203-07/08
RB204-07/08
S214-07/08, Part II
RB205-07/08
RB206-07/08
RB207-07/08
RB208-07/08
G179-07/08, Part II
RB210-07/08
RB211-07/08
RB212-07/08
RB213-07/08
S18-07/08, Part II
S19-07/08, Part II
S20-07/08, Part II
RB214-07/08
S25-07/08, Part II
S26-07/08, Part II
S6-07/08, Part II
S5-07/08, Part II
RB215-07/08
RB216-07/08
S29-07/08, Part II
S30-07/08, Part II
S35-07/08, Part II
S37-07/08, Part II
S44-07/08, Part II
S194-07/08, Part II
S195-07/08, Part II
S197-07/08, Part II
S198-07/08, Part II
S199-07/08, Part II
S196-07/08, Part II
RB217-07/08
RB218-07/08
RB219-07/08
S237-07/08, Part II
RB220-07/08
RB221-07/08
RB222-07/08
RB223-07/08, Part I
RB224-07/08, Part I
RB225-07/08, Part I
RB226-07/08, Part I
RB227-07/08, Part I
RB228-07/08
G180-07/08, Part II
RB229-07/08

RB39-07/08: Replace the first Item 10 in Section R308.4 to read as follows:

10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

RB76-07/08: Replace the proposal with the following:

RB76–07/08
R314.5.3, R314.5.4

Proponent: Marcelo M. Hirschler, GBH International, representing American Fire Safety Council

Revise as follows:

R314.5.3 Attics. The thermal barrier specified in Section 314.4 is not required where attic access is required by Section R807.1 and where the space is entered only for service of utilities and when the foam plastic insulation is protected against ignition using one of the following ignition barrier materials:

1. 1.5-inch-thick (38 mm) mineral fiber insulation;
~~2. 0.25-inch-thick (6.4 mm) wood structural panels;~~
~~3. 0.375-inch (9.5 mm) particleboard;~~
~~4. 0.25-inch (6.4 mm) hardboard;~~
~~5.~~ 2. 0.375-inch (9.5 mm) gypsum board; ~~or~~
~~6.~~ 3. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm); or
4. Other approved material.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R314.6.

R314.5.4 Crawl spaces. The thermal barrier specified in Section 314.4 is not required where crawlspace access is required by Section R408.3 and where entry is made only for service of utilities and when the foam plastic insulation is protected against ignition using one of the following ignition barrier materials:

1. 1.5-inch-thick (38 mm) mineral fiber insulation;
~~2. 0.25-inch-thick (6.4 mm) wood structural panels;~~
~~3. 0.375-inch (9.5 mm) particleboard;~~
~~4. 0.25-inch (6.4 mm) hardboard;~~
~~5.~~ 2. 0.375-inch (9.5 mm) gypsum board; ~~or~~
~~6.~~ 3. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm); or
4. Other approved material.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R314.6.

The Reason and Cost impact remain as they were published in the Monograph.

RB102-07/08: Replace the proposal with the following:

RB102–07/08
R401.3

Proponent: Gary J. Ehrlich, National Association of Home Builders (NAHB)

Revise as follows:

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection so as to not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), the final grade shall slope away from the foundation at a minimum slope of ~~5~~ 2 percent and the water shall be directed to drains or swales to ensure drainage away from the structure. Swales shall be sloped a minimum of ~~2~~ 1 percent when located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

(Reason and cost impact remain as published)

RB172-07/08: Add the following:

Analysis: A review of the standard proposed for inclusion in the code, ASTM E2112-07, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

RB220-06/07: Revise the proposal as follows:

1. Add Canadian Standards Association (CSA) as follows:

CSA

Canadian Standards Association
5060 Spectrum Way, Suite 100
Mississauga, Ontario, Canada L4W 5N6

Standard reference number	Title
~~0~~ O325~~.0—92~~ 07	Construction Sheathing ~~(Reaffirmed 1998)~~
~~0~~O437-Series—93	Standards on OSB and Waferboard (Reaffirmed ~~2001~~ 2006)

2. Revise Underwriters Laboratories (UL) by adding 325-2002 as follows:

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

Standard reference number	Title
325-2002	**Door, Drapery, Louver and Window Operators and Systems – with Revisions through February 2006**
726-1995	**Oil Fired Boiler Assemblies – with Revisions through ~~February~~ March 2006**
959—01	Medium Heat Appliance Factory-built Chimneys-with Revisions through September 2006
2158A-2006 ~~96~~	**Outline of Investigation for Clothes Dryer Transition Duct**

RB223-07/08: Replace Part I and Part II reason statements as follows:

PART I – IRC
Reason: The purpose of the proposed code change is to clarify the intent of the current language, to correct the punctuation and to create uniformity with the IBC. With the recent introduction of inflatable pools (usually blue) to the market place, a new hazard has emerged. According to the Consumer Product Safety Commission web site, the number of children dying in these types of pools is growing at an alarming rate.

The depth clarification was addressed by a formal ICC interpretation this past year and this code change simply puts that interpretation into the text of the code. Many homeowners would simply lower the water level of the pool to a depth just under 24 inches for the inspection and claim to be exempt.

The portable and inflatable language was added because many homeowners mistakenly believe that because these types of pools are exempt from the electrical code that they are also exempt from the building codes. For this reason, many inspectors are also hesitant to enforce the current pool safety barrier requirements because inflatable and portable pools are not specifically listed and/or are mistakenly thought to be unregulated due to their temporary nature.

Wading pool language was added for consistency with the IBC definition of a swimming pool.

PART II – IBC GENERAL
Reason: The purpose of the proposed code change is to clarify the intent of the current language, to correct the punctuation and to create uniformity with the IRC. With the recent introduction of inflatable pools (usually blue) to the market place, a new hazard has emerged. According to the Consumer Product Safety Commission web site, the number of children dying in these types of pools is growing at an alarming rate.

The depth clarification was addressed by a formal ICC interpretation this past year and this code change simply puts that interpretation into the text of the code. Many homeowners would simply lower the water level of the pool to a depth just under 24 inches for the inspection and claim to be exempt.

The portable and inflatable language was added because many homeowners mistakenly believe that because these types of pools are exempt from the electrical code that they are also exempt from the building codes. For this reason, many inspectors are also hesitant to enforce the current pool safety barrier requirements because inflatable and portable pools are not specifically listed and/or are mistakenly thought to be unregulated due to their temporary nature.

RB225-07/08: Replace Part I and Part II reason statements as follows:

PART I – IRC
Reason: The purpose of this code change is to clarify the intent of pool barrier requirements to include language that would address common elements that defeat the safety barriers.

With the introduction of inflatable pools, a new issue has emerged. These pools allow for easy climbing by young children, as demonstrated in the video on the Consumer Product Safety Commission web site, due to the soft texture and sloped sides. Owners of these pools claim that the 4 foot high sides of these climbable pools meet the barrier requirements of the code. While common sense dictates that having a climbable barrier does not meet the intent of the code, the code does not currently contain language to that effect, which is leading to enforcement difficulties in the field. According to the Consumer Product Safety Commission web site, the death toll from these pools is rising at an alarming rate.

Some of the fabric sided above ground pools have pockets for the support bars that offer a ladder effect into the pool, effectively eliminating the effectiveness of the safety that the sides of the pool would otherwise provide. Metal sided above ground pools often have angled braces to support the pool side walls that small children can easily climb. Pool filters, pumps and other ancillary pool accessories are often placed next to the above ground pool and act as easy steps into the pool. None of these issues are addressed in the current code language. Because this code change is only a clarification, the code change will not increase the cost of construction.

PART II – IBC GENERAL
~~Reason (Part I):~~ ~~This code change recognizes the promulgation of APSP-7 (2006) "American National Standard For Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins". This standard is basically a construction standard but it does not require the same entrapment protection as that provided for in the existing IBC Code requirements. Thus, the Pool Safety Consortium has maintained the Section requiring atmospheric vacuum relief systems.~~

~~The APSP's Suction Entrapment Avoidance Standard is based upon the following premises:~~

~~4.3"*There is no backup for a missing or damaged suction outlet cover/grate. If any cover/grate is found to be damaged or missing, the pool or spa shall be immediately closed to bathers.*"~~

~~*5.1" General, Methods to avoid entrapment in circulation systems, swim jet systems, alternative suction systems, and debris removal systems are shown in 5.2 through 5.10.*~~

~~APSP's long held position is that Dual outlets (Sec. 5.3) is the only necessary entrapment avoidance method and back up systems such as Safety Vacuum Release Systems are not needed and an unnecessary added expense to the cost of a pool or spa. Notice for Sec. 5.1 above there is no back up (additional layer of protection) for when unforeseen blockage occurs or especially contractor error, Contractor error has been documented in past and recent entrapment investigations by the US CPSC.~~
~~This formula for safety presumes that a child or a responsible party understands the clear and present danger of a missing or damaged cover or grate, and is informed enough to know that the pool or spa should immediately be closed to bathers. This safety prescription is short sighted, and does not protect the child or parent from their own lack of understanding as to the degree of danger this condition represents.~~
~~Many entrapment accidents happen when the child themselves remove the drain cover. In a recent evisceration case in Minneapolis, Minn., the drain cover was reported to be floating next to the child's body.~~
~~The safety standards now promulgated under the IBC and IRC recognize the need for a safety formula that requires an additional degree of protection to guard against the possibility of body or limb entrapment on a single functioning suction outlet with a missing or broken suction outlet cover.~~

~~APSP's guidelines for dual suction outlets as detailed in Section 5 of the Standard are not descriptive enough to provide direction to the Industry or the Code Officials as to how to construct a safe dual drain system.~~

~~When two suction outlets are flowing, and one is blocked by a bather, there is a resultant hold down force on the bather proportional to the exposed area of the suction outlet blocked, and proportional to the dynamic pressure drop in the branch piping.~~

~~The Standard does require a 3 ft/sec velocity limit in branch suction piping between suction outlets (see 4.4 Water velocity). This limit further restricts branch suction piping velocity to 8 ft/sec when one suction outlet is blocked. While the dynamic pressure drop in the branch piping is proportional to the square of the velocity in the pipe, it is also affected by entrance losses through outlet covers and grates, as well as separation distances and piping configurations.~~

~~Thorough testing for one of the ASTM 15.51 Sub-Committees has shown that the 3ft/sec can not be accomplished when 2" PVC piping is used in the interconnecting piping (see figure 1- Pipe Velocity of section 4.4). How is a building inspector to know what the velocity is before OR after the pool/spa is built?~~

~~Figure 4 of this section states "*minimum distance 3 feet apart*". Testing shows that there is a definite increase in hold down force the further apart the suction outlets are placed.~~

~~The Standard does not provide the Industry or the Code Officials with the necessary criteria in terms of suction outlet covers, piping configurations and allowable fittings, and maximum allowable suction outlet separation distances. Lacking this information, the Standard does not adequately protect the bathing public from the risk of entrapment due to dynamic hold down forces on dual suction outlets.~~

~~APSP's guidelines for Engineered Vent Systems detailed in Section 7.2 of the Standard are not descriptive enough to provide direction to the Industry or the Code Officials as to how to construct a safe vent line system.~~

~~So called "Engineered" vent line systems have been used in Florida for the past five years, with no consideration given to static differential forces, and the hold down force that results when a bather blocks a single functioning suction outlet. The Standard lacks descriptive information regarding the requirement for hydrostatically balanced vent line designs, to mitigate the affect of static differential hold down forces.~~

~~In April of 2004, Mr. Art Kamm, P.E. wrote a letter to the Florida Building Commission's Plumbing Technical Advisory Committee, detailing the resulting affect caused by static differentials in improperly designed vent lines. The hold-down force created by an evacuated deep vent line in a 6 foot deep pool, can exceed 100 lbs on a single operating open suction outlet sump. This force is excessive and dangerous.~~

~~The Standard does not provide the Industry or the Code Officials with the necessary criteria in terms of hydraulically balanced vent line design. Lacking this information, the Standard does not adequately protect the bathing public from the risk of entrapment due to static differential hold-down forces on a single functioning suction outlet.~~

~~APSP 7 allows alternative methods to be determined by the "*authority having jurisdiction*". This loophole was used in Florida to allow the use of the Hayward "Drain Flapper" as a substitute for the SVRS for years before the Florida Building Commission found it to unsafe and reversed the position allowing it's use as a final layer of protection.~~

~~These arguments and others were presented to the IBC and the IRC when APSP attempted to remove the requirement for atmospheric vacuum relief systems. To date, the ICC has appropriately rejected these arguments during the last two code cycles.~~

~~**Cost Impact:** The code change proposal will increase the cost of construction.~~

~~**Analysis:** A review of the standard proposed for inclusion in the code, APSP-7 (2006), for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.~~

Reason: The purpose of this code change is to clarify the intent of pool barrier requirements to include language that would address common elements that defeat the safety barriers. While this is primarily an IRC issue, it should be added to the IBC for consistency and for those residential projects that may need to deal with this issue.

With the introduction of inflatable pools, a new issue has emerged. These pools allow for easy climbing by young children, as demonstrated in the video on the Consumer Product Safety Commission web site, due to the soft texture and sloped sides. Owners of these pools claim that the 4 foot high sides of these climbable pools meet the barrier requirements of the code. While common sense dictates that having a climbable barrier does not meet the intent of the code, the code does not currently contain language to that effect, which is leading to enforcement difficulties in the field. According to the Consumer Product Safety Commission web site, the death toll from these pools is rising at an alarming rate.

Some of the fabric sided above ground pools have pockets for the support bars that offer a ladder effect into the pool, effectively eliminating the effectiveness of the safety that the sides of the pool would otherwise provide. Metal sided above ground pools often have angled braces to support the pool side walls that small children can easily climb. Pool filters, pumps and other ancillary pool accessories are often placed next to the above ground pool and act as easy steps into the pool. None of these issues are addressed in the current code language. Because this code change is only a clarification, the code change will not increase the cost of construction.

RB226-07/08: Add reason statement for Part I as follows:

Reason (Part I): This code change recognizes the promulgation of APSP-7 (2006) "American National Standard For Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins". This standard is basically a construction standard but it does not require the same entrapment protection as that provided for in the existing IBC Code requirements. Thus, the Pool Safety Consortium has maintained the Section requiring atmospheric vacuum relief systems.

The APSP's Suction Entrapment Avoidance Standard is based upon the following premises:

> 4.3"*There is no backup for a missing or damaged suction outlet cover/grate. If any cover/grate is found to be damaged or missing, the pool or spa shall be immediately closed to bathers."*
>
> *5.1" General, Methods to avoid entrapment in circulation systems, swim jet systems, alternative suction systems, and debris removal systems are shown in 5.2 through 5.10.*

APSP's long held position is that Dual outlets (Sec. 5.3) is the only necessary entrapment avoidance method and back up systems such as Safety Vacuum Release Systems are not needed and an unnecessary added expense to the cost of a pool or spa. Notice for Sec. 5.1 above there is no back-up (additional layer of protection) for when unforeseen blockage occurs or especially contractor error, Contractor error has been documented in past and recent entrapment investigations by the US-CPSC.

This formula for safety presumes that a child or a responsible party understands the clear and present danger of a missing or damaged cover or grate, and is informed enough to know that the pool or spa should immediately be closed to bathers. This safety prescription is short sighted, and does not protect the child or parent from their own lack of understanding as to the degree of danger this condition represents.

Many entrapment accidents happen when the child themselves remove the drain cover. In a recent evisceration case in Minneapolis, Minn., the drain cover was reported to be floating next to the child's body.

The safety standards now promulgated under the IBC and IRC recognize the need for a safety formula that requires an additional degree of protection to guard against the possibility of body or limb entrapment on a single functioning suction outlet with a missing or broken suction outlet cover.

APSP's guidelines for dual suction outlets as detailed in Section 5 of the Standard are not descriptive enough to provide direction to the Industry or the Code Officials as to how to construct a safe dual drain system.

When two suction outlets are flowing, and one is blocked by a bather, there is a resultant hold down force on the bather proportional to the exposed area of the suction outlet blocked, and proportional to the dynamic pressure drop in the branch piping.

The Standard does require a 3 ft/sec velocity limit in branch suction piping between suction outlets (see 4.4 Water velocity). This limit further restricts branch suction piping velocity to 8 ft/sec when one suction outlet is blocked. While the dynamic pressure drop in the branch piping is proportional to the square of the velocity in the pipe, it is also affected by entrance losses through outlet covers and grates, as well as separation distances and piping configurations.

Thorough testing for one of the ASTM 15.51 Sub-Committees has shown that the 3ft/sec can not be accomplished when 2" PVC piping is used in the interconnecting piping (see figure 1- Pipe Velocity of section 4.4). How is a building inspector to know what the velocity is before OR after the pool/spa is built?

Figure 4 of this section states "*minimum distance 3 feet apart*". Testing shows that there is a definite increase in hold down force the further apart the suction outlets are placed.

The Standard does not provide the Industry or the Code Officials with the necessary criteria in terms of suction outlet covers, piping configurations and allowable fittings, and maximum allowable suction outlet separation distances. Lacking this information, the Standard does not adequately protect the bathing public from the risk of entrapment due to dynamic hold-down forces on dual suction outlets.

APSP's guidelines for Engineered Vent Systems detailed in Section 7.2 of the Standard are not descriptive enough to provide direction to the Industry or the Code Officials as to how to construct a safe vent line system.

So called "Engineered" vent line systems have been used in Florida for the past five years, with no consideration given to static differential forces, and the hold-down force that results when a bather blocks a single functioning suction outlet. The Standard lacks descriptive information regarding the requirement for hydrostatically balanced vent line designs, to mitigate the affect of static differential hold-down forces.

In April of 2004, Mr. Art Kamm, P.E. wrote a letter to the Florida Building Commission's Plumbing Technical Advisory Committee, detailing the resulting affect caused by static differentials in improperly designed vent lines. The hold-down force created by an evacuated deep vent line in a 6 foot deep pool, can exceed 100 lbs on a single operating open suction outlet sump. This force is excessive and dangerous.

The Standard does not provide the Industry or the Code Officials with the necessary criteria in terms of hydraulically balanced vent line design. Lacking this information, the Standard does not adequately protect the bathing public from the risk of entrapment due to static differential hold-down forces on a single functioning suction outlet.

APSP-7 allows alternative methods to be determined by the "*authority having jurisdiction*". This loophole was used in Florida to allow the use of the Hayward "Drain Flapper" as a substitute for the SVRS for years before the Florida Building Commission found it to unsafe and reversed the position allowing it's use as a final layer of protection.

These arguments and others were presented to the IBC and the IRC when APSP attempted to remove the requirement for atmospheric vacuum relief systems. To date, the ICC has appropriately rejected these arguments during the last two code cycles.

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, APSP-7 (2006), for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

IBC –MEANS OF EGRESS (VOLUME 1)

E6-07/08: Revise definition of "Exit Passageway" to read as follows:

EXIT PASSAGEWAY. An exit component that is separated from all other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a primarily horizontal direction to ~~the~~ an exit discharge or ~~the~~ a public way.

E28-07/08: Revise proposed new Exception 4 to Section 1007.1 as follows:

4. ~~An~~ Accessible means of egress are not required from accessible spaces that are not required by Section 1104 to be provided with accessible route.

E90-07/08: Replace proposed new Section 422.1 (to become Section 421.2) as follows:

421.2 Compliance with other codes and standards. Elimination, prevention or control of fall hazards shall comply with the provisions and requirements of ANSI/ASSE Z359, ANSI/ASSE A1264.1 and DOL-29 CFR Part 1910, Subpart D.

Revise reference to standard in Chapter 35 (IFC Chapter 45) as follows:

~~**American National Standards Institute**~~ **American Society of Safety Engineers**
ANSI/ASSE Z359~~.0, 1, 2, 3 and 4 (2007)~~ Fall Protection Code
Z359.0-2007 Definitions and Nomenclature Used for Fall Protection and Fall Arrest
Z359.1-2007 Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
Z359.2-2007 Minimum Requirements for a Comprehensive Managed Fall Protection Program
Z359.3-2007 Safety Requirements for Positioning and Travel Restraint Systems
Z359.4-2007 Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components

ANSI/ASSE A1264.1-2007 Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, ~~and~~ Wall and Roof Openings; Stairs and Guardrails Systems

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E132-07/08: Replace the 1st paragraph of Section 1020.1.3 (IFC [B] 1020.1.3) as follows:

1020.1.3 (IFC [B] 1020.1.3) Ventilation. Equipment and ductwork for ~~exit enclosure~~ mechanical ventilation of smokeproof enclosures and stairway pressurization as permitted by Section 1020.1.2 shall comply with one of the following ~~items~~:

E136-07/08: Replace the proposal with the following:

E136–07/08
1022.1, 1022.4, (IFC [B] 1022.1, [B] 1022.4)

Proponent: Gregory R. Keith, Professional heuristic Development, representing The Boeing Company

Revise as follows:

1022.1 (IFC [B] 1022.1) Horizontal exits. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit width shall be horizontal exits.

Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100 percent of the exits required for occupancies in Group I-3.

At least 6 square feet (0.6 m^2) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

~~Every fire compartment for which credit is allowed in connection with a horizontal exit shall not be required to have a stairway or door leading directly outside, provided the adjoining fire compartments have stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.~~

~~The area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant capacity imposed by persons entering it through horizontal exits from other areas. At least one of its exits shall lead directly to the exterior or to an exit enclosure.~~

1022.4 (IFC [B] 1022.4) Capacity of refuge area. The refuge area of a horizontal exit shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original occupant load of the refuge area plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit doors entering the refuge area. The capacity of the refuge area shall be computed based on a net floor area allowance of 3 square feet (0.2787 m^2) for each occupant to be accommodated therein.

Exception: The net floor area allowable per occupant shall be as follows for the indicated occupancies:

1. Six square feet (0.6 m^2) per occupant for occupancies in Group I-3.
2. Fifteen square feet (1.4 m^2) per occupant for ambulatory occupancies in Group I-2.
3. Thirty square feet (2.8 m^2) per occupant for nonambulatory occupancies in Group I-2.

<u>The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering it through horizontal exits from other areas. At least one refuge area exit shall lead directly to the exterior or to an exit enclosure.</u>

<u>**Exception**: The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided the refuge area into which a horizontal exit leads has stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.</u>

Reason: This proposal intends to clarify horizontal exit provisions. First, the third paragraph of Section 1022.1 has been relocated to Section 1022.4. That provision deals with the design of the means of egress from the refuge area and is more appropriately located in the latter section. Secondly, the second paragraph of Section 1022.1 currently contains some confusing language referencing a fire compartment credit concept that is not recognized anywhere in Chapter 10. The paragraph has been rewritten in more contemporary language while maintaining the original technical intent. Additionally, based on IBC errata, the provision in question was originally intended to be an exception. Accordingly, it has been retained as an exception; however, it also been placed in context following the proposed second paragraph of Section 1022.4. Approval of this proposal will clarify the intent of the code and assist users in the proper determination of horizontal exit technical requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: An errata has been issued for Section 1022.1, Exception 2. In the 2000 IBC this section had two paragraphs under the exception. The 2003 IBC and 2006 IBC show the second paragraph of Exception 2 moved out as a main section paragraph. There was no code change proposal to relocate this paragraph, therefore, and errata has been issued for the 2003 and 2006 IBC to locate the paragraph starting “Every fire compartment….” as part of Exception 2.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

IBC–GENERAL (VOLUME 1)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add G22-07/08 to IBC General Hearing Order following G33-07/08, Part I
Add G34-07/08 to IBC General Hearing Order following G225-07/08
Add G227-07/08 to IBC General Hearing Order following G187-07/08
Remove G109-07/08, Part I from IBC General Hearing Order
Remove G183-07/08, Part I from the IBC General Hearing Order and place on the IECC Hearing Order
Remove FS2-07/08, Part I from IBC General Hearing Order

TENTATIVE ORDER OF DISCUSSION

REVISED 1/8/08

2007-2008 PROPOSED CHANGES TO THE INTERNATIONAL BUILDING CODE

GENERAL

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair. Note that some "IBC-G" code change proposals are not included on this list, as they are being heard by other committees. Please consult the Cross Index of Proposed Changes.

G1-07/08
G2-07/08, Part I
G3-07/08, Part I
G4-07/08, Part I
G5-07/08, Part I
G6-07/08, Part I
G7-07/08, Part I
G8-07/08, Part I
G9-07/08, Part I
G10-07/08, Part I
G11-07/08
G12-07/08, Part I
G16-07/08, Part I
G17-07/08, Part I
G18-07/08
G19-07/08
G20-07/08
G21-07/08, Part I
G23-07/08, Part I
G24-07/08
    G225-07/08
    G34-07/08
    G33-07/08, Part I
    G22-07/08
G25-07/08, Part I
G26-07/08
G27-07/08
G30-07/08
G31-07/08
G32-07/08
G35-07/08
G36-07/08
G37-07/08
G38-07/08
G39-07/08, Part I
G40-07/08
    FS22-07/08, Part II
G41-07/08, Part I
G42-07/08
G43-07/08
    G14-07/08, Part I
    G15-07/08
G44-07/08
G45-07/08
G47-07/08
G48-07/08
G49-07/08
G50-07/08
G51-07/08
G52-07/08
G54-07/08
G58-07/08, Part I
G59-07/08
G60-07/08
G70-07/08
G71-07/08
    FS162-07/08, Part I
G72-07/08
G73-07/08
G74-07/08
G75-07/08
G76-07/08
G77-07/08, Part I
G78-07/08
G79-07/08
G80-07/08
    F233-07/08, Part II
    FS81-07/08, Part II
G82-07/08
G83-07/08
G84-07/08
G85-07/08
G86-07/08
G87-07/08
G88-07/08
G89-07/08
G90-07/08
G91-07/08
    FS20-07/08, Part I
G93-07/08
G94-07/08
G95-07/08
G102-07/08
G103-07/08
G104-07/08
G105-07/08, Part I
G106-07/08, Part I
G107-07/08, Part I
G108-07/08
~~G109-07/08, Part I~~
    G13-07/08
    F75-07/08, Part II
    F77-07/08, Part II
G110-07/08
    G224-07/08
G111-07/08
G112-07/08
G113-07/08
G114-07/08
G115-07/08
G116-07/08
G117-07/08
G118-07/08
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G148-07/08
G149-07/08
G150-07/08
G151-07/08
G152-07/08
G153-07/08
G154-07/08
G155-07/08
G156-07/08, Part I
G157-07/08
~~FS2-07/08, Part I~~
G158-07/08
G159-07/08
G160-07/08
G161-07/08
G162-07/08
G163-07/08
G164-07/08
G165-07/08
G166-07/08
G167-07/08
G168-07/08
FS114-07/08, Part I
FS115-07/08, Part II
G169-07/08
G170-07/08
G171-07/08
G172-07/08
G173-07/08
G174-07/08
G175-07/08
G176-07/08
G177-07/08
G178-07/08, Part I
G179-07/08, Part I
G180-07/08, Part I
G181-07/08
G182-07/08, Part I
~~G183-07/08, Part I~~
S42-07/08, Part I
S43-07/08
G184-07/08
G185-07/08
P29-07/08, Part II
PC2-07/08
G186-07/08
G187-07/08
G227-07/08
G188-07/08
G189-07/08
G190-07/08
G191-07/08
G192-07/08
F96-07/08, Part II
G193-07/08
G194-07/08
G195-07/08
G196-07/08
G197-07/08
G198-07/08
G199-07/08
G200-07/08
G201-07/08
F241-07/08, Part II
F243-07/08, Part II
G202-07/08
G226-07/08
RB223-07/08, Part II
RB224-07/08, Part II
RB225-07/08, Part II
RB226-07/08, Part II
RB227-07/08, Part II
G220-07/08, Part I
G204-07/08
G212-07/08, Part I
G217-07/08
G218-07/08
G219-07/08
G221-07/08
G222-07/08
G223-07/08

G183-07/08: Replace the proposal with the following:

G183–07/08
1301.1.1, 202 (New); IECC 404.2 (New), 202 (New)

Proponent: Dave Collins, AIA, The Preview Group, Inc., representing the AIA Codes Committee

THIS PROPOSAL IS ON THE AGENDA OF THE IECC CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

1. IBC Revise as follows:

1301.1.1 Criteria. Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code*. The energy use of all structures shall be 50% less than the average building site energy intensity per square foot as determined by the building occupancy and location in the U.S. Department of Energy's Energy Information Administration (EIA) 2003 Commercial Building Energy Consumption Survey (CBECS). Where a building occupancy is used for an activity that does not align closely the activities listed, the code official is authorized to determine the activity that the building occupancy most nearly resembles:

US DOE EIA	Occupancy
Education	(E)
Food Sales	(B)
Food Services	(A-2)
Health Care	
Inpatient	(I-2)
Outpatient	(B)
Lodging	(R-1, R-2, R-3, R-4, I-4)
Mercantile	(M)
Retail (Other Than Mall)	(M)
Enclosed and Strip Malls	(See Section 402)
Office	(B)
Public Assembly	(A-1, A-3, A-4)
Public Order and Safety	(B, I-3)
Religious Worship	(A-3)
Service	
Warehouse and Storage	(S-1.S-2)
Other	(F-1, F-2, H)
Vacant	(U)

2. Add new definition as follows:

SECTION 202
DEFINITIONS

SITE ENERGY INTENSITY. Site energy intensity is the energy use in a building and facilities on the site expressed in kBtu's used per year per area of total useful area of a building – (kBtu/ft^2/yr).

2. IECC Add new text as follows:

101.6 Site energy intensity criteria. The energy use of all structures shall be 50% less than the average building site energy intensity per square foot as determined by the building occupancy and location in the U.S. Department of Energy's Energy Information Administration (EIA) 2003 Commercial Building Energy Consumption Survey (CBECS). Where a building occupancy is used for an activity that does not align closely the activities listed, the code official is authorized to determine the activity that the building occupancy most nearly resembles:

US DOE EIA	Occupancy
Education	(E)
Food Sales	(B)
Food Services	(A-2)
Health Care	
Inpatient	(I-2)
Outpatient	(B)
Lodging	(R-1, R-2, R-3, R-4, I-4)

Mercantile	(M)
Retail (Other Than Mall)	(M)
Enclosed and Strip Malls	(See Section 402)
Office	(B)
Public Assembly	(A-1, A-3, A-4)
Public Order and Safety	(B, I-3)
Religious Worship	(A-3)
Service Warehouse and Storage	(S-1.S-2)
Other	(F-1, F-2, H)
Vacant	(U)

2. Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

SITE ENERGY INTENSITY. Site energy intensity is the energy use in a building and facilities on the site expressed in kBtu's used per year per area of total useful area of a building – (kBtu/ft^2/yr).

Reason: The United States leads the world in per capita consumption of energy. Buildings are fully 48% of the consumption of energy nationwide. The US Department of Energy has compiled data showing how the energy is being used by various types of buildings. The following table shows the distribution of the samples as of 2003.

Table A1. Summary Table for All Buildings (Including Malls), 2003

	Number of Buildings (thousand)	Total Floor Space (million square feet)	Mean Square Feet per Building (thousand)	Median Square Feet per Building (thousand)
All Buildings	4,859	71,658	14.7	5.0
Building Floorspace (Square Feet)				
1,001 to 5,000	2,586	6,922	2.7	2.4
5,001 to 10,000	948	7,033	7.4	7.2
10,001 to 25,000	810	12,659	15.6	15.0
25,001 to 50,000	261	9,382	36.0	35.0
50,001 to 100,000	147	10,291	70.2	67.0
100,001 to 200,000	74	10,217	138.6	130.0
200,001 to 500,000	26	7,494	287.6	260.0
Over 500,000	8	7,660	937.6	700.0
Principal Building Activity				
Education	386	9,874	25.6	7.0
Food Sales	226	1,255	5.6	2.8
Food Service	297	1,654	5.6	3.5
Health Care	129	3,163	24.6	6.0
Inpatient	8	1,905	241.4	106.0
Outpatient	121	1,258	10.4	6.0
Lodging	142	5,096	35.8	12.5
Mercantile	657	11,192	17.0	6.9
Retail (Other Than Mall)	443	4,317	9.7	4.8
Enclosed and Strip Malls	213	6,875	32.2	12.3
Office	824	12,208	14.8	4.0
Public Assembly	277	3,939	14.2	6.7
Public Order and Safety	71	1,090	15.5	5.0
Religious Worship	370	3,754	10.1	6.0
Service	622	4,050	6.5	2.8
Warehouse and Storage	597	10,078	16.9	5.2
Other	79	1,738	21.9	4.6
Vacant	182	2,567	14.1	3.7
Year Constructed				
Before 1920	333	3,784	11.4	4.9
1920 to 1945	536	6,985	13.0	4.0
1946 to 1959	573	7,262	12.7	4.0
1960 to 1969	600	8,641	14.4	5.0
1970 to 1979	784	12,275	15.6	5.8
1980 to 1989	768	12,468	16.2	4.2
1990 to 1999	917	13,981	15.2	5.0
2000 to 2003	347	6,262	18.1	5.6

As a first step toward improvement of energy consumption in buildings, we can begin to reduce the energy consumption in new construction and renovations as they are being undertaken, making a significant impact on their long-term consumption of energy. This is a welfare issue affecting the health and productivity of our society. By making significant reductions in the use of energy in buildings the codes will have an enduring affect on our economy and the depletion of valuable resources.

Awareness of the impact of building energy use and the need to address this is a rising concern among various communities. Codes and standards are being developed and adopted locally to include various types of guideline systems for sustainable design such as LEED, Green Globes, EnergyStar, and others. While these are an important aspect of improved building design, they do not yet address the threshold of energy consumption and improved energy efficiency that we believe is critical. By incorporating a maximum energy use criteria, the ICC family of codes will set a precedent for communities to follow, making measurable change.

Standards such as ASHRAE 90.1 and the proposed standard for high performance buildings ASHRAE/USGBC/IESNA SPC 189, *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*, both will include criteria that are similar to this proposal. While these standards may be available in the near future, it is imperative that the codes make a statement as to how the subject should be addressed now.

Use of the CBECS data to establish energy consumption criteria addresses two very important aspects of this issue. Defining the energy target at the outset of the design process gives the design team a clear, achievable target. This target will allow the design team to focus its effort on achieving the target through a range of design strategies without reference to other model designs. Having the criteria based on reductions in real world, actual energy use for each occupancy type in a given region provides a second identifiable achievement. The code is not seeking reductions in the theoretical energy consumption determined through design efforts. Using CEBECS data to determine the criteria will lead to reductions in what buildings really use.

Cost Impact: The code change proposal will increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

G206-07/08: Add definition and Section 3403.3 to the proposal as follows:

1. Add new definition as follows:

SUBSTANTIAL STRUCTURAL DAMAGE. A condition where:

1. In any story, the vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of the structure in any horizontal direction has been reduced by more than 20 percent from its pre-damage condition; or
2. The capacity of any vertical gravity load-carrying component, or any group of such components, that supports more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its pre-damage condition and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by this code for new buildings of similar structure, purpose and location.

2. Revise text as follows:

3403.3 (Supp) Nonstructural. Nonstructural alterations ~~or repairs~~ to an existing building or structure are permitted to be made of the same materials of which the building or structure is constructed, provided that they do not adversely affect any structural member or the fire-resistance rating of any part of the building or structure.

The work shall not make the building less conforming to the building, plumbing, mechanical, electrical or fire codes of the jurisdiction, or to alternative materials, design and methods of construction, or to any previously approved plans, modifications, alternative methods, or compliance alternatives, than it was before the alteration ~~repair~~ was undertaken.

G209-07/08: Revise the following sections:

3403.2.3.1 (IEBC [B] 302.2.3.1) Additions to existing buildings.
Item 2: Replace "this code and ASCE 7" with "Section 1613"
Item 3: Replace "this code and ASCE 7" with "Section 1613"

3403.2.3.2 (IEBC [B] 302.2.3.2) Alterations.
1st paragraph: Replace "this code and ASCE 7" with "Section 1613"
Exception: Replace "this code and ASCE 7" with "Section 1613" in 2 places
Exception 5: Replace "this code and ASCE 7" with "Section 1613"

3406.4 Change of occupancy.
Exception 1: Replace "this code and ASCE 7" with "Section 1613"
Exception 2: Replace "this code and ASCE 7" with "Section 1613"

G224-07/08: Further revise sections within the proposed new Appendix L as follows:

L503.1 (Supp) General. The height and maximum area of any fire compartment and the number of fire compartments in ~~a~~ buildings shall not exceed the limits specified in Tables L503.1(1), L503.1(2), L503.1(3) and L503.1(4) based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. Each portion of a building separated by one or more fire walls complying with Section 705 shall be considered to be a separate building.

(Delete existing Table 503 in its entirety and replace with Tables L503.1(1) through L503.1(4))

TABLE L503.1(1)
MAXIMUM ALLOWABLE BUILDING HEIGHT (Feet and Stories above grade plane)

OCCUPANCY	TYPE IA	TYPE IB	TYPE IIA	TYPE IIB	TYPE IIIA	TYPE VA	TYPE IV	TYPE IIIB	TYPE VB
Feet	UL	160	65	55	65	50	65	55	40
A-5	UL	UL	UL	UL	UL	UL	UL	UL	UL
S-2	UL	11	5	~~4~~3	4	5	5	~~4~~3	2
F-2	UL	11	5	3	4	3	5	3	2
B	UL	11	5	~~4~~3	5	3	5	~~4~~3	2
R-1, R-2, R-4	UL	11	4	~~4~~3	4	3	4	~~4~~3	2
R-3	UL	11	4	4	4	3	4	4	3
~~M~~	~~UL~~	~~11~~	~~4~~	~~4~~	~~4~~	~~3~~	~~4~~	~~4~~	~~1~~
F-1	UL	11	4	2	3	2	4	2	1
S-1	UL	11	4	~~3~~2	3	3	4	~~3~~2	1
A-3, A-4	UL	11	3	2	3	2	3	2	1
M	UL	11	4	~~4~~2	4	2	4	~~4~~2	1
A-2	UL	11	3	2	3	2	3	2	1
I-1	UL	9	4	3	4	3	4	3	2
H-4	UL	7	5	3	5	3	5	3	2
H-3	UL	6	4	2	4	2	4	2	1
U	UL	5	4	2	3	2	4	2	1
A-1	UL	5	3	2	3	2	3	2	1
I-4	UL	5	3	2	3	1	2	3	1
E	UL	5	3	2	3	1	3	2	1
H-5	4	4	3	3	3	3	3	3	2
I-2	UL	4	2	1	1	1	1	NP	NP

OCCUPANCY	TYPE IA	TYPE IB	TYPE IIA	TYPE IIB	TYPE IIIA	TYPE VA	TYPE IV	TYPE IIIB	TYPE VB
I-3	UL	4	2	1	2	2	2	1	1
H-2	UL	3	2	1	2	1	2	1	1
H–1	1	1	1	1	1	1	1	1	NP

UL = unlimited in height

NP = not permitted

TABLE L503.1(2)

MAXIMUM ALLOWABLE AREA PER FIRE COMPARTMENT (sf) - WITHOUT SPRINKLERS [a, b, c]

OCCUPANCY	TYPE IA/IB	TYPE IIA	TYPE IIIA	TYPE IV AND VA	TYPE IIB AND IIIB	TYPE VB
S-2, F-2	30,267	16,933	16,933	10,933	7,867	4,800
A-3, A-4, B, H-4, I, R, E	26,706	14,941	14,941	9,647	6,941	4,235
A-1, A-2, M	22,700	12,700	12,700	8,200	5,900	3,600
F-1, S-1, H-5	19,739	11,043	11,043	7,130	5,130	3,130
H–1, H-2, H-3	NP	NP	NP	NP	NP	NP

a. ~~One or more~~ The fire compartment ~~in the building~~ does not have an automatic ~~fire suppression~~ sprinkler system installed in accordance with Section 903.3.1.1 ~~or 903.3.1.2~~.
b. A-5 Assembly uses intended for participation in or viewing outdoor activities shall be permitted to be unlimited in area.
c. Round table values off to the nearest 1000.

NP = not permitted

TABLE L503.1(3)

MAXIMUM ALLOWABLE AREA PER FIRE COMPARTMENT (sf) - WITH SPRINKLERS[a, b, c]

OCCUPANCY	TYPE IA/IB	TYPE IIA	TYPE IIIA	TYPE IV AND VA	TYPE IIB AND IIIB	TYPE VB
S-2, F-2	423,733	169,333 ~~237,067~~	169,333	109,333	78,667	48,000
A-3, A-4, B, H-4, I, R, E	373,882	149,412 ~~209,176~~	149,412	96,471	69,412	42,353
A-1, A-2, M	227,000	63,500 ~~127,000~~	63,500	41,000	29,500	18,000
F-1, S-1, H-5	98,696	40,861 ~~55,217~~	40,861	26,383	18,983	11,583
H–1, H-2, H-3	30,960 ~~67,192~~	17,440 ~~37,592~~	17,440 ~~37,592~~	10,320 ~~24,272~~	7,840 ~~17,464~~	4,960 ~~10,656~~

a. All fire compartments in the building have an automatic ~~fire suppression~~ sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
b. A-5 Assembly uses intended for participation in or viewing outdoor activities shall be permitted to be unlimited in area.
c. Round table values off to the nearest 1000.

TABLE L503.1(4)
MAXIMUM BUILDING AREA FACTOR[a]

ACTUAL BUILDING HEIGHT, STORIES	NUMBER OF STORIES ALLOWED BY TABLE L503.1(1)								
	1	2	3	4	5	6	7	8	9
1	4	8	12	16	20	24	28	32	36
2	-	6	9	12	15	18	21	24	27
3	-	-	6	8	10	12	14	16	18

a. The maximum building area factor shall be permitted to be doubled where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

L503.2 Maximum allowable building area. The maximum allowable building area shall not exceed the ~~maximum area of fire~~ compartment~~s~~ area in ~~accordance with~~ Tables L503.1(2) or L503.1(3) multiplied by the maximum building area factor ~~number~~ in Table L503.1(4). ~~A building shall be considered one fire compartment except where subdivided by compartment fire barriers conforming with this section.~~

L503.2.1 Absolute maximum allowable building area. Regardless of the provisions in Section L503.2, the maximum allowable building area shall not exceed 500,000 square feet.

Exception: Type I construction for buildings containing any occupancy group other than Groups H-1, H-2, H-3, I-1, I-4, S-1, S-2 and U.

L503.2.2 Enclosure. Each fire compartment shall be completely enclosed by any combination of exterior walls, roof, fire resistance rated horizontal assemblies ~~,or~~ fire compartment barrier walls and fire walls. If a building has more than one fire compartment, each fire compartment shall be separated by horizontal and ~~or~~ vertical compartment barrier having a fire resistance rating determined by ~~in accordance with~~ Table L503.2.2.

L503.2.3 Fire compartment barriers. Fire compartment barriers separating a building into fire compartments shall comply with Sections L503.2.3.1 and L503.2.3.2 and Table L503.3.2.

TABLE L503.2.2
FIRE COMPARTMENT FIRE RESISTANCE (hrs)

	SPRINKLERED[a]	NON-SPRINKLERED[b]
Assembly		
A-1	2	2
A-2	2	2
A-3	2	2
A-4	2	2
A-5	NA	NA
Business		
B	1	2
Educational		
E	2	2

	SPRINKLERED[a]	NON-SPRINKLERED[b]
Factory and Industry		
F-1	2	3
F-2	1	2
Hazardous		
H-1	4	4
H-2	3	4
H-3	3	3
H-4	1	2
H-5	2	2
Institutional		
I-1	2	2
I-2	2	2
I-3	2	2
I-4	2	~~3~~2
Mercantile		
M	~~1~~2	~~2~~3
Residential		
R-1	2	2
R-2	2	2
R-3	2	2
R-4	2	2
Storage		
S-1	2	3
S-2	1	2
Utility		
U	1	1

a. All adjacent compartments sharing the same fire compartment barrier shall be protected by an automatic sprinkler system complying with Section 9.3.3.1.1.
b. Applies to any fire compartment barrier separating a fire compartment that is not protected throughout by an automatic sprinkler system complying with Section 903.3.3.1.1

NA = Not Applicable

L503.2.3.1 Horizontal fire compartment barriers. Horizontal fire compartment barriers shall comply ~~be constructed in accordance~~ with Section 711.

L503.2.3.2 Vertical fire barriers. Vertical fire compartment barriers shall extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above or to a termination point at least 30 inches above both adjacent roofs and shall be securely attached thereto. Such fire barriers shall be continuous through concealed spaces such as the space~~, including but not limited to spaces such as~~ above a suspended ceiling.

L503.2.3.2.1 Vertical continuity. Fire compartment barriers shall extend from the foundation to a termination point at least 30 inches above both adjacent roofs.

Exceptions:

1. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab provided:
   1.1. The lower roof assembly within 4 feet (1220 mm) of the wall has not less than a 1-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.
   1.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
   1.3. Each building shall be provided with not less than a Class B roof covering.
2. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck, or slabs where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire compartment barrier.
3. In buildings of Type III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks provided:
   3.1. There are no openings in the roof within 4 feet (1220 mm) of a fire wall,
   3.2. The roof is covered with a minimum Class B roof covering, and
   3.3. The roof sheathing or deck is constructed of fire-retardant-treated wood for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with 5/8 inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm) on both sides of the fire wall.
4. Buildings located above a parking garage designed in accordance with Section L508.2 ~~509.2~~ shall be permitted to have the fire compartment barriers for the buildings located above the parking garage extend from the horizontal separation between the parking garage and the buildings.

L503.2.3.3 Glazed openings. Glazed openings in fire compartment barriers shall be limited to those in fire doors complying with Section 715.4.

L503.2.3.4 Fire compartment doors. Doors in fire compartment barriers shall have a fire protection rating of not less than ~~at least~~ 1 hour in accordance with Table L503.2.3.4. Doors in fire compartment barriers shall limit temperature rise to 450°F (250°C) when tested in accordance with NFPA 252.

L503.2.3.5 Other openings fire compartment barriers. Openings in 1-hour fire compartment barriers for ducts and air transfer openings ~~air-handling~~ shall be protected in accordance with Section 707 and Section 716. ~~with~~ Fire dampers shall have a minimum ~~having a~~ fire protection rating of 1.5 hours.

L503.3 Smoke management for adjacent fire compartments. Where adjacent fire compartments share a common fire compartment wall or horizontal assembly, or both, for the purpose of creating separate fire compartments, a method of smoke management shall be provided in accordance with Section L503.3.1 for such fire compartments that meet any of the following conditions:

1. The fire compartment is not protected with an automatic sprinkler system in accordance with Section 903.3.1 and contains one or more stories located more than one story above grade plane or
2. The fire compartment contains one or more stories located more than two stories above grade ~~plane having any of the following occupancies:~~
   ~~2.1. Group A occupancy with an occupant load of 300 or more persons;~~
   ~~2.2. Group I-1 occupancy; or~~
   ~~2.3. Group I-2 occupancy.~~

L503.4 Smoke management methods. Smoke management as required by Section L503.3 shall comply with any one or a combination of any of the following methods, as applicable:

1. Door openings, joints and penetrations in fire compartment separation walls and horizontal assemblies shall be protected as required for smoke barriers in accordance with the following:
   1.1. Door openings shall comply with Section 715.4.3.1.
   1.2. Penetrations shall comply with Section 712.5.
   1.3. Joints shall comply with Section 713.6.
   1.4. Ducts and air transfer openings shall comply with Section 716.5.5.
2. Openings in fire compartment separation horizontal assemblies shall be protected by shaft enclosures in accordance with Section 707. For the purpose of smoke management at fire compartment separations, the exceptions to Section 707.2 shall not apply.
3. Exit stair enclosures penetrating a fire compartment separation horizontal assembly shall comply with the requirements ~~be protected as~~ for smokeproof enclosures in accordance with Section 909.20.
4. One or more of the following mechanical methods shall be permitted to be used for smoke management in lieu of Items 1 and 2 above:
   4.1. The pressurization method in accordance with Section 909.6
   4.2. The air flow design method in accordance with Section 909.7 for buildings protected by an automatic sprinkler system in accordance with Section 903.3.1
   4.3. The exhaust method in accordance with Section 909.8 for buildings protected by an automatic sprinkler system in accordance with Section 903.3.1

L503.5 Special industrial occupancies. Buildings and structures designed to house special industrial processes that require large areas and unusual heights to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the height and area limitations of Table L503.1(1) through L503.1(3).

L503.6 Buildings on same lot. Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building if the height of each building and the aggregate maximum number ~~area~~ of fire compartments are within the limitations of Tables L503.1(1) through L503.1(3) as modified by Section~~s~~ L504. The provisions of this code applicable to the aggregate building shall be applicable to each building.

L503.7 Type I construction. Buildings of Type I construction permitted to be of unlimited tabular heights or number of fire compartments are not subject to the special requirements that allow unlimited fire compartments in Section L506~~7~~ or unlimited height in Sections L503.5 and L504.3 or increased height and areas of fire compartments for other types of construction.

SECTION L504
HEIGHT

L504.1 General. The height permitted by Table L503.1(1) shall be increased in accordance with this section.

Exception: The height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited if the building is provided with an automatic fire-extinguishing system in accordance with Chapter 9 and is entirely surrounded by public ways or yards not less in width than one and one-half times the height of the building.

L504.2 (Supp) Automatic sprinkler system increase. Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table L503.1(1) for maximum height shall be increased by 5 feet (6096 mm) and the maximum number of stories shall be increased by one.

Exceptions:

1. Buildings, or portions of buildings, classified as a Group I-2 occupancy of Type IIB, III, IV or V construction.
2. Buildings, or portions of buildings, classified as a Group H-1, H-2, H-3 or H-5 occupancy.
3. Fire-resistance rating substitution in accordance with Table 601, Note e.

L505.1 General. A mezzanine or mezzanines in compliance with Section L505 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the fire compartment area or number of stories as regulated by Section L503.1. The area of the mezzanine shall be included in determining the fire area defined in Section 702. The clear height above and below the mezzanine floor construction shall not be less than 7 feet (2134 mm).

L505.2 Area limitation. The aggregate area of a mezzanine or mezzanines within a room shall not exceed one-third of the floor area of that room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the floor area of the room.

Exceptions:

1. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section L503.5 shall not exceed two-thirds of the floor area of the room.
2. The aggregate area of mezzanines in buildings and structures of Type I or II construction shall not exceed one-half of the floor area of the room in buildings and structures equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 and an approved emergency voice/alarm communication system in accordance with Section 907.2.12.2.

L505.5 (Supp) Equipment platforms. Equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section L503.1. The area of the equipment platform shall not be included in determining the fire area in accordance with Section 903. Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairs and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.

L505.5.1 Area limitations. The aggregate area of all equipment platforms within a room shall not exceed two-thirds of the area of the room in which they are located. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section L505.2 and the combined aggregate area of the equipment platforms and mezzanines shall not exceed two-thirds of the room in which they are located.

L506.1 General. The area of a fire compartment shall not be limited and only one fire compartment is required in buildings meeting the requirements of Sections L506.2 through L506.11

L506.3 (Supp) Sprinklered, one story. The area of the fire compartment in a Group B, F, M or S occupancy no more than one-story above grade plane, or the fire compartment in a Group A-4 occupancy no more than one-story above grade plane, of other than Type V construction, shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) n width.

Exceptions:

1. The fire compartment in structures of Type I and II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such fire compartment conform to the requirements of Sections L506.2 and 903.3.1.1 and NFPA 230.
2. The automatic sprinkler system shall not be required in parts of fire compartments that are occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that:
   2.1. Exit doors directly to the outside are provided for occupants of the participant sports areas; and
   2.2. The fire compartment is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.
3. Group A-1 and A-2 occupancies of other than Type V construction shall be permitted, provided:
   3.1. All assembly occupancies are separated from other spaces as required for separated occupancies in Section L507~~8~~.4.4 with no reduction allowed in the fire-resistance rating of the separation based upon the installation of an automatic sprinkler system;
   3.2. Each Group A occupancy shall not exceed the maximum allowable area permitted in Section L503.1; and
   3.3. All required exits shall discharge directly to the exterior.

L506.5 Reduced open space. The permanent open space of 60 feet (18 288 mm) required in Sections L506~~7~~.2, L506~~7~~.3, L506~~7~~.4, L506~~7~~.6 and L506~~7~~.10 shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the building.
2. The exterior wall facing the reduced open space shall have a minimum fire-resistance rating of 3 hours.
3. Openings in the exterior wall facing the reduced open space shall have opening protectives with a minimum fire protection rating of 3 hours.

L506.7 (Supp) Group H occupancies. Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area fire compartments containing Group F and S occupancies, in accordance with Sections 5067.3 and 5067.4 and the limitations of this section. The aggregate floor area of the Group H occupancies located at the perimeter of the unlimited area fire compartment shall not exceed 10 percent of the area of the building nor the area limitations for the Group H occupancies as specified in Tables L503.1(2) and L503.1(3), based upon the percentage of the perimeter of each Group H floor area that fronts on a street or other unoccupied space. The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25 percent of the fire compartment area limitations for the Group H occupancies as specified in Tables L503.1(2) and L 503.1(3). Group H occupancies shall be separated from the rest of the unlimited area building and from each other in accordance with Table L5078.4. For two-story unlimited area fire compartments, the Group H occupancies shall not be located more than one story above grade plane unless permitted by the allowable height in stories and feet as set forth in Table L503.1(1) based on the type of construction of the unlimited area building.

L506.10 (Supp) Motion picture theaters. In fire compartments of Type II construction, the area of the fire compartment for a motion picture theater located on the first story above grade plane shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

L507.1 (Supp) General. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section L5078.2, L5078.3 or L5078.4, or a combination of these sections.

Exceptions:

1. Occupancies separated in accordance with Section L5089.
2. Where required by Table 415.3.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a separate and detached building or structure.
3. Live/Work Units in accordance with Section 419 are not considered separate occupancies.

L507. 2 (Supp) Accessory occupancies Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections L5078.2.1 through L5078.2.5.3.

L507.2.1 (Supp) Area limitations. Aggregate accessory occupancies shall not occupy more than 10 percent of the area of the story in which they are located and shall not exceed the tabular values in Tables L503.1(2) and L503.1(3),

L507.2.3 (Supp) Allowable area and height. The allowable area of the fire compartment and height of the building shall be based on the allowable area and height for the main occupancy in accordance with Section L503.1. The height of each accessory occupancy shall not exceed the tabular values in Table L503.1(1), without increases in accordance with Section L 504 for such accessory occupancies. The area of the accessory occupancies shall be in accordance with Section 5078.2.1

L507.2.4 (Supp) Separation of occupancies. No separation is required between accessory occupancies and the main occupancy.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section L5078.4.
2. Incidental accessory occupancies required to be separated or protected by Section L5078.2.5.
3. Group R occupancies shall be separated from other accessory occupancies in accordance with Section L5078.4.4

L507.2.5 (Supp) Separation of incidental accessory occupancies. The incidental accessory occupancies listed in Table L5078.2.5 shall be separated from the remainder of the building or equipped with an automatic fire-extinguishing system, or both, in accordance with Table L5078.2.5.

Exception: Incidental accessory occupancies within and serving a dwelling unit are not required to comply with this section.

L507.2.5.1 (Supp) Fire resistance rated separation. Where Table L507~~8~~.2.5 specifies a fire-resistance rated separation, the incidental accessory occupancies shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 706 or a horizontal assembly constructed in accordance with Section 711, or both.

L507.2.5.2 (Supp) Nonfire-resistance rated separation and protection. Where Table L507~~8~~.2.5 permits an automatic fire extinguishing system without a fire barrier, the incidental accessory occupancies shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The walls shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the fire-resistance-rated floor/ceiling assembly above or fire-resistance-rated roof/ceiling assembly above or to the underside of the floor or roof sheathing, deck or slab above. Doors shall be self- or automatic closing upon detection of smoke in accordance with Section 715.4.7.3. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80.

L507.2.5.3 (Supp) Protection. Where an automatic fire-extinguishing system or an automatic sprinkler system is provided in accordance with Table L507~~8~~.2.5, only the space occupied by the incidental accessory occupancy need be equipped with such a system.

L507.3.2 (Supp) Allowable fire compartment area and height. The allowable fire compartment area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section L503.1.

L507.3.3 (Supp) Separation. No separation is required between nonseparated occupancies.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section L507~~8~~.3.3.
2. All Group R occupancies shall be separated from other occupancies in accordance with Section L507~~8~~.4.4.

L507.4.3 (Supp) Allowable height. Each separated occupancy shall comply with the height limitations based on the type of construction of the building in accordance with Section L503.1.

Exception: Special provisions permitted by Section L508~~9~~.

L507.4.4 (Supp) Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table L507~~8~~.4.

L508.1 (Supp) General. The provisions in this section shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections L508~~9~~.2 through L508~~9~~.8 are to be considered independent and separate from each other.

L508.2 (Supp) Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining fire compartment area limitations, continuity of fire walls, limitation of number of stories and type of construction where all of the following conditions are met:

1. The buildings are separated with a horizontal assembly having a minimum 3-hour fire-resistance rating.
2. The building below the horizontal assembly is no more than one story above grade plane
3. The building below the horizontal assembly is of Type IA construction.
4. Shaft, stairway, ramp and escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Table 715.4.

   Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire resistance rating with opening protectives in accordance with Table 715.4, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided:

   1. The building above the horizontal assembly is not required to be of Type I construction;
   2. The enclosure connects less than four stories; and

3. The enclosure opening protectives above the horizontal assembly have a minimum 1-hour fire protection rating.

5. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A uses, each with an occupant load of less than 300, or Group B, M, R or S uses.
6. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any of the following occupancies:

    1. Group S-2 parking garage used for the parking and storage of private motor vehicles;
    2. Multiple Group A, each with an occupant load of less than 300;
    3. Group B;
    4. Group M;
    5. Group R; and
    6. Uses incidental to the operation of the building (including entry lobbies, mechanical rooms, storage areas and similar uses).

7. The maximum building height in feet shall not exceed the limits set forth in Section L503 for the building having the smaller allowable height as measured from the grade plane.

L508.4 Parking beneath Group R. Where a maximum one-story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section L507~~8~~.3.3.

L508.7 Open parking garage beneath Groups A, I, B, M and R. Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.3. The height and fire compartment area of the portion of the building above the open parking garage shall not exceed the limitations in Section L503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

L508.7.1 Fire separation. Fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table L507~~8~~3.3 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having at least a 2-hour fire-resistance rating as required by Section 706 with self-closing doors complying with Section 715 or horizontal assemblies having at least a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 715. Means of egress from the open parking garage shall comply with Section 406.3.

L509.1 General. When this appendix is adopted modify ~~replace~~ the sprinkler requirements in Chapter 9 for Group E, F-1, M, and S-1 Occupancies and repair garages in accordance with the following ~~requirements~~.

[F] 903.2.3 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy located more than three stories above grade plane.

[F] 903.2.6 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy located more than three stories above grade plane.

[F] 903.2.8 Group S-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy located more than three stories above grade plane~~.~~

(Portions of the proposal not shown remain unchanged)

G227-07/08: Add new code change as follows:

G227–07/08
3002.4

Proponent: Chad Lawry, City of Vancouver, WA, representing City of Vancouver Firefighters

Revise as follows:

3002.4 Elevator car to accommodate ambulance stretcher. Where elevators are provided in buildings ~~four~~ two or more stories above grade plane or ~~four~~ two or more stories below grade plane, at least one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate a 24-inch by 84-inch (610 mm by 2250 mm) ambulance stretcher in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall not be less than 3 inches (76 mm) high and shall be placed inside on both sides of the hoistway door frame.

Reason: The purpose of the code change is the safe egress of patients and emergency responders during medical emergencies.

Justification: When an elevator car is too small to accommodate an ambulance stretcher, patients and emergency responses are at increased risk when negotiating stairways. When a patient is strapped to a backboard due to back or neck injuries, the stretcher cannot be set to a reclined position in order to fit in a typical elevator which is designed to accommodate a wheelchair.

It is virtually impossible to provide effective CPR while carrying a patient up or down stairs. However, effective CPR can be provided in an elevator.

As with many jurisdictions, our local ambulances and Fire Department medic units are staffed by only 2 people. Due to back injuries and near mishaps carrying large patients down stairs, our Firefighters are requesting simple code change for this high-risk, high-frequency activity.

Scope: This pertains to all new construction subject to the requirements of the International Building Code. The proposed code revision will not require elevators where they are not already required by the building codes.

Cost Impact: The proposal will negligibly increase the cost of construction.

As an example, according to a sales representative of American Crescent Elevator Mfg., Corp. (310 Stephens Street Picayune, Ms. 39466 Sales: 800-748-9711 Fax: 601-798-9444), the cost of a 2100 pound capacity elevator accommodating wheel chairs is roughly $35,000 installed compared to a 2500 pound capacity elevator accommodating stretchers at roughly $36,000 installed.

The impact is a 2.77% increase in the cost of one elevator. EXAMPLE: In $1,000,000 project, the cost impact is approximately one tenth of 1%

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

IBC – FIRE SAFETY (Volume 1)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Remove FS170-07/08 from IBC Fire Safety Hearing Order
Remove FS179-07/08 from IBC Fire Safety Hearing Order

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL BUILDING CODE

FIRE SAFETY

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair. Note that some "IBC-FS" code change proposals are not included on this list, as they are being heard by other committees. Please consult the Cross Index of Proposed Changes.

G55-07/08
G57-07/08
G68-07/08
G69-07/08
FS1-07/08
FS2-07/08, Part I
FS3-07/08
FS4-07/08, Part I
FS5-07/08, Part I
FS6-07/08
FS7-07/08
FS8-07/08
FS9-07/08
FS10-07/08
FS11-07/08
FS12-07/08
FS13-07/08
FS14-07/08
FS15-07/08
FS16-07/08
FS17-07/08
FS18-07/08
FS19-07/08
FS20-07/08, Part II
FS21-07/08
FS22-07/08, Part I
FS23-07/08
FS24-07/08
FS25-07/08
FS26-07/08
FS27-07/08
FS28-07/08
FS29-07/08
FS30-07/08
FS31-07/08
FS32-07/08
FS33-07/08
FS34-07/08
FS35-07/08
FS36-07/08
FS37-07/08
G156-07/08, Part II
FS38-07/08
FS39-07/08
FS40-07/08
FS41-07/08
FS42-07/08
FS43-07/08
FS44-07/08
FS45-07/08
FS46-07/08
FS47-07/08
FS48-07/08
FS49-07/08
FS50-07/08
FS51-07/08
FS52-07/08
FS53-07/08
FS54-07/08
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FS57-07/08
FS58-07/08
FS59-07/08
FS60-07/08
FS61-07/08
FS62-07/08
FS63-07/08
FS64-07/08
FS65-07/08
FS66-07/08
FS67-07/08
FS68-07/08
FS69-07/08
FS70-07/08
FS71-07/08
FS72-07/08
FS73-07/08, Part I
FS74-07/08
FS75-07/08
FS76-07/08
FS77-07/08
FS78-07/08
FS79-07/08
FS80-07/08
FS81-07/08, Part I
FS82-07/08
FS83-07/08
FS84-07/08
FS85-07/08, Part I
FS86-07/08, Part I
FS87-07/08, Part I
FS88-07/08
FS89-07/08
FS90-07/08
FS91-07/08
FS92-07/08
FS93-07/08
FS94-07/08
FS95-07/08
FS96-07/08
FS97-07/08
FS98-07/08
FS99-07/08
FS100-07/08
FS101-07/08
FS102-07/08
FS103-07/08
FS104-07/08
FS105-07/08
FS106-07/08
FS107-07/08
FS108-07/08
FS109-07/08
FS110-07/08
FS111-07/08
FS112-07/08
FS113-07/08
FS114-07/08, Part II
FS115-07/08, Part I
FS116-07/08
FS117-07/08
FS118-07/08
FS119-07/08
FS120-07/08
FS121-07/08
FS122-07/08
FS123-07/08
FS124-07/08
FS125-07/08
FS126-07/08
FS127-07/08

FS128-07/08
FS129-07/08
FS130-07/08
FS131-07/08
FS132-07/08
FS133-07/08
FS134-07/08
FS135-07/08
FS136-07/08
FS137-07/08
FS138-07/08
FS139-07/08
FS140-07/08
FS141-07/08
M16-07/08, Part IV
FS142-07/08
FS143-07/08
FS144-07/08
FS145-07/08
FS146-07/08
FS147-07/08, Part I
FS148-07/08
FS149-07/08
FS150-07/08
FS151-07/08
FS152-07/08
FS153-07/08
FS154-07/08
FS155-07/08
FS156-07/08
FS157-07/08
FS158-07/08
FS159-07/08
FS160-07/08, Part I
FS161-07/08
FS162-07/08, Part II
FS163-07/08
FS164-07/08
F116-07/08, Part II
G33-07/08, Part II
FS165-07/08, Part I
FS166-07/08, Part I
FS167-07/08
FS168-07/08
FS169-07/08
~~FS170-07/08~~
FS171-07/08
FS172-07/08
FS173-07/08
FS174-07/08, Part I
FS175-07/08, Part I
FS176-07/08
FS177-07/08, Part I
FS178-07/08
~~FS179-07/08~~
RB173-07/08, Part II
RB174-07/08, Part II
FS181-07/08
FS182-07/08, Part I
FS183-07/08
FS184-07/08, Part I
FS185-07/08
FS186-07/08
FS187-07/08
FS188-07/08
S17-07/08
S18-07/08, Part I
S19-07/08, Part I
S20-07/08, Part I
S21-07/08
S22-07/08
S23-07/08
S24-07/08
S45-07/08
S102-07/08
S124-07/08
FS190-07/08
FS191-07/08
FS192-07/08
FS193-07/08
FS194-07/08
FS195-07/08
FS196-07/08
FS198-07/08

FS2-07/08 Part I: Add Section 707.1 and revise the first paragraph of Section 707.2 as follows:

707.1 General. The provisions of this section shall apply to vertical shafts where such shafts are required to protect openings and penetrations through ~~floor/ceiling~~ floor and ~~roof/ceiling~~ roof assemblies. Shaft enclosures shall be constructed as fire barriers in accordance with Section 706 or horizontal assemblies in accordance with Section 711, or both.

707.2 Shaft enclosure required. Openings through a ~~floor/ceiling~~ floor assembly shall be protected by a shaft enclosure complying with this section.

Delete Section 914.3.1 (IBC [F] 403.2) from Part III IFC of the proposed change without substitution:

FS20-07/08, PART II: Revise Sections 711.3.3, 711.4 and 909.20.2 as follows:

711.3.3 Unusable space. In 1-hour fire-resistance-rated floor ~~construction~~ assemblies, the ceiling membrane is not required to be installed over unusable crawl spaces. In 1-hour fire-resistance-rated roof ~~construction~~ assemblies, the floor membrane is not required to be installed where unusable attic space occurs above.

711.4 (Supp) Continuity. Assemblies shall be continuous without openings, penetrations or joints except as permitted by this section and Sections 707.2, 712.4, 713 and 1020.1. Skylights and other penetrations through a fire-resistance-rated roof deck or slab are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated roof ~~construction~~ assembly is maintained. Unprotected skylights shall not be permitted in roof ~~construction~~ assemblies required to be fire-resistance rated in accordance with Section 704.10. The supporting construction shall protected to afford the required fire-resistance rating of the horizontal assembly supported.

909.20.2 Construction. The smokeproof enclosure shall be separated from the remainder of the building by not less than a 2-hour fire barrier without openings other than the required means of egress doors. The vestibule shall be separated from the stairway by not less than a 2-hour fire barrier. The open exterior balcony shall be constructed in accordance with the fire-resistance-rating requirements for floor ~~construction~~ assemblies.

FS45-07/08: Revise proponent's representation as follows:

Proponent: Tony Crimi, AC Consulting Solutions, Inc., representing ~~North American Insulation Manufacturers' Association (NAIMA)~~ International Fire Stop Council

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FS103-07/08: Revise exception 5 to Section 713.1 (Supp) by removing the strikeout from the word "open." Exception 5 should read as follows:

5. Floors and ramps within open ~~parking structures~~ and enclosed parking garages or structures constructed in accordance with Sections 406.3 and 406.4, respectively.

FS178-07/08: Replace Section 1406.2.2 with the following:

1406.2.2 (Supp) Architectural trim. In buildings of Type I, II, III and IV construction, exterior wall coverings shall be permitted to be constructed of wood where permitted by Section 1405.4 or other equivalent combustible material. Combustible exterior wall coverings, other than fire-retardant-treated wood complying with Section 2303.2 for exterior installation, shall not exceed 10 percent of an exterior wall surface area where the fire separation distance is 5 feet (1524 mm) or less. Combustible architectural trim shall be limited to ~~three stories or~~ 40 feet (12 192 mm) in height above grade ~~plane~~. Noncombustible materials shall be permitted to be of any height provided the materials are secured to the wall with metal or other approved noncombustible brackets.

Exception: Combustible architectural trim of fire-retardant treated wood shall be permitted up to ~~four stories or~~ 60 feet (18.29 m) in height above grade ~~plane~~.

FS197-07/08: Replace the proposal with the following:

FS197–07/08
905.11, Chapter 35

Proponent: Jeff Hugo, National Fire Sprinkler Association (NFSA)

THIS PROPOSAL IS ON THE AGENDA OF THE IFC CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

1. Add new text as follows:

905.11 Testing and maintenance. Standpipe systems shall be tested and maintained in accordance with NFPA 25.

2. Add new standard to Chapter 35 as follows:

National Fire Protection Association

25–07 Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

Reason: This new text will allow the building official or the department to be able to enforce NFPA 25 for standpipes, in the cases where no fire official is present in the jurisdiction. This new text will also point out to designers and building owners their responsibilities by the direct reference to NFPA 25, helping out follow up inspectors such as fire, building, and/or property maintenance.

The need for sprinkler and standpipe maintenance after the installation is imperative. Oftentimes, sprinklers and standpipe systems are combined and standpipe maintenance could be accomplished along with sprinkler system easily. However, this section will cover those standpipes that stand alone, such as dry standpipes in parking garages, marinas, boatyards, etc.

Catastrophic fires involving malfunctioning standpipes have hampered firefighting efforts and have led to several firefighter deaths and injuries. The One Meridian Plaza fire in 1991 and the Deutsche Bank tower at ground zero in 2007 come to mind. The One Meridian Plaza fire claimed three firefighters and the Deutsche Bank killed two firefighters. In both fires, faulty standpipe components contributed to these deaths by not supplying adequate water.

Cost Impact: The code change proposal will not increase the cost of construction.

INTERNATIONAL WILDLAND-URBAN INTERFACE CODE/ INTERNATIONAL FIRE CODE (VOLUME 1)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add "Part II" to FS165-07/08 on the IFC Hearing Order
Add PM18-07/08 to the IFC Hearing Order following F148-07/08

TENTATIVE ORDER OF DISCUSSION

REVISED 1/8/08

2007-2008 PROPOSED CHANGES TO THE INTERNATIONAL WILDLAND/URBAN INTERFACE CODE/ INTERNATIONAL FIRE CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes. Code Changes to the International Wildland-Urban Interface Code (WUIC) are heard by the International Fire Code Committee.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

WILDLAND-URBAN
WUIC1-07/08
FG2-07/08, Part V
FG3-07/08, Part V
FG5-07/08, Part V
WUIC2-07/08
WUIC3-07/08
WUIC4-07/08
WUIC5-07/08
WUIC6-07/08
FS5-07/08, Part VII
WUIC7-07/08
WUIC8-07/08
WUIC9-07/08
WUIC10-07/08
WUIC11-07/08
WUIC12-07/08
WUIC13-07/08
WUIC14-07/08
WUIC15-07/08
WUIC16-07/08
WUIC17-07/08

FIRE CODE
F1-07/08
F2-07/08
G3-07/08, Part II
G4-07/08, Part II
F3-07/08
F4-07/08
F5-07/08
F6-07/08
F7-07/08
F8-07/08
F9-07/08
F10-07/08
F11-07/08
F12-07/08
F13-07/08
F14-07/08
F15-07/08
F16-07/08
G6-07/08, Part II
F17-07/08
F18-07/08
F19-07/08
F20-07/08
FG6-07/08, Part V
F21-07/08
FG5-07/08, Part VI
F22-07/08
F23-07/08
F24-07/08
F25-07/08
F26-07/08
F27-07/08
F28-07/08
F29-07/08
F30-07/08
F31-07/08
F32-07/08
G12-07/08, Part II
F33-07/08
F34-07/08
F35-07/08
F36-07/08
G16-07/08, Part III
G17-07/08, Part III
F37-07/08
F38-07/08
FS5-07/08, Part III
F39-07/08
F40-07/08
F41-07/08
F42-07/08
F43-07/08
F44-07/08
F45-07/08
F46-07/08
F47-07/08
F48-07/08
F49-07/08
F50-07/08
F51-07/08
F52-07/08
F53-07/08
F54-07/08,
F55-07/08
F56-07/08
F57-07/08
F58-07/08
G212-07/08, Part II
F59-07/08
F60-07/08
E9-07/08, Part II
E35-07/08, Part II
F61-07/08
F62-07/08
F63-07/08
F64-07/08
G33-07/08, Part IV
F65-07/08
F66-07/08
F67-07/08
F68-07/08
F69-07/08
F70-07/08
F71-07/08
F72-07/08
F73-07/08
F74-07/08
F75-07/08, Part I
F76-07/08
F77-07/08, Part I
F78-07/08
F79-07/08
F80-07/08
F81-07/08
F82-07/08
F83-07/08
F84-07/08
F85-07/08
F86-07/08
G58-07/08, Part II
F87-07/08
G53-07/08
F204-07/08
F171-07/08

F88-07/08, Part I
F89-07/08
F90-07/08
F91-07/08
M94-07/08
M97-07/08
F92-07/08
F93/07/08
F94-07/08
F95-07/08
F96-07/08, Part I
F97-07/08
F98-07/08
F99-07/08
F100-07/08
M29-07/08
F101-07/08
F102-07/08, Part I
FS160-07/08, Part II
F103-07/08
F104-07/08
F105-07/08
F106-07/08
F107-07/08
FS2-07/08, Part III
F108-07/08
F109-07/08
F110-07/08
F111-07/08
F112-07/08
F113-07/08
F114-07/08
F115-07/08
F116-07/08, Part I
G220-07/08, Part II
F117-07/08
F118-07/08
F119-07/08
FS165-07/08, Part II
FS166-07/08, Part II
F120-07/08
FS189-07/08, Part I
F121-07/08
F122-07/08
F123-07/08
F124-07/08
F125-07/08
F126-07/08
F127-07/08
F128-07/08
F129-07/08
F130-07/08
E8-07/08, Part II
F131-07/08
E10-07/08, Part II
G46-07/08
F132-07/08
F133-07/08
G23-07/08, Part II
G99-07/08
F134-07/08
F135-07/08
F136-07/08
F137-07/08
F138-07/08
F139-07/08
E14-07/08, Part II
F140-07/08
F141-07/08
F142-07/08
F143-07/08
F144-07/08
F145-07/08
F146-07/08
G14-07/08, Part II
F147-07/08
F148-07/08
PM18-07/08
FS170-07/08
F149-07/08
F150-07/08
F151-07/08
F152-07/08
F153-07/08
F154-07/08
F155-07/08
F156-07/08
FS197-07/08
F157-07/08
F158-07/08
F159-07/08
F160-07/08
F161-07/08
F162-07/08
F163-07/08
G21-07/08, Part II
F164-07/08
F165-07/08
F166-07/08
F167-07/08
F168-07/08
F169-07/08
F170-07/08, Part I
F172-07/08
F173-07/08
F174-07/08
F175-07/08
F176-07/08
F177-07/08
F178-07/08
F179-07/08
F180-07/08
F181-07/08
F182-07/08
F183-07/08
F184-07/08
F185-07/08
G63-07/08
F186-07/08
F187-07/08
G64-07/08
F188-07/08
F189-07/08
F190-07/08
F191-07/08
F192-07/08
F193-07/08
F194-07/08
F195-07/08
F196-07/08
F197-07/08
F198-07/08
F199-07/08
F200-07/08
F201-07/08
F202-07/08
F203-07/08
G41-07/08, Part II
G25-07/08, Part II
E1-07/08, Part II
E2-07/08, Part II
F205-07/08
E19-07/08, Part II
F206-07/08
F207-07/08
F208-07/08
F209-07/08
F210-07/08
F211-07/08
F212-07/08
F213-07/08
F214-07/08
F215-07/08
F216-07/08
F217-07/08
F218-07/08
F219-07/08
F220-07/08
F221-07/08
G101-07/08
F222-07/08
F223-07/08
F224-07/08
F225-07/08
F226-07/08
F227-07/08
F228-07/08
F229-07/08
F230-07/08
F231-07/08
F232-07/08
F233-07/08, Part I
F234-07/08
FG49-07/08
F235-07/08
F236-07/08
F237-07/08
F238-07/08
F239-07/08
F240-07/08
F241-07/08, Part I
F242-07/08
F243-07/08, Part I
F244-07/08
G28-07/08
G29-07/08
F245-07/08
F246-07/08
G96-07/08
F247-07/08
F248-07/08
F249-07/08
F250-07/08
F251-07/08
F252-07/08
F253-07/08
FS20-07/08, Part III
F254-07/08
F255-07/08
F256-07/08
F257-07/08
F258-07/08
F259-07/08
F260-07/08
G107-07/08, Part II
F261-07/08
F262-07/08
F263-07/08
F264-07/08
F265-07/08
F266-07/08
G97-07/08
F267-07/08
F268-07/08
G98-07/08
F269-07/08
F270-07/08
F271-07/08
F272-07/08
F273-07/08
F274-07/08
F275-07/08
F276-07/08
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F278-07/08
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F281-07/08
F282-07/08
F283-07/08
F284-07/08
F285-07/08
F286-07/08
F287-07/08
F288-07/08
F289-07/08
G100-07/08
F290-07/08
F291-07/08
F292-07/08
F293-07/08
F294-07/08
F295-07/08
F296-07/08
F297-07/08
F298-07/08
F299-07/08
F300-07/08
F301-07/08
F302-07/08
F303-07/08
F304-07/08
F305-07/08

INTERNATIONAL WILDLAND-URBAN INTERFACE CODE (VOLUME 1)

WUIC5-07/08 (first one on page WUIC-5): Renumber to become WUIC4-07/08

WUIC9-07/08: Replace the proposal with the following:

WUIC9–07/08
302.2

Proponent: Anthony C. Apfelbeck, Building/Fire Safety Division, City of Altamonte Springs, FL

Revise as follows:

302.2 Mapping. The wildland-urban interface areas shall be recorded on maps available for inspection by the public. ~~and filed with the clerk of the jurisdiction. These areas shall become effective immediately thereafter.~~

(Reason and Cost Impact remain unchanged)

WUIC10-07/08: Delete Chapter 45 from Masthead, Item 5 and the analysis without substitution as follows:

WUIC10–07/08
503.1, 503.2, 503.2.1 through 503.3.3, 503.3 through 503.3.2 (New), 504.12 (New), 505.12 (New), 506.1~~, Chapter 45 (New)~~

~~**5. Add standards to Chapter 45 as follows:**~~

~~**ASTM**~~

~~D 7032-07~~	~~Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)~~
~~D 6662-06~~	~~Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards~~

~~**Analysis:** A review of the standards proposed for inclusion in the code, ASTM D7032-07 and ASTM D6662-06, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.~~

F23-07/08: Revise new item 10 to read as follows:

~~9.~~10. To engage in the dispensing of liquid fuels into the fuel tanks of motor vehicles from tank vehicles at commercial, industrial, governmental or manufacturing establishments.

F97-07/08: Replace the proposal by adding Item 2 as follows:

F97–07/08
608, IMC [F] 502.4, [F] 502.4.1; 602.1 (New)

Proponent: Ronald Marts, Telcordia Technologies, representing AT&T, BellSouth, SBC, PacBell, Ameritech, SNET, Qwest, Cincinnati Bell

1. Revise IFC as follows:

608.1 (Supp) Scope. Stationary storage battery systems having an electrolyte capacity of more than 50 gallons (189L) for flooded lead acid, Nickel Cadmium, and VRLA, or a total battery weight (excluding racks or cabinets) of 1000 pounds for Lithium-Ion, ~~and~~ Lithium Metal Polymer and Nickel Metal Hydride, used for facility standby power, emergency power, or uninterrupted power supplies shall comply with this section and with Table 608.1.

TABLE 608.1 (Supp)
BATTERY REQUIREMENTS

	Non-Recombinant Batteries		Recombinant Batteries			Other
Requirement	**Flooded Lead Acid Batteries**	**Flooded Nickel Cadmium (Ni-Cd) Batteries**	**Valve Regulated Lead Acid (VRLA) Batteries**	**Lithium-Ion**	**Nickel Metal Hydride**	**Lithium Metal Polymer**
Safety Caps (608.2)	Venting caps (608.2.1)	Venting caps (608.2.1)	Self-resealing flame-arresting caps (608.2.2)	No caps	Self-resealing flame-arresting caps (608.2.2)	No caps
Thermal Runaway Management	Not required	Not required	Required (608.3)	Not required	Required (608.3)	Required (608.3)
Spill Control	Required (608.5)	Required (608.5)	Not required	Not required	Not Required	Not Required
Neutralization	Required (608.5.1)	Required (608.5.1)	Required (608.5.2)	Not required	Required (608.5.2)	Not Required
Ventilation	Required (608.6.1; 608.6.2)	Required (608.6.1; 608.6.2)	Required (608.6.1; 608.6.2)	Not Required	Required (608.6.1; 608.6.2)	Not Required
Signage	Required (608.7)	Required (608.7)	Required (608.7)	Required (608.7)	Required (608.7)	Required (608.7)
Seismic Control	Required (608.8)	Required (608.8)	Required (608.8)	Required 608.8	Required (608.8)	Required 608.8
Fire Detection	Required (608.9)	Required (608.9)	Required (608.9)	Required 608.9	Required (608.9)	Required 608.9

608.2.2 Recombinant batteries. Valve-regulated lead-acid (VRLA), nickel metal hydride, or other types of sealed, recombinant batteries shall be equipped with self-resealing flame-arresting safety vents.

608.3 (Supp) Thermal runaway. VRLA and lithium metal polymer, and nickel metal hydride battery systems shall be provided with a listed device or other approved method to preclude, detect, and control thermal runaway.

608.5 (Supp) Spill control and neutralization. An approved method and materials for the control and neutralization of a spill of electrolyte shall be provided in areas containing lead-acid, nickel-cadmium, or other types of batteries with freeflowing liquid electrolyte. For purposes of this paragraph, a “spill” is defined as any unintentional release of electrolyte.

Exception: VRLA, Lithium-Ion, Lithium Metal Polymer, nickel metal hydride, or other types of sealed batteries with immobilized electrolyte shall not require spill control.

608.5.1 Non-recombinant battery neutralization. For battery systems containing lead-acid, nickel-cadmium, or other types of batteries with free-flowing electrolyte, the method and materials shall be capable of neutralizing a spill from the largest ~~lead-acid battery~~ cell or block to a pH between 7.0 and 9.0.
608.5.2 (Supp) Recombinant battery neutralization. For VRLA, nickel metal hydride, or other types of sealed batteries with immobilized electrolyte, the method and material shall be capable of neutralizing a spill of 3.0 percent of the capacity of the largest VRLA cell or block in the room to a pH between 7.0 and 9.0.

Exception: Lithium-Ion and Lithium Metal Polymer batteries shall not require neutralization.

608.6 Ventilation. Ventilation of stationary storage battery systems shall comply with Sections 608.6.1 and 608.6.2.

608.6.1 (Supp) Room ventilation. Ventilation shall be provided in accordance with the *International Mechanical Code* and one of the following:

1. For flooded lead acid, flooded Ni-Cad, ~~and~~ VRLA, and nickel metal hydride batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room; or
2. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (1 $ft^3/min/ft^2$) [0.0051m^3/s m^2] of floor area of the room.

Exception: Lithium-Ion and Lithium Metal Polymer batteries shall not require ventilation beyond what is normally required in accordance with the *International Mechanical Code*..

2. Revise IMC as follows:

[F] 502.4 (Supp) Stationary storage battery systems. Stationary storage battery systems, as regulated by Section 608 of the *International Fire Code*, shall be provided with ventilation in accordance with this chapter and Section 502.4.1 or 502.4.2.

Exception: Lithium-ion and Lithium Metal Polymer batteries shall not require ventilation beyond what is normally required by this code.

[F] 502.4.1 Hydrogen limit in rooms. For flooded lead acid, flooded nickel cadmium, ~~and~~ VRLA and nickel metal hydride batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room.

[F] 502.4.2 Ventilation rate in rooms. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft2) [0.00508 m3/(s • m2)] of floor area of the room.

3. Add new definition as follows:

602.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

BATTERY TYPES

Nickel metal hydride battery. An electrochemical secondary (rechargeable) alkaline battery where the charge carriers (positive Hydrogen ions) are stored in non-gaseous form in a metal alloy hydride material.

Reason: This proposed change adds Nickel Metal Hydride (NMH) batteries to Section 608. NMH batteries are currently undergoing tests by several end users for use as stationary battery back-up systems where lead acid and VRLA batteries are currently used. Section 608 has become the "battery" section of the code, where several requirements can be addressed for each technology battery. The new definition is required for clarity.
This proposed change also includes an enhancement to rooms where Lithium-Ion and Lithium Metal Polymer batteries are located by requiring general ventilation in accordance with the IMC.

Cost Impact: The code change proposal will not increase the cost of construction.

F99-07/08: Replace the proposal by adding Item 2 as follows:

F99–07/08
608.6.1; IMC [F] 502.4, [F] 502.4.1

Proponent: Stephen McCluer, APC-MGE

1. Revise IFC as follows:

608.6.1 (Supp) Room ventilation. Ventilation shall be provided in accordance with the *International Mechanical Code* and the following:

1. For flooded lead acid, flooded Ni-Cad, nickel metal hydride and VRLA batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room within an eight hour period and under the worst case condition of recharge following a discharge, or equalize charging, if the capability exists, whichever is higher; or
2. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot ($1ft^3/min/ft^2$) [$0.0051m_3/s\ m^2$] of floor area of the room.

   Exception: Lithium-Ion and Lithium Metal Polymer batteries shall not require ventilation in excess of that required by the *International Mechanical Code*.

2. Revise IMC as follows:

[F] 502.4 (Supp) Stationary storage battery systems. Stationary storage battery systems, as regulated by Section 608 of the *International Fire Code*, shall be provided with ventilation in accordance with this chapter and Section 502.4.1 or 502.4.2.

Exception: Lithium-ion and Lithium Metal Polymer batteries shall not require ventilation in excess of that required by this code.

[F] 502.4.1 Hydrogen limit in rooms. For flooded lead acid, flooded nickel cadmium, nickel metal hydride and VRLA batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room within an eight hour period and under the worst case condition of recharge following a discharge, or equalize charging, if the capability exists, whichever is higher.

[F] 502.4.2 Ventilation rate in rooms. Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft2) [0.00508 m3/(s • m2)] of floor area of the room.

Reason: The IMC is a big document. It would be helpful to guide the reader to the relevant section of the IMC, which would logically be the VENTILATION section (presently Chapter 4). [see proposal M29-07/08 on IMC Ch 5]

Add nickel-metal-hydride batteries to the list of regulated battery types. Stationary NiMH battery systems have only recently been introduced to the market and are expected to become more widely used in the near future.

Add a time limit to the requirement for gassing. Theoretically, given enough time in a sealed space and given an infinite amount of gas generation, enough hydrogen could be generated to reach a one percent concentration… sometimes in days, weeks or even months. Assuming that other monitoring protections required by this code are functioning, such a design requirement is unrealistic and needlessly expensive. A requirement to design a ventilation system to prevent the accumulation of 1% hydrogen gas within an eight hour period is reasonable. Realistically, most battery systems must be in a sustained failure mode to generate that much gas. Vented batteries could do so, and would require a ventilation system designed for such conditions under this proposal.

Add the requirements under which such hydrogen gassing could occur. It should not be the theoretical laboratory maximum failure mode. Hydrogen release is created under conditions of excessive heat and/or voltage through the cells. Assuming compliance with the thermal runaway protection required by 608.3, the requirement should be based upon the worst case event likely to be seen in actual applications. Worst case would be during the high voltage event of equalize charging for a vented (flooded) battery. Some battery systems, such as UPS with VRLA batteries, do not permit or have provisions for equalize charging, in which case the worst case high voltage condition is recharge following a discharge.

Add the caveat that no "additional" ventilation is required beyond what is required by the IMC. Even Li-Ion and LMP batteries need at least some ventilation.

Cost Impact: The code change proposal will not increase the cost of construction beyond what is already required by the *International Fire Code* and the *International Mechanical Code*.

F268-07/08: Revise reason statement to read as follows:

Reason: Since the temporary storage of consumer fireworks, 1.4G occurs in almost every state in the US, it makes good sense to specify fire safety regulations for those situations. NFPA 1124-2006 contains fairly comprehensive requirements for such storage that have been developed through the NFPA consensus process.

TRACK 2
INTERNATIONAL EXISTING BUILDING CODE (Volume 2)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add E8-07/08, Part III after EB31-07/08 on IEBC Hearing Order
Add Part I to EB14-07/08 on IEBC Hearing Order
Add E19-07/08, Part III after EB17-07/08 on IEBC Hearing Order
Add E26-07/08, Part II after EB19-07/08 on IEBC Hearing Order
Add EB52-07/08 to the end of IEBC Hearing Order
Remove EB10-07/08 from the IEBC Hearing Order (Duplicate of G209-07/08)
Remove Part I from EB15-07/08 on IEBC Hearing Order

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL EXISTING BUILDING CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

EB1-07/08
EB2-07/08
EB3-07/08
    G6-07/08, Part IV
    G7-07/08, Part II
    G8-07/08, Part II
    G9-07/08, Part II
    G10-07/08, Part II
    G12-07/08, Part III
EB4-07/08
EB5-07/08
EB6-07/08
    FS5-07/08, Part II
    G207-07/08, Part II
    S55-07/08, Part II
EB7-07/08
EB8-07/08
EB9-07/08
    G209-07/08, Part II
~~EB10-07/08~~
EB11-07/08
EB12-07/08
EB13-07/08
EB14-07/08, Part I
EB15-07/08~~, Part I~~
EB16-07/08
EB17-07/08
    E19-07/08, Part III
EB18-07/08
    G214-07/08, Part II
    G213-07/08, Part II
    G215-07/08, Part II
EB19-07/08
    E26-07/08, Part II
EB20-07/08
EB21-07/08
EB22-07/08
EB23-07/08
EB24-07/08
EB25-07/08
EB26-07/08
EB27-07/08
EB28-07/08
EB29-07/08
EB30-07/08
EB31-07/08
    E8-07/08, Part III
EB32-07/08
EB33-07/08
EB34-07/08
EB35-07/08
    G211-07/08, Part II
EB36-07/08
EB37-07/08
EB38-07/08
EB39-07/08
EB40-07/08
EB41-07/08
EB42-07/08
EB43-07/08
EB44-07/08
EB45-07/08
EB46-07/08
EB47-07/08
EB48-07/08
EB49-07/08
EB50-07/08
EB51-07/08
EB52-07/08

EB1-07/08: Revise Sections 506.1, 506.1.1, 506.2 and 506.2.1 as follows:

506.1 General. ~~Repairs of structural elements shall comply with this section~~ Structural repairs shall be in compliance with this section and Section 501.3. Regardless of the extent of structural or nonstructural damage, the code official shall have the authority to require the elimination of conditions deemed dangerous. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

~~**506.1.1 Seismic evaluation and design.**~~ (Delete entire section –relocated to Section 101.5.4)

506.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

~~**506.2.1 Dangerous Conditions.** Regardless of the extent of structural damage, dangerous conditions shall be eliminated.~~ (Relocated to Section 506.1)

EB22-07/08: Revise Sections 606.2.2 and 606.2.3 as follows:

606.2.2: In the second line add the words "is issued for reroofing" after "Where a permit"

606.2.3: In the first line change the word "reproofing" to reroofing"

EB52-07/08: Add the following code change:

EB52-07/08
Chapter 15

Proponent: Peter Somers, PE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise Chapter 15 as follows:

ASCE

ASCE 31-~~03~~ 08 Seismic Evaluation of Existing Buildings

Reason: The purpose of the proposed change is to maintain in the IEBC the most current update and state of the practice references for seismic evaluation. In accordance with ASCE practice, standards are reaffirmed or updated in intervals of no more than five years. Therefore, by the time the 2009 IEBC is published, there will be a newer version of ASCE 31. The updated version will be available in time for the final action hearings.

Cost Impact: This revision is not expected to impact construction cost.

G209-07/08, Part II – IEBC: Revise Section 506.1.1.3, item 1 as follows:

506.1.1.3 (Supp) Reduced IBC level seismic forces. When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:

1. Seventy-five percent of the forces prescribed in the *International Building Code*. ~~The *R* factor~~ Values of R, Ω_0, and C_d used for analysis in accordance with Chapter 16 of the *International Building Code* shall be those ~~the *R* factor as~~ specified in Section 506.1.1.2 of this code.

INTERNATIONAL PROPERTY MAINTENANCE CODE (Volume 2)

REVISION TO TENTATIVE ORDER OF DISCUSSION:

Remove PM18-07/08 from the IPMC Hearing Order

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL PROPERTY MAINTENANCE CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation does **not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

IPMC

PM1-07/08
PM2-07/08
    G16-07/08, Part VI
PM3-07/08
PM4-07/08
PM5-07/08
PM6-07/08
PM7-07/08
PM8-07/08
PM9-07/08
PM10-07/08
PM11-07/08
PM12-07/08
PM13-07/08
PM14-07/08
PM15-07/08
PM16-07/08
PM17-07/08
~~PM18-07/08~~
PM19-07/08
PM20-07/08

ZONING

Z1-07/08

PM3-07/08: Replace the proposal with the following:

EXTERMINATION. The control and elimination of insects, rats or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food; ~~by poison spraying, fumigating, trapping or by any other approved pest elimination methods.~~ or water; by trapping; and, when necessary, by use of registered pesticides consistent with label instructions in a manner that effectively controls the pest with the lowest exposure to occupants.

(Reason and cost impact to remain as published)

PM10-07/08: Replace the proposal with the following:

403.5 Clothes dryer exhaust. Clothes dryer exhaust systems shall be independent of all other systems and shall be exhausted outside the structure in accordance with the ~~manufacturer's instructions~~ label.

Exception: Listed and labeled condensing (ductless) clothes dryers.

(Reason and cost impact to remain as published)

PM13-07/08: Replace the proposal with the following:

503.4 Floor surface. In other than single family dwelling units, every bathroom and toilet room floor shall be maintained to be a smooth, hard, nonabsorbent surface to permit such floor to be easily kept in a clean and sanitary condition.

(Reason and cost impact to remain as published)

PM17-07/08: Replace the reason statement with the following:

Reason: Based upon similar code language contained within the National Electrical Code.

INTERNATIONAL ENERGY CONSERVATION CODE (Volume 2)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add G183-07/08, Part I to IECC Hearing Order before G183-07/08, Part II
Add EC49-07/08, Part I after EC48-07/08, Part I on the IECC Hearing Order
Revise EC90-07/08 (before EC100-07/08) to become EC99-07/08 on the IECC Hearing Order
Remove Part II from G183-07/08 on IECC Hearing Order

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2007-2008 PROPOSED CHANGES TO THE INTERNATIONAL ENERGY CONSERVATION CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

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EC1-07/08
EC2-07/08I
EC3-07/08, Part I
EC4-07/08
EC5-07/08, Part I
EC6-07/08
EC7-07/08, Part I
EC8-07/08
EC9-07/08
    G16-07/08, Part II
    G17-07/08, Part II
EC10-07/08, Part I
EC11-07/08, Part I
EC12-07/08
EC13-07/08
    RE2-07/08, Part II
EC14-07/08
EC15-07/08, Part I
EC16-07/08
EC17-07/08
EC18-07/08, Part I
EC19-07/08, Part I
EC20-07/08, Part I
EC21-07/08, Part I
EC22-07/08, Part I
EC23-07/08, Part I
EC24-07/08
EC25-07/08, Part I
EC26-07/08
EC27-07/08
EC28-07/08, Part I
EC29-07/08
EC30-07/08
EC31-07/08
EC32-07/08
EC33-07/08
EC34-07/08, Part I
EC35-07/08
EC36-07/08, Part I
EC37-07/08, Part I
EC38-07/08
EC39-07/08
EC40-07/08
EC41-07/08
EC42-07/08, Part I
EC43-07/08, Part I
EC44-07/08
EC45-07/08, Part I
EC46-07/08
EC47-07/08, Part I
EC48-07/08, Part I
EC49-07/08, Part I
EC50-07/08, Part I
EC51-07/08, Part I
EC52-07/08
EC53-07/08, Part I
EC54-07/08
EC55-07/08
EC56-07/08, Part I
EC57-07/08, Part I
EC58-07/08I, Part I
EC59-07/08, Part I
EC60-07/08, Part I
EC61-07/08
EC62-07/08, Part I
EC63-07/08, Part I
EC64-07/08, Part I
EC65-07/08, Part I
    FS177-07/08, Part II
EC66-07/08
EC67-07/08
EC68-07/08, Part I
EC69-07/08, Part I
EC70-07/08, Part I
EC71-07/08, Part I
EC72-07/08, Part I
EC73-07/08
EC74-07/08, Part I
EC75-07/08
EC76-07/08, Part I
EC77-07/08
EC78-07/08, Part I
EC79-07/08, Part I
EC80-07/08, Part I
EC81-07/08, Part I
EC82-07/08
EC83-07/08, Part I
    G183-07/08~~, Part I~~
EC84-07/08, Part I
EC85-07/08
EC86-07/08
EC87-07/08
EC88-07/08
EC89-07/08
EC90-07/08
EC91-07/08
EC92-07/08
EC93-07/08
EC94-07/08
EC95-07/08
EC96-07/08, Part I
EC97-07/08, Part I
EC98-07/08
EC99-07/08
EC100-07/08
EC101-07/08
EC102-07/08
EC103-07/08
EC104-07/08
EC105-07/08
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EC142-07/08
EC143-07/08
EC144-07/08
EC145-07/08
EC146-07/08
EC147-07/08
EC148-07/08
EC149-07/08
EC150-07/08
EC151-07/08
EC152-07/08, Part I
EC153-07/08
EC154-07/08

EC116-07/08: Remove ASTM E903 from 1st paragraph of Section 502.3 and also from added standards to read as follows:

502.3 Roof reflectance. Low and medium sloped roofs in Climate Zones 1, 2, and 3 shall comply with the following requirements for reflectance when tested in accordance with ASTM C1549, E1918 or by testing with a portable reflectometer at near ambient conditions. The roof surface of low sloped roofs (2:12 or less) shall have an initial solar reflectance greater than or equal to 0.65 and shall maintain a reflectance equal or grater than 0.50 for three years after installation. Medium sloped roofs (greater than 2:12 and less than or equal to 5:12) shall have a solar reflectance equal to or greater than 0.15 initially and for three years after installation.

ASTM

C1549-(04)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E1918-(1997)	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

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EC153-07/08: Add ASHRAE standard to the Administrative Update as follows:

ASHRAE

90.1-~~04~~ 07	Energy Standard for Buildings Except for Low-Rise Residential Buildings

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INTERNATIONAL RESIDENTIAL CODE (IRC P-M) (Volume 2)

REVISION TO TENTATIVE ORDER OF DISCUSSION:

IRC-P-M: Remove RP6-07/08 from RP agenda (Not used)
Add RP8-07/08 to RP agenda following RP3-07/08

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL RESIDENTIAL CODE

PLUMBING/MECHANICAL

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

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IRC PLUMBING

P1-07/08, Part II
P2-07/08, Part II
RP1-07/08
P13-07/08, Part II
P8-07/08, Part II
P7-07/08, Part II
P9-07/08, Part II
P32-07/08, Part II
P33-07/08, Part II
P34-07/08, Part II
P27-07/08, Part II
P46-07/08, Part II
P52-07/08, Part II
P48-07/08, Part II
P49-07/08, Part II
P50-07/08, Part II
P51-07/08, Part II
P63-07/08, Part II
P36-07/08, Part II
P37-07/08, Part II
P38-07/08, Part II
P39-07/08, Part II
P40-07/08, Part II
P41-07/08, Part II
P42-07/08, Part II
P43-07/08, Part II
P45-07/08, Part II
P54-07/08, Part II
P55-07/08, Part II
P56-07/08, Part II
RP2-07/08
RP3-07/08
RP8-07/08
RP7-07/08
P58-07/08, Part II
P59-07/08, Part II
P60-07/08, Part II
P61-07/08, Part II
P62-07/08, Part II
RP4-07/08
P69-07/08, Part II
P70-07/08, Part II
P71-07/08, Part II
P73-07/08, Part II
RP5-07/08
P80-07/08, Part II
P81-07/08, Part II
P84-07/08, Part II
P89-07/08, Part II
P86-07/08, Part II
~~RP6-07/08~~

IRC MECHANICAL

FG17-07/08, Part III
M10-07/08, Part II
M11-07/08, Part II
M9-07/08, Part II
M16-07/08, Part II
M17-07/08, Part II
RM1-07/08
RM2-07/08
RM3-07/08
M6-07/08, Part II
RM4-07/08
RM5-07/08
RM6-07/08
M91-07/08, Part II
M92-07/08, Part II
RM7-07/08
M30-07/08, Part II
RM8-07/08
RM9-07/08
RM10-07/08
M32-07/08, Part II
M33-07/08, Part II
RM11-07/08
RM12-07/08
RM13-07/08
RB28-07/08
EC72-07/08, Part III
RM14-07/08
M79-07/08, Part II
M80-07/08, Part II
RM15-07/08
RM16-07/08
RM17-07/08
RM18-07/08
FG46-07/08, Part III
M88-07/08, Part II
EC76-07/08, Part II
RM19-07/08
M103-07/08, Part II
M104-07/08, Part II
F88-07/08, Part II
RM20-07/08

RP4-07/08: Add the following code change:

RP4–07/08
P2904.17.2

Proponent: Jud Collins, JULYCO, representing himself

Revise as follows:

P2904.17.2 (Supp) Plastic pipe or tubing to other piping material. Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. ~~Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint.~~

Reason: Cast-iron pipe is not approved for water supply or distribution. This sentence does not belong in the water supply chapter.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

RP6–07/08 (NOT USED)

RM19-07/08: Replace Section M2005.2 to read as follows:

M2005.2 Prohibited locations. Fuel-fired water heaters shall not be installed in a room used as a ~~storage,~~ clothes or other similar closet. Water heaters located in a bedroom or bathroom shall be installed in a sealed enclosure so that combustion air will not be taken from the living space. Installation of direct-vent water heaters within an enclosure is not required.

INTERNATIONAL MECHANICAL CODE (Volume 2)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add Part I to the following code changes on the IMC Hearing Order:

M6-07/08,
M7-07/08
M9-07/08
M10-07/08
M11-07/08
M16-07/08
M17-07/08
M30-07/08
M32-07/08
M33-07/08
M79-07/08
M80-07/08
M88-07/08
M91-07/08
M92-07/08
M103-07/08
M104-07/08

Remove M29-07/08 from IMC Hearing Order

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2007-2008 PROPOSED CHANGES TO THE INTERNATIONAL MECHANICAL CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

M1-07/08
FG2-07/08, Part II
FG3-07/08, Part II
FG4-07/08, Part II
FG5-07/08, Part II
FG6-07/08, Part II
FG7-07/08, Part II
FS5-07/08, Part V
M2-07/08
M3-07/08
M4-07/08
M5-07/08
G16-07/08, Part V
G17-07/08, Part V
M6-07/08, Part I
M7-07/08, Part I
M8-07/08
M9-07/08, Part I
M10-07/08, Part I
M11-07/08, Part I
FG17-07/08, Part II
M12-07/08
M13-07/08
M14-07/08
M15-07/08
M16-07/08, Part I
M17-07/08, Part I
M18-07/08
M19-07/08
M20-07/08
M21-07/08
M22-07/08
M23-07/08
M24-07/08
M25-07/08
M26-07/08
M27-07/08
M28-07/08
~~M29-07/08~~
M30-07/08, Part I
M31-07/08
M32-07/08, Part I
M33-07/08, Part I
M34-07/08
M36-07/08
M37-07/08
M38-07/08
M39-07/08
M35-07/08
M40-07/08
M41-07/08
M42-07/08
M43-07/08
M44-07/08
M45-07/08
M46-07/08
M47-07/08
M48-07/08
M49-07/08
M50-07/08
M51-07/08
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M59-07/08
M60-07/08
M61-07/08
M62-07/08
M63-07/08
M64-07/08
M65-07/08
M66-07/08
M67-07/08
M68-07/08
M69-07/08
M70-07/08
M71-07/08
M72-07/08
M73-07/08
EC72-07/08, Part IV
M74-07/08
M75-07/08
M76-07/08
M77-07/08
M78-07/08
M79-07/08, Part I
M80-07/08, Part I
M81-07/08
M82-07/08
M83-07/08
F170-07/08, Part II
M84-07/08
M85-07/08
M86-07/08
M87-07/08
M88-07/08, Part I
FG45-07/08, Part II
FG46-07/08, Part II
M89-07/08
M90-07/08
M91-07/08, Part I
M92-07/08, Part I
M93-07/08
M95-07/08
M96-07/08
M98-07/08
M99-07/08
M100-07/08
M101-07/08
M102-07/08
M103-07/08, Part I
M104-07/08, Part I
M105-07/08
M106-07/08

M6-07/08: Add exception to proposal as follows:

404.1 General. Enclosed parking garages shall be provided with mechanical ventilation as prescribed in this chapter.

Exception: Private garages classified as Group U occupancies.

INTERNATIONAL PLUMBING CODE (Volume 2)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Revise G106-07/08, Part II to become G106-07/08, Part III
Revise E169-07/08, Part II, to become E168-7/08, Part II

TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL PLUMBING CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

PLUMBING
- FG2-07/08, Part III
- FG3-07/08, Part III
- FG4-07/08, Part III
- FG5-07/08, Part III
- FG6-07/08, Part III
- FG7-07/08, Part III

P1-07/08, Part I
P2-07/08, Part I
P3-07/08
P4-07/08
- M7-07/08, Part II

P5-07/08
P6-07/08
P7-07/08, Part I
P8-07/08, Part I
P9-07/08, Part I
P10-07/08
- G182-07/08, Part II

P11-07/08
P12-07/08
P13-07/08, Part I
P14-07/08
- F102-07/08, Part II

P15-07/08
P16-07/08
- G33-07/08, Part V
- G106-07/08, Part ~~II~~ III

P17-07/08
- E~~169~~ 168-07/08, Part II

P18-07/08
P19-07/08
P20-07/08
P21-07/08
P22-07/08
P23-07/08
P24-07/08
P25-07/08
P26-07/08
P27-07/08, Part I
P28-07/08
P29-07/08, Part I
P30-07/08
P31-07/08
P32-07/08, Part I
P33-07/08, Part I
P34-07/08, Part I
P35-07/08
P36-07/08, Part I
P37-07/08, Part I
P38-07/08, Part I
P39-07/08, Part I
P40-07/08, Part I
P41-07/08, Part I
P42-07/08, Part I
P43-07/08, Part I
P44-07/08
P45-07/08, Part I
P46-07/08, Part I
P47-07/08
P48-07/08, Part I
P49-07/08, Part I
P50-07/08, Part I
P51-07/08, Part I
P52-07/08, Part I
P53-07/08
P54-07/08, Part I
P55-07/08, Part I
P56-07/08, Part I
P57-07/08
P58-07/08, Part I
P59-07/08, Part I
P60-07/08, Part I
P61-07/08, Part I
P62-07/08, Part I
P63-07/08, Part I
P64-07/08
P65-07/08
P66-07/08
P67-07/08
P68-07/08
P69-07/08, Part I
P70-07/08, Part I
P71-07/08, Part I
P72-07/08
P73-07/08, Part I
P74-07/08
P75-07/08
P76-07/08
P77-07/08
P78-07/08
P79-07/08
P80-07/08, Part I
P81-07/08, Part I
P82-07/08
P83-07/08
P84-07/08, Part I
P85-07/08
P86-07/08, Part I
P87-07/08
P88-07/08
P89-07/08, Part I
P90-07/08
P91-07/08
P92-07/08
P93-07/08
P94-07/08
P95-07/08
P96-07/08
P97-07/08
P98-07/08
P99-07/08
P100-07/08
P101-07/08

PRIVATE SEWAGE
- FG2-07/08, Part IV
- FG3-07/08, Part IV
- FG4-07/08, Part IV
- FG5-07/08, Part IV
- FG6-07/08, Part IV
- FG7-07/08, Part IV

PSD1-07/08
PSD2-07/08

STRUCTURAL (VOLUME 1)

REVISIONS TO TENTATIVE ORDER OF DISCUSSION:

Add FS179-07/08 as the first change on the IBC Structural Hearing Order
Add G109-07/08, Part I following S79-07/08 on the IBC Structural Hearing Order
Add EB14-07/08, Part II following S87-07/08 on the IBC Structural Hearing Order
Remove S140-07/08 from the 1st column (page 18) of the IBC Structural Hearing Order

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TENTATIVE ORDER OF DISCUSSION

Revised 1/8/08

2006-2007 PROPOSED CHANGES TO THE INTERNATIONAL BUILDING CODE

STRUCTURAL

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair. Note that some "IBC-S" code change proposals are not included on this list, as they are being heard by other committees. Please consult the Cross Index of Proposed Changes.

FS179-07-08
S1-07/08
S2-07/08
S3-07/08
FS2-07/08, Part II
S4-07/08
S5-07/08, Part I
S6-07/08, Part I
S7-07/08
S8-07/08
S9-07/08
S10-07/08
S11-07/08
S12-07/08
S13-07/08
S14-07/08
S16-07/08
S25-07/08, Part I
S26-07/08, Part I
S27-07/08
S28-07/08
S29-07/08, Part I
S30-07/08, Part I
S31-07/08
S32-07/08
S33-07/08
S34-07/08
S35-07/08, Part I
S36-07/08
S37-07/08, Part I
S38-07/08
S39-07/08
S40-07/08
S41-07/08
S44-07/08, Part I
S238-07/08
S46-07/08
S47-07/08
S48-07/08
S49-07/08
S50-07/08, Part I
S51-07/08
S52-07/08
S53-07/08
S54-07/08
S55-07/08, Part I
S57-07/08
S58-07/08
S60-07/08
S61-07/08
S62-07/08
S63-07/08
S64-07/08
S65-07/08
S66-07/08
S67-07/08
S68-07/08
S69-07/08
S70-07/08
S71-07/08
S72-07/08, Part I
S73-07/08
G77-07/08, Part II
S74-07/08
S75-07/08
S76-07/08
S77-07/08
S78-07/08
S79-07/08, Part I
G109-07/08, Part I
S80-07/08
S81-07/08
S82-07/08, Part I
S15-07/08, Part I
S83-07/08
S84-07/08
S85-07/08
S86-07/08
S87-07/08
EB14-07/08, Part II
S88-07/08
S89-07/08
PC1-07/08
G207-07/08, Part I
G208-07/08
S140-07/08
S235-07/08
G210-07/08
S90-07/08
S91-07/08
S92-07/08
S93-07/08
S94-07/08
S95-07/08
S96-07/08
S97-07/08
S98-07/08
S99-07/08
S100-07/08
S56-07/08
G203-07/08, Part I
G206-07/08
G209-07/08, Part I
G211-07/08, Part I
G216-07/08
G205-07/08
S101-07/08
S59-07/08

G56-07/08
G65-07/08
S103-07/08
S104-07/08
S105-07/08
S106-07/08
S107-07/08
S108-07/08
S109-07/08
S110-07/08
S111-07/08
S112-07/08
S113-07/08
S114-07/08
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S131-07/08
S132-07/08
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S134-07/08
S135-07/08
S136-07/08
S137-07/08
S138-07/08
S139-07/08
~~S140-07/08~~
S141-07/08, Part I
S142-07/08
S143-07/08
S144-07/08
S145-07/08
S155-07/08, Part I
S146-07/08
S148-07/08, Part I
S147-07/08
S149-07/08
S150-07/08
S151-07/08
S153-07/08
S154-07/08, Part I
S156-07/08
S157-07/08
S158-07/08
S159-07/08, Part I
S160-07/08
S161-07/08
S162-07/08
S163-07/08
S164-07/08
S165-07/08
S166-07/08
S167-07/08
S168-07/08
S169-07/08
S170-07/08
S171-07/08
S152-07/08
S172-07/08
S173-07/08
FS85-07/08, Part II
S174-07/08
S175-07/08
S176-07/08
S177-07/08
S178-07/08
S179-07/08
S180-07/08
S181-07/08
S182-07/08
S183-07/08
S184-07/08
S185-07/08
S186-07/08
S187-07/08
S188-07/08
S189-07/08
S190-07/08
S191-07/08
S192-07/08
S193-07/08
S194-07/08, Part I
S195-07/08, Part I
S196-07/08, Part I
S197-07/08, Part I
S198-07/08, Part I
S199-07/08, Part I
S201-07/08
S202-07/08
S203-07/08
S204-07/08
S205-07/08
S206-07/08
S207-07/08
S208-07/08
S209-07/08
S210-07/08
S200-07/08
S211-0708
S213-07/08
S214-07/08, Part I
S215-07/08, Part I
S216-07/08
S212-07/08
S217-07/08
S218-07/08
S219-07/08, Part I
S220-07/08
S221-07/08
S222-07/08
S236-07/08
S237-07/08, Part I
S223-07/08
S224-07/08
S225-07/08
S226-07/08
S22707/08, Part I
S228-07/08
S229-07/08
S230-07/08
S231-07/08
S232-07/08, Part I
S233-07/08
S234-07/08

S6-07/08, Part I: Add reference to footnote a in table title as follows:

TABLE 1507.2.7.1(1)
CLASSIFICATION OF ASPHALT SHINGLES PER ASTM D 7158[a]

Correct figure number in first column heading as follows:

TABLE 1507.2.7.1(2)
CLASSIFICATION OF ASPLALT SHINGLES PER ASTM D 3161

MAXIMUM BASIC WIND SPEED FROM FIGURE ~~R301.2(4)~~ 1609

S8-07/08: Indicate the year of the proposed standard:

Single-Ply Roofing Institute
ANSI/SPRI WD-1-07 Wind Design Standard Practice for Roofing Assemblies

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S83-07/08: Correct indicated Standards Organization as follows:

~~ANSI~~ Steel Door Institute
ANSI/SDI A250.13-XX Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies.

S95-07/08: Add omitted text from Sec. 12.14.7.5 of ASCE 7:

1613.7.2 ASCE 7, Section 12.14.7.5. Modify ASCE 7, Section 12.14.7.5 to read as follows:

12.14.7.5 Anchorage of Concrete or Masonry Structural Walls. Concrete or masonry structural walls shall be anchored to all floors, roofs and members that provide out-of-plane lateral support for the wall or that are supported by the wall. The anchorage shall provide a positive direct connection between the wall and floor, roof or supporting member with the strength to resist horizontal forces specified in this section for structures with flexible diaphragms or of Section 13.3.1 (using a_p and R_p equal to 2.5) for structures with diaphragms that are not flexible.

(Portions of proposal not shown remain unchanged)

S122-07/08 Revise exception to Section 1803.5 to read as follows:

Exception: Compacted fill material ~~less than~~ 12 inches (305 mm) in depth or less need not comply with an approved report, provided it has been compacted to a minimum of 90 percent Modified Proctor in accordance with ASTM D 1557. The compaction shall be verified by ~~a qualified inspector approved by the building official~~ special inspection in accordance with Section 1704.7.

S143-07/08: Correct indicated Standards Organization as follows:

~~ANSI~~ Steel Door Institute
ANSI/SDI A250.13-XX Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies.

S146-07/08, S149-07/08, S150-07/08 and S160-07/08 – See page 61

S147-07/08: Revise exception to Section 1804.2 as follows:

Exception: A presumptive load-bearing capacity ~~is~~ shall be permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared fill is adequate for the support of lightweight ~~and~~ or temporary structures.

S172-07/08: In item 3 correct new section numbers as follows:

~~**1904.2**~~ **1904.4 Freezing and thawing exposures.** Concrete that will be exposed to freezing and thawing, in the presence of moisture, with or without deicing chemicals being present, ~~or other exposure conditions as defined below~~ shall comply with Sections ~~1904.2.1 through 1904.2.3~~ 1904.4.1 and 1904.4.2.

~~**1904.2.1**~~ **1904.4.1 Air entrainment.** Concrete exposed to freezing and thawing ~~or deicing chemicals~~ while moist shall be air entrained in accordance with ACI 318, Section ~~4.2.1~~ 4.4.1:

Revise Item 9 to read as follows:

~~**1908.1.4**~~ **1908.1.2 ACI 318,** Section ~~21.2.1~~ 21.1.1. Modify ACI 318 Sections ~~21.2.1.2, 21.2.1.3 and 21.2.1.4~~ 21.1.1.3 through 21.1.1.5, to read as follows:

Revise item 10 to read as follows:

21.1.1.3 – Structures assigned to SDC B shall comply with Chapters 1 through 19 and 22. For a structure assigned to SDC B using ordinary moment frames as part of the seismic-force resisting system, the provisions of 21.1.2 and 21.2 shall apply. For a structure assigned to SDC B and using intermediate or special systems, the applicable provisions of 21.1.3 through 21.1.7, and 21.3 through 21.10 shall also apply.

21.1.1.4 – Structures assigned to SDC C shall comply with Chapters 1 through 19, and the seismic-force-resisting system shall be intermediate or special moment frames, intermediate precast structural walls, or ordinary reinforced concrete or special structural walls. For a structure assigned to SDC C and using intermediate moment frames as part of the seismic-force-resisting system the provisions of 21.1.2 and 21.3 shall apply. For a structure assigned to SDC C and using special moment frames, or intermediate precast or special structural walls, the applicable provisions of 21.1.3 through 21.1.7, and 21.4 through 21.10 shall also apply. Any structure assigned to SDC C shall satisfy 21.1.8. *Except for footings, pedestals and basement walls in accordance with 22.10 or as permitted by the International Building Code, structural elements of plain concrete are prohibited.*

21.1.1.5 – Structures assigned to SDC D, E or F shall comply with Chapters 1 through 19, and the seismic-force-resisting system shall be special moment frames, intermediate precast structural walls, or special structural walls. For a structure assigned to SDC D, E, or F, the provisions of 21.1.2 through 21.1.8 and 21.4 through 21.13 shall apply. *Except for footings, pedestals and basement walls in accordance with 22.10 or as permitted by the International Building Code, structural elements of plain concrete are prohibited.*

Revise Item 17 to read as follows:

1912.1 Scope. The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolts, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI 318 as modified by Section ~~1908.1.16~~ 1908.1.9, provided they are within the scope of Appendix D.

> ~~**Exception**: Where the basic concrete breakout strength in tension of a single anchor, Nb, is determined in accordance with Equation (D-7), the concrete breakout strength requirements of Section D.4.2.2 shall be considered satisfied by the design procedures of Sections D.5.2 and D.6.2 for anchors exceeding 2 inches (51 mm) in diameter or 25 inches (635 mm) tensile embedment depth.~~

The strength design of anchors that are not within the scope of Appendix D of ACI 318, and as amended ~~above~~ in Section 1908.1.9, shall be in accordance with an approved procedure.

Add update to referenced standard as follows:

ACI
318-~~05~~08 Building Code Requirements for Structural Concrete

S174-07/08: Add Item 2 as follows:

3. Revise Chapter 35 as follows:

ACI
ACI 530-~~05~~ 08 Building Code Requirements for Masonry Structures
ACI 530.1-~~05~~ 08 Specification~~s~~ for Masonry Structures

ASCE/SEI
ASCE/SEI 5-~~05~~ 08 Building Code Requirements for Masonry Structures
ASCE/SEI 6-~~05~~ 08 Specification~~s~~ for Masonry Structures

TMS
TMS 402-~~05~~ 08 Building Code Requirements for Masonry Structures
TMS 602-~~05~~ 08 Specification for Masonry Structures

S175-07/08:

31. Revise Chapter 35 as follows:

(See S174-07/08)

S176-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S178-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S180-07/08: Correct notation in table as shown:

TABLE 1708.1.2
LEVEL 1 QUALITY ASSURANCE
MINIMUM TESTS AND SUBMITTALS

Certificates of compliance used in masonry construction.
Verification of f'_m and f'_{AAC} prior to construction, except where specifically exempted by this code.

(Portions of table not shown remain unchanged)

Correct notation in table as shown:

TABLE 1708.1.4
LEVEL 2 QUALITY ASSURANCE
MINIMUM TESTS AND SUBMITTALS

Certificates of compliance used in masonry construction.
Verification of f'_m and f'_{AAC} prior to construction and every 5,000 square feet during construction.

(Portions of able not shown remain unchanged)

4. Revise Chapter 35 as follows:

(See S174-07/08)

S182-07/08:

3. Revise Chapter 35 as follows:

(See S174-07/08)

S184-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S186-07/08:

3. Revise Chapter 35 as follows:

(See S174-07/08)

S187-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S188-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S189-07/08:

2. Revise Chapter 35 as follows:

(See S174-07/08)

S202-07/08: Revise Section 2203.2 to read as follows:

2203.2 Protection. Painting of structural steel shall comply with the requirements contained in AISC 360. Individual structural members and assembled panels of cold-formed steel construction~~, except where fabricated of approved corrosion-resistant steel or of steel having a corrosion-resistant or other approved coating,~~ shall be protected against corrosion ~~with an approved coat of paint, enamel or other approved protection~~ in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light frame construction shall also comply with the requirements contained in AISI S200.

S238-07/08: Delete reference to TMS standards as follows:

~~TMS~~	~~The Masonry Society 3970 Broadway, Unit 201-D Boulder, CO 80304-1135~~
~~Standard reference number~~	~~Title~~
~~402—08 05~~	~~Building Code Requirements for Masonry Structures~~
~~602—08 05~~	~~Specification for Masonry Structures~~

Revise TIA standard update to read as follows:

222-G—2005 Structural Standard for Antenna Supporting Structures and Antennas, including Addendum 1, 222-G-1 dated 2007.

S146-07/08, S149-07/08, S150 and S160-07/08: Reformat as follows:

The following code change proposals have been reformatted. For clarity, the proposals are reproduced here in their entirety.

S146-07/08: Replace the proposal with the following:

S146–07/08

106.1, 1610.1, 1802, 1803, 1805.3.5, 1808.2.2, 1808.2.8.4, 1808.2.10, 3304.1.4, Appendix J101.1, J104.3, J106.1, J107.1, J107.6

Proponent: Edwin T. Huston, Smith & Huston, Inc., representing the National Council of Structural Engineering Associations

Revise as follows:

106.1 (Supp) General. Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

1610.1 General. Basement, foundation and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless ~~specified~~ determined otherwise ~~in~~ by a ~~soil~~ geotechnical investigation ~~report approved by the building official~~ in accordance with Section 1803. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top ~~are~~ shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils with expansion potential are present at the site.

Exception: Basement walls extending not more than 8 feet (2438 mm) below grade and supporting flexible floor systems shall be permitted to be designed for active pressure.

SECTION ~~1802~~ 1803
~~FOUNDATION AND SOILS~~ GEOTECHNICAL INVESTIGATIONS

~~1802.1~~ 1803.1 General. ~~Foundation and soils~~ Geotechnical investigations shall be conducted in ~~conformance~~ accordance with ~~Sections 1802.2 through 1802.6~~ Section 1803.2 and reported in accordance with Section 1803.6.

Where required by the building official ~~the classification and investigation of the soil~~ or where geotechnical investigations involve in-situ testing, laboratory testing, or engineering calculations, such investigations shall be ~~made~~ conducted by a registered design professional.

~~**1802.2**~~ **1803.2** ~~**Where**~~ **Investigations** ~~**required**~~. ~~The owner or applicant shall submit a foundation and soils investigation to the building official where required in~~ Geotechnical investigations shall be conducted in accordance with Sections ~~1802.2.1 through 1802.2.7~~ 1803.3 through 1803.5.

Exception: The building official ~~need not require~~ shall be permitted to waive the requirement for a ~~foundation or soils~~ geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections ~~1802.2.1 through 1802.2.6~~ 1803.5.1 through 1803.5.6 and Sections 1803.5.10 and 1803.5.11.

~~**1802.3 Soil classification.** Where required, soils shall be classified in accordance with Section 1802.3.1 or 1802.3.2.~~

~~**1802.4**~~ **1803.3 Basis of investigation.** Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

~~**1802.4.1**~~ **1803.3.1** ~~**Exploratory boring**~~ **Scope of investigation.** The scope of the ~~soil~~ geotechnical investigation including the number and types of borings or soundings, the equipment used to drill ~~and~~ or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

~~**1802.5**~~ **1803.4** ~~**Soil boring and sampling**~~ **Qualified representative.** The ~~soil boring and sampling~~ investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on the site during all boring ~~and~~ or sampling operations.

1803.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803.5.1 through 1803.5.12.

~~**1802.3.1**~~ **1803.5.1** ~~**General**~~ **Classification.** ~~For the purposes of this chapter, the definition and classification of~~ Soil materials ~~for use in Table 1804.2~~ shall be classified in accordance with ASTM D 2487.

~~**1802.2.1**~~ **1803.5.2 Questionable soil.** Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that ~~the necessary~~ a geotechnical investigation be ~~made~~ conducted. ~~Such investigation shall comply with the provisions of Sections 1802.4 through 1802.6.~~

~~**1802.2.2**~~ **1803.5.3 Expansive** ~~**soils**~~ **soil.** In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

~~**1802.3.2 Expansive soils.** Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:~~

1. ~~Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318.~~
2. ~~More than 10 percent of the soil particles pass a No. 200 sieve (75 μm), determined in accordance with ASTM D 422.~~
3. ~~More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.~~
4. ~~Expansion index greater than 20, determined in accordance with ASTM D 4829.~~

~~**1802.2.3**~~ **1803.5.4 Ground-water table.** A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

Exception: A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with Section 1807.

~~1802.2.4~~ **1803.5.5 Deep ~~Pile and pier~~ foundations.** ~~Pile and pier foundations shall be designed and installed on the basis of a foundation investigation and report as specified in Sections 1802.4 through 1802.6 and Section 1808.2.1.~~ Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data upon which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

~~1802.2.5~~ **1803.5.6 Rock strata.** Where subsurface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which foundations are to be constructed, a sufficient number of borings shall be made to a depth of not less than 10 feet (3048 mm) below the level of the foundations to provide assurance of the soundness of the foundation bed and its load-bearing capacity.

1803.5.7 Excavation near foundations. Where excavation will remove lateral support from any foundation, an investigation shall be conducted to assess the potential consequences and address mitigation measures.

1803.5.8 Compacted fill material. Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803.5.9 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803.5.10 Alternate setback and clearance. Where setbacks or clearances other than those required in Section 1805.3 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1805.3 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

~~1802.2.6~~ **1803.5.11 Seismic Design ~~Category~~ Categories C through F.** ~~Where a~~ For structures ~~is determined~~ assigned to ~~be in~~ Seismic Design Category C, D, E, or F in accordance with Section 1613, ~~an~~ a geotechnical investigation shall be conducted, and shall include an evaluation of all the following potential geologic and seismic hazards ~~resulting from earthquake motions~~:

1. Slope instability.
2. Liquefaction.
3. Differential settlement. ~~and~~
4. Surface ~~rupture~~ displacement due to faulting or lateral spreading.

~~1802.2.7~~ 1803.5.12 Seismic Design ~~Category~~ Categories D~~, E or~~ through F. ~~Where the~~ For structures ~~is determined~~ assigned to ~~be in~~ Seismic Design Category D, E or F~~,~~ in accordance with Section 1613, the ~~soils~~ geotechnical investigation ~~requirements for Seismic Design Category C, given in~~ required by Section ~~1802.2.6~~ 1803.5.11~~, shall be met, in addition to the following. The investigation~~ shall also include:

1. ~~A.~~ The determination of lateral pressures on basement and retaining walls due to earthquake motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground accelerations, magnitudes, and source characteristics consistent with the design earthquake ground motions. Peak ground acceleration shall be permitted to be determined based on a site-specific study taking into account soil amplification effects, as specified in Chapter 21 of ASCE 7, or, in the absence of such a study, peak ground accelerations shall be assumed equal to S_{DS} / 2.5, where S_{DS} is determined in accordance with Section 11.4 of ASCE 7.
3. An assessment of potential consequences of ~~any~~ liquefaction and soil strength loss, including estimation of differential settlement, lateral movement ~~or~~, lateral loads on foundations, reduction in foundation soil-bearing capacity, increases in lateral pressures on retaining walls and flotation of buried structures.
4. ~~and shall address~~ Discussion of mitigation measures~~. Such measures shall be given consideration in the design of the structure and can include, but are~~ such as, but not limited to, ground stabilization, selection of appropriate foundation type and depths, selection of appropriate structural systems to accommodate anticipated displacements and forces, or any combination of these measures and how they shall be considered in the design of the structure. ~~The potential for liquefaction and soil strength loss shall be evaluated for site peak ground acceleration magnitudes and source characteristics consistent with the design earthquake ground motions. Peak ground acceleration shall be determined from a site-specific study taking into account soil amplification effects, as specified in Chapter 21 of ASCE 7.~~

   ~~**Exception:** A site-specific study need not be performed provided that peak ground acceleration equal to S_{DS} / 2.5 is used, where S_{DS} is determined in accordance with Section 21.2.1 of ASCE 7.~~

~~1802.6~~ 1803.6 ~~Reports~~ Reporting. The soil classification and design load-bearing capacity shall be shown on the construction document. Where geotechnical investigations are required ~~by the building official~~, a written report of the investigations shall be submitted ~~that includes~~ to the building official by the owner or authorized agent at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of ~~test borings and/or excavations~~ the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. ~~Pile and pier~~ Deep foundation information in accordance with Section ~~1808.2.2~~ 1803.5.5.
8. Special design and construction provisions for ~~footings or~~ foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section ~~1803.5~~ 1803.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803.5.9.

SECTION ~~1803~~ 1804
EXCAVATION, GRADING AND FILL

~~1803.1~~ 1804.1 ~~Excavations~~ Excavation near ~~footings or~~ foundations. ~~Excavations~~ Excavation for any purpose shall not remove lateral support from any ~~footing or~~ foundation without first underpinning or protecting the ~~footing or~~ foundation against settlement or lateral translation.

~~1803.2~~ 1804.2 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted, in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: Controlled low-strength material need not be compacted.

~~1803.3~~ 1804.3 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of

10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternate method of diverting water away from the foundation. Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

Exception: Where climatic or soil conditions warrant, the slope of the ground away from the building foundation ~~is~~ shall be permitted to be reduced to not less than one unit vertical in 48 units horizontal (2-percent slope).

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

~~1803.4~~ 1804.4 Grading and fill in flood hazard areas. In flood hazard areas established in Section 1612.3, grading and/or fill shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of floor water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In flood hazard areas subject to high-velocity wave action, unless such fill is conducted and/or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed floor hazard area encroachment, when combined with all other existing and anticipated floor hazard area encroachment, will not increase the design flood elevation more than one foot (305 mm) at any point.

~~1803.5~~ 1804.5 Compacted fill material. Where ~~footings~~ shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report~~, which shall contain the following:~~ as set forth in Section 1803.

~~1. Specifications for the preparation of the site prior to placement of compacted fill material.~~
~~2. Specifications for material to be used as compacted fill.~~
~~3. Test method to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.~~
~~4. Maximum allowable thickness of each lift of compacted fill material.~~
~~5. Field test method for determining the in-place dry density of the compacted fill.~~
~~6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.~~
~~7. Number and frequency of field tests required to determine compliance with Item 6.~~

Exception: Compacted fill material less than 12 inches (305 mm) in depth need not comply with an approved report, provided it has been compacted to a minimum of 90 percent Modified Proctor in accordance with ASTM D 1557. The compaction shall be verified by a qualified inspector approved by the building official.

~~1803.6~~ 1804.6 Controlled low-strength material (CLSM). Where ~~footings~~ shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, ~~which shall contain the following:~~ as set forth in Section 1803.

~~1. Specifications for the preparation of the site prior to placement of the CLSM.~~
~~2. Specifications for the CLSM.~~
~~3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.~~
~~4. Test methods for determining the acceptance of the CLSM in the field.~~
~~5. Number and frequency of field tests required to determine compliance with Item 4.~~

1805.3.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official ~~is~~ shall be permitted to require ~~an~~ a geotechnical investigation ~~and recommendation of a registered design professional to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material~~ as set forth in Section 1803.5.10.

1808.2.2 General. Pier and pile foundations shall be designed and installed on the basis of a ~~foundation~~ geotechnical investigation as ~~defined~~ set forth in Section ~~1802~~ 1803 ~~unless sufficient data upon which to base the design and installation is available~~.

~~The investigation and report provisions of Section 1802 shall be expanded to include, but not be limited to, the following:~~

~~1. Recommended pier or pile types and installed capacities.~~
~~2. Recommended center to center spacing of piers or piles.~~
~~3. Driving criteria.~~
~~4. Installation procedures.~~
~~5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).~~
~~6. Pier or pile load test requirements.~~
~~7. Durability of pier or pile materials.~~
~~8. Designation of bearing stratum or strata.~~
~~9. Reductions for group action, where necessary.~~

1808.2.8.4 Allowable frictional resistance. The assumed frictional resistance developed by any pier or uncased cast-in-place pile shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1804.2, up to a maximum of 500 psf (24 kPa), unless a greater value is allowed by the building official after a ~~soil~~ geotechnical investigation as specified in Section ~~1802~~ 1803 is submitted or a greater value is substantiated by a load test in accordance with Section 1808.2.8.3. Frictional resistance and bearing resistance shall not be assumed to act simultaneously unless ~~recommended~~ determined by a ~~soil~~ geotechnical investigation ~~as specified~~ in accordance with Section ~~1802~~ 1803.

1808.2.10 Use of higher allowable pier or pile stresses. Allowable stresses greater than those specified for piers or for each pile type in Sections 1809 and 1810 are permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A ~~soils~~ geotechnical investigation in accordance with Section ~~1802~~ 1803.
2. Pier or pile load tests in accordance with Section 1808.2.8.3, regardless of the load supported by the pier or pile.

The design and installation of the pier or pile foundation shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and pier or pile foundations who shall certify to the building official that the piers or piles as installed satisfy the design criteria.

3304.1.4 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with Section ~~1803.5~~ 1804.5. Special inspections of compacted fill shall be in accordance with Section 1704.7.

J101.1 Scope. The provisions of this chapter apply to grading, excavation and earthwork construction, including fills and embankments. Where conflicts occur between the technical requirements of this chapter and the ~~soils~~ geotechnical report, the ~~soils~~ geotechnical report shall govern.

J104.3 Soils report. A ~~soils~~ geotechnical report prepared by a registered design ~~professionals~~ professional shall be provided ~~which~~. The report shall ~~identify~~ contain at least the following:

1. The nature and distribution of existing soils;
2. Conclusions and recommendations for grading procedures;
3. Soil design criteria for any structures or embankments required to accomplish the proposed grading; and
4. Where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

Exception: A ~~soils~~ geotechnical report is not required where the building official determines that the nature of the work applied for is such that a report is not necessary.

J106.1 Maximum slope. The slope of cut surfaces shall be no steeper than is safe for the intended use, and shall be no steeper than 2 horizontal to 1 vertical (50 percent) unless the ~~applicant~~ owner or authorized agent furnishes a ~~soils~~ geotechnical report justifying a steeper slope.

Exceptions:

1. A cut surface may be at a slope of 1.5 horizontal to 1 vertical (67 percent) provided that all the following are met:

1.1. It is not intended to support structures or surcharges.
1.2. It is adequately protected against erosion.
1.3. It is no more than 8 feet (2438 mm) in height.
1.4. It is approved by the building official.
1.5. Ground-water is not encountered.

2. A cut surface in bedrock shall be permitted to be at a slope of 1 horizontal to 1 vertical (100 percent).

J107.1 General. Unless otherwise recommended in the ~~soils~~ geotechnical report, fills shall ~~conform to~~ comply with the provisions of this section.

J107.6 Maximum slope. The slope of fill surfaces shall be no steeper than is safe for the intended use. Fill slopes steeper than 2 horizontal to 1 vertical (50 percent) shall be justified by ~~soils reports~~ a geotechnical report or engineering data.

Reason: Code update and clarification.

Reorganizes and clarifies the sections related to geotechnical investigations and excavation, grading and fill. Provides consistent use of "geotechnical" as related to investigations and reports.

Section 1802.1 allows the building official to require that investigations be conducted by a registered design professional (RDP), but does NOT allow the building official to remove such a requirement that appears elsewhere. Several sections of the code do require investigations by a RDP. The text of 1802.1 is revised to clarify those requirements. Section 1802.4.1 requires that a RDP establish the scope of investigations that involve borings and soundings, drilling and sampling, in-situ testing, and laboratory testing. Since the purpose of borings, soundings, drilling, and sampling is related to "in-situ testing, laboratory testing, or engineering calculations", the scope is slightly revised by use of those terms in new Section 1803.1. Several sections outside 1802 set forth requirements for geotechnical investigations; those items are all collected and coordinated in this proposal.

Where excavation will remove lateral support for a foundation, current Section 1803.1 requires underpinning or protection against settlement or lateral translation. In practice, compliance requires a geotechnical investigation. Section 1803.5.7 is added to reflect that reality.

The addition of a tenth item in the section on reporting relates to an item that already requires investigation.

The requirements related to seismic design categories are recast (and slightly revised) for better agreement with Section 11.8.2 and 11.8.3 of ASCE 7-05.

The change is made to Section J106.1 because cuts below the ground-water table are less stable than those above.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

S149-07/08: Replace the proposal with the following:

S149–07/08

1610, 1807 (New), 1805.5.2, 1805.5.4, 1805.5.5, 1805.6

Proponent: Edwin T. Huston, Smith & Huston, Inc., representing National Council of Structural Engineering Associations

1. Revise as follows:

1610.1 General. ~~Basement,~~ Foundation walls and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless specified otherwise in a soil investigation report approved by the building official. ~~Basement~~ Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top ~~are~~ shall be permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils ~~with expansion potential are present at the site~~ at the site are expansive. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1807.4.2 and 1807.4.3.

Exception: ~~Basement~~ Foundation walls extending not more than 8 feet (2438 mm) below grade and ~~supporting~~ laterally supported at the top by flexible ~~floor systems~~ diaphragms shall be permitted to be designed for active pressure.

TABLE 1610.1
~~SOIL~~ LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL [c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD [a] (pounds per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.
b. Unsuitable as backfill material.
c. The definition and classification of soil materials shall be in accordance with ASTM D 2487.

SECTION 1807
FOUNDATION WALLS, RETAINING WALLS, AND EMBEDDED POSTS AND POLES

1807.1 Foundation walls. Foundation walls shall be designed and constructed in accordance with Sections 1807.1.1 through 1807.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808.

1807.1.1 Design lateral soil loads. Foundation walls shall be designed for the lateral soil loads set forth in Section 1610.

1807.1.2 Unbalanced backfill height. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

~~**1805.5.1.3**~~ **1807.1.3 Rubble stone foundation walls.** Foundation walls of rough or random rubble stone shall not be less than 16 inches (406 mm) thick. Rubble stone shall not be used for foundation~~s~~ walls for structures ~~in~~ assigned to Seismic Design Category C, D, E or F.

~~**1805.4.6**~~ **1807.1.4 Permanent wood foundation~~s~~ systems.** Permanent wood foundation systems shall be designed and installed in accordance with AF&PA Technical Report No. 7. Lumber and plywood shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2) and shall be identified in accordance with Section 2303.1.8.1.

~~**1805.5**~~ **1807.1.5 Concrete and masonry foundation walls.** Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21, ~~respectively~~ as applicable.

Exception: Concrete and masonry foundation walls ~~that are laterally supported at the top and bottom within the parameters of Tables 1805.5(1) through 1805.5(5) are~~ shall be permitted to be designed and constructed in accordance with ~~Sections 1805.5.1 through 1805.5.5~~ Section 1807.1.6.

1807.1.6 Prescriptive design of concrete and masonry foundation walls. Concrete and masonry foundation walls that are laterally supported at the top and bottom shall be permitted to be designed and constructed in accordance with this section.

~~1805.5.1~~ 1807.1.6.1 Foundation wall thickness. ~~The minimum thickness of concrete and masonry foundation walls shall comply with Sections 1805.5.1.1 through 1805.5.1.3.~~

~~1805.5.1.1 Thickness at top of foundation wall.~~ The thickness of prescriptively designed foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least 8 inch (203 mm) nominal width ~~are~~ shall be permitted to support brick-veneered frame walls and 10-inch-wide (254 mm) cavity walls provided the requirements of Section ~~1805.5.1.2~~ 1807.1.6.2 or 1807.1.6.3 are met. ~~Corbeling of masonry shall be in accordance with Section 2104.2. Where an 8-inch (203 mm) wall is corbeled, the top corbel shall not extend higher than the bottom of the floor framing and shall be a full course of headers at least 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm). The hollow space behind the corbelled masonry shall be filled with mortar or grout.~~

~~1805.5.1.2 Thickness based on soil loads, unbalanced backfill height and wall height.~~ ~~The thickness of foundation walls shall comply with the requirements of Table 1805.5(5) for concrete walls, Table 1805.5(1) for plain masonry walls or Table 1805.5(2), 1805.5(3) or 1805.5(4) for masonry walls with reinforcement. When using the tables, masonry shall be laid in running bond and the mortar shall be Type M or S.~~

~~Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.~~

~~1805.5.2 Foundation wall materials.~~ ~~Concrete foundation walls constructed in accordance with Table 1805.5(5) shall comply with Section 1805.5.2.1. Masonry foundation walls constructed in accordance with Table 1805.5(1), 1805.5(2), 1805.5(3) or 1805.5(4) shall comply with Section 1805.5.2.2.~~

~~1805.5.2.1~~ 1807.1.6.2 Concrete foundation walls. Concrete foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.2.
2. The size and spacing of vertical reinforcement shown in Table ~~1805(5)~~ 1807.1.6.2 is based on the use of reinforcement with a minimum yield strength of 60,000 psi (414 Mpa). Vertical reinforcement with a minimum yield strength of 40,000 psi (276 Mpa) or 50,000 psi (345 Mpa) ~~is~~ shall be permitted, provided the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.
3. Vertical reinforcement, when required, shall be placed nearest the inside face of the wall a distance, *d*, from the outside face (soil face) of the wall. The distance, *d*, is equal to the wall thickness, *t*, minus 1.25 inches (32 mm) plus one-half the bar diameter, d_b, [$d = t - (1.25 + d_b / 2)$]. The reinforcement shall be placed within a tolerance of ± 3/8 inch (9.5 mm) where *d* is less than or equal to 8 inches (203 mm) or ± 1/2 inch (12.7 mm) where *d* is greater than 8 inches (203 mm).
4. In lieu of the reinforcement shown in Table ~~1805.5(5)~~ 1807.1.6.2, smaller reinforcing bar sizes with closer spacings that provide an equivalent cross-sectional area of reinforcement per unit length ~~are~~ shall be permitted.
5. Concrete cover for reinforcement measured from the inside face of the wall shall not be less than 3/4 inch (19.1 mm). Concrete cover for reinforcement measured from the outside face of the wall shall not be less than 1.5 inches (38 mm) for No. 5 bars and smaller, and not less than 2 inches (51 mm) for larger bars.
6. Concrete shall have a specified compressive strength, f_c', of not less than 2,500 psi (17.2 MPa) at 28 days.
7. The unfactored axial load per linear foot of wall shall not exceed $1.2\ t\ f_c'$ where *t* is the specified wall thickness in inches.

~~1805.5.5.1~~ 1807.1.6.2.1 Seismic requirements ~~for concrete foundation walls~~. Based on the seismic design category assigned to the structure in accordance with Section 1613, concrete foundation walls designed using Table ~~1805.5(5)~~ 1807.1.6.2 shall be subject to the following limitations:

1. Seismic Design Categories A and B. No additional seismic requirements, except provide not less than two No. 5 bars around window and door openings. Such bars shall extend at least 24 inches (610 mm) beyond the corners of the openings.
2. Seismic Design Categories C, D, E and F. Tables shall not be used except as allowed for plain concrete members in Section 1908.1.15.

TABLE ~~1805.5(5)~~ 1807.1.6.2
CONCRETE FOUNDATION WALLS [b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	VERTICAL REINFORCEMENT AND SPACING (inches)								
		Design lateral soil load[a] (psf per foot of depth)								
		30[d]			45[d]			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	PC	PC	PC
7	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 48"	PC	PC
	7	PC	PC	PC	#5 at 46"	PC	PC	#6 at 48"	PC	PC
8	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 43"	PC	PC
	7	PC	PC	PC	#5 at 41"	PC	PC	#6 at 43"	PC	PC
	8	#5 at 47"	PC	PC	#6 at 43"	PC	PC	#6 at 32"	#6 at 44"	PC
9	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 39"	PC	PC
	7	PC	PC	PC	#5 at 37"	PC	PC	#6 at 38"	#5 at 37"	PC
	8	#5 at 41"	PC	PC	#6 at 38"	#5 at 37"	PC	#7 at 39"	#6 at 39"	#4 at 48"
	9[d]	#6 at 46"	PC	PC	#7 at 41"	#6 at 41"	PC	#7 at 31"	#7 at 41"	#6 at 39"
10	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 37"	PC	PC
	7	PC	PC	PC	#6 at 48"	PC	PC	#6 at 35"	#6 at 48"	PC
	8	#5 at 38"	PC	PC	#7 at 47"	#6 at 47"	PC	#7 at 35"	#7 at 47"	#6 at 45"
	9[d]	#6 at 41"	#4 at 48"	PC	#7 at 37"	#7 at 48"	#4 at 48"	#6 at 22"	#7 at 37"	#7 at 47"
	10[d]	#7 at 45"	#6 at 45"	PC	#7 at 31"	#7 at 40"	#6 at 38"	#6 at 22"	#7 at 30"	#7 at 38"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads ~~for different classes of soil~~, see Section 1610.
b. Provisions for this table are based on design and construction requirements specified in Section ~~1805.5.2.1~~ 1807.1.6.2.
c. "PC" means plain concrete.
d. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.
e. For height of unbalanced backfill, see Section ~~1805.5.1.2~~ 1807.1.2.

~~1805.5.2.2~~ 1807.1.6.3 Masonry foundation walls. Masonry foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.3(1) for plain masonry walls or Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4) for masonry walls with reinforcement.
2. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 Mpa).
3. The specified location of the reinforcement shall equal or exceed the effective depth distance, *d*, noted in Tables ~~1805.5(2), 1805.5(3) and 1805.5(4)~~ 1807.1.6.3(2), 1807.1.6.3(3) and 1807.1.6.3(4) and shall be measured from the face of the exterior (soil) side of the wall to the center of the vertical reinforcement. The reinforcement shall be placed within the tolerances specified in ACI 530.1/ASCE 6/TMS 402, Article 3.4 B7 of the specified location.
4. Grout shall comply with Section 2103.12.
5. Concrete masonry units shall comply with ASTM C 90.
6. Clay masonry units shall comply with ASTM C 652 for hollow brick, except compliance with ASTM C 62 or C 216 ~~is~~ shall be permitted ~~when~~ where solid masonry units are installed in accordance with Table ~~1805.5(1)~~ 1807.1.6.3(1) for plain masonry.
7. Masonry units shall be laid in running bond and installed with Type M or S mortar in accordance with Section 2103.8.
8. The unfactored axial load per linear foot of wall shall not exceed $1.2\,t\,f'_m$ where t is the specified wall thickness in inches and f'_m is the specified compressive strength of masonry in pounds per square inch.
9. At least 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.
10. Corbeling of masonry shall be in accordance with Section 2104.2. Where an 8-inch (203 mm) wall is corbeled, the top corbel shall not extend higher than the bottom of the floor framing and shall be a full course of headers at least 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm). The hollow space behind the corbelled masonry shall be filled with mortar or grout.

~~1805.5.3~~ **1807.1.6.3.1 Alternative foundation wall reinforcement.** In lieu of the reinforcement provisions for masonry foundation walls in Table ~~1805.5(2), 1805.5(3) or 1805.5(4)~~ 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall ~~are~~ shall be permitted to be used, provided the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

~~**1805.5.4 Hollow masonry walls.** At least 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.~~

~~**1805.5.5 Seismic requirements.** Tables 1805.5(1) through 1805.5(5) shall be subject to the following limitations in Sections 1805.5.5.1 and 1805.5.5.2 based on the seismic design category assigned to the structure as defined in Section 1613.~~

~~**1805.5.5.2**~~ **1807.1.6.3.2 Seismic requirements ~~for masonry foundation walls~~.** Based on the seismic design category assigned to the structure in accordance with Section 1613, masonry foundation walls designed using Tables ~~1805.5(1) through 1805.5(4)~~ 1807.1.6.3(1) through 1807.1.6.3(4) shall be subject to the following limitations:

1. Seismic Design Categories A and B. No additional seismic requirements.
2. Seismic Design Category C. A design using Tables ~~1805.5(1) through 1805.5(4)~~ 1807.1.6.3(1) through 1807.1.6.3(4) is subject to the seismic requirements of Section 2106.4.
3. Seismic Design Category D. A design using Tables ~~1805.2(2) through 1805.5(4)~~ 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 2106.5.
4. Seismic Design Categories E and F. A design using Tables ~~1805.2(2) through 1805.5(4)~~ 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 2106.6.

(Renumber subsequent sections)

TABLE ~~1805.5(1)~~ 1807.1.6.3(1)
PLAIN MASONRY FOUNDATION WALLS [a, b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		~~Soil classes and~~ Design lateral soil load[a] (psf per foot ~~below natural grade~~ of depth)		
		~~GW, GP, SW and SP soils~~ 30[f]	~~GM, GC, SM, SM-SC and ML soils~~ 45[f]	~~SC, ML-CL and Inorganic CL soils~~ 60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid[c])
	7	12	10 (solid[c])	10 (solid[c])
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid[c])
	7	12	12 (solid[c])	Note d
	8	10 (solid[c])	12 (solid[c])	Note d
9	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid[c])
	7	12 (solid[c])	12 (solid[c])	Note d
	8	12 (solid[c])	Note d	Note d
	9[f]	Note d	Note d	Note d

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. ~~Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.~~
b. Provisions for this table are based on design and construction requirements specified in Section ~~1805.5.2.2~~ 1807.1.6.3.
c. Solid grouted hollow units or solid masonry units.
d. A design in compliance with Chapter 21 or reinforcement in accordance with Table ~~1805.5(2)~~ 1807.1.6.3(2) is required.
e. For height of unbalanced backfill, see Section ~~1805.5.1.2~~ 1807.1.2.
f. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

TABLE ~~1805.5(2)~~ 1807.1.6.3(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 5 INCHES [a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		~~Soil classes and~~ Design lateral soil load[a] (psf per foot ~~below natural grade~~ of depth)		
		~~GW, GP, SW and SP soils~~ 30[e]	~~GM, GC, SM, SM-SC and ML soils~~ 45[e]	~~SC, ML-CL and Inorganic CL soils~~ 60
7-4	4-0 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5-0	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	6-0	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 48" o.c.
	7-4	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
8-0	4-0 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5-0	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	6-0	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 48" o.c.
	7-0	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
	8-0	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
8-8	4-0 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5-0	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6-0	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7-0	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
	8-8[e]	#6 at 48" o.c.	#7 at 48" o.c.	#8 at 48" o.c.
9-4	4-0 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5-0	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6-0	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7-0	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
	8-0	#6 at 48" o.c.	#7 at 48" o.c.	#8 at 48" o.c.
	9-4[e]	#7 at 48" o.c.	#8 at 48" o.c.	#9 at 48" o.c.
10-0	4-0 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5-0	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6-0	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7-0	#5 at 48" o.c.	#6 at 48" o.c.	#7 at 48" o.c.
	8-0	#6 at 48" o.c.	#7 at 48" o.c.	#8 at 48" o.c.
	9-0[e]	#7 at 48" o.c.	#8 at 48" o.c.	#9 at 48" o.c.
	10-0[e]	#7 at 48" o.c.	#9 at 48" o.c.	#9 at 48" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. ~~Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.~~
b. Provisions for this table are based on design and construction requirements specified in Section ~~1805.5.2.2~~ 1807.1.6.3.
c. For alternative reinforcement, see Section ~~1805.5.3~~ 1807.1.6.3.1.
d. For height of unbalanced backfill, see Section ~~1805.5.1.2~~ 1807.1.2.
e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

TABLE ~~1805.5(3)~~ 1807.1.6.3(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 6.75 INCHES [a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		~~Soil classes and~~ Design lateral soil load[a] (psf per foot ~~below natural grade~~ of depth)		
		~~GW, GP, SW and SP soils~~ 30[e]	~~GM, GC, SM, SM-SC and ML soils~~ 45[e]	~~SC, ML-CL and Inorganic CL soils~~ 60
7-4	4-0 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5-0	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6-0	#4 at 56" o.c.	#4 at 56" o.c.	#5 at 56" o.c.
	7-4	#4 at 56" o.c.	#5 at 56" o.c.	#6 at 56" o.c.
8-0	4-0 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5-0	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6-0	#4 at 56" o.c.	#4 at 56" o.c.	#5 at 56" o.c.
	7-0	#4 at 56" o.c.	#5 at 56" o.c.	#6 at 56" o.c.
	8-0	#5 at 56" o.c.	#6 at 56" o.c.	#7 at 56" o.c.
8-8	4-0 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5-0	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6-0	#4 at 56" o.c.	#4 at 56" o.c.	#5 at 56" o.c.
	7-0	#4 at 56" o.c.	#5 at 56" o.c.	#6 at 56" o.c.
	8-8[e]	#5 at 56" o.c.	#7 at 56" o.c.	#8 at 56" o.c.
9-4	4-0 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5-0	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6-0	#4 at 56" o.c.	#5 at 56" o.c.	#5 at 56" o.c.
	7-0	#4 at 56" o.c.	#5 at 56" o.c.	#6 at 56" o.c.
	8-0	#5 at 56" o.c.	#6 at 56" o.c.	#7 at 56" o.c.
	9-4[e]	#6 at 56" o.c.	#7 at 56" o.c.	#8 at 56" o.c.
10-0	4-0 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5-0	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6-0	#4 at 56" o.c.	#5 at 56" o.c.	#5 at 56" o.c.
	7-0	#5 at 56" o.c.	#6 at 56" o.c.	#7 at 56" o.c.
	8-0	#5 at 56" o.c.	#7 at 56" o.c.	#8 at 56" o.c.
	9-0[e]	#6 at 56" o.c.	#7 at 56" o.c.	#9 at 56" o.c.
	10-0[e]	#7 at 56" o.c.	#8 at 56" o.c.	#9 at 56" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. ~~Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.~~
b. Provisions for this table are based on design and construction requirements specified in Section ~~1805.5.2.2~~ 1807.1.6.3.
c. For alternative reinforcement, see Section ~~1805.5.3~~ 1807.1.6.3.1.
d. For height of unbalanced backfill, see Section ~~1805.5.1.2~~ 1807.1.2.
e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

TABLE ~~1805.5(4)~~ 1807.1.6.3(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 8.75 INCHES [a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		~~Soil classes and~~ Design lateral soil load[a] (psf per foot ~~below natural grade~~ of depth)		
		~~GW, GP, SW and SP soils~~ 30[e]	~~GM, GC, SM, SM-SC and ML soils~~ 45[e]	~~SC, ML-CL and Inorganic CL soils~~ 60
7-4	4-0 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5-0	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6-0	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
	7-4	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
8-0	4-0 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5-0	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6-0	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
	7-0	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
	8-0	#5 at 72" o.c.	#6 at 72" o.c.	#7 at 72" o.c.
8-8	4-0 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5-0	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6-0	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
	7-0	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
	8-8[e]	#5 at 72" o.c.	#7 at 72" o.c.	#8 at 72" o.c.
9-4	4-0 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5-0	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6-0	#4 at 72" o.c.	#5 at 72" o.c.	#5 at 72" o.c.
	7-0	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
	8-0	#5 at 72" o.c.	#6 at 72" o.c.	#7 at 72" o.c.
	9-4[e]	#6 at 72" o.c.	#7 at 72" o.c.	#8 at 72" o.c.
10-0	4-0 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5-0	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6-0	#4 at 72" o.c.	#5 at 72" o.c.	#5 at 72" o.c.
	7-0	#4 at 72" o.c.	#6 at 72" o.c.	#6 at 72" o.c.
	8-0	#5 at 72" o.c.	#6 at 72" o.c.	#7 at 72" o.c.
	9-0[e]	#6 at 72" o.c.	#7 at 72" o.c.	#8 at 72" o.c.
	10-0[e]	#7 at 72" o.c.	#8 at 72" o.c.	#9 at 72" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. ~~Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.~~
b. Provisions for this table are based on design and construction requirements specified in Section ~~1805.5.2.2~~ 1807.1.6.3.
c. For alternative reinforcement, see Section ~~1805.5.3~~ 1807.1.6.3.1.
d. For height of unbalanced backfill, see Section ~~1805.5.1.2~~ 1807.1.2.
e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

~~**SECTION 1806**~~
~~**RETAINING WALLS**~~

1807.2 Retaining walls. Retaining walls shall be designed in accordance with Sections 1807.2.1 through 1807.2.3.

~~**1806.1**~~ **1807.2.1 General.** Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1807.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil loads set forth in Section 1610.

1807.2.3 Safety factor. Retaining walls shall be designed ~~for~~ to resist the lateral action of soil to produce sliding and overturning with a safety factor of 1.5 ~~against lateral sliding and overturning~~. The load combinations of Section 1605.3 shall not apply to these requirements.

~~**1805.7**~~ **1807.3** ~~**Designs employing lateral bearing**~~ **Embedded posts and poles.** Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or embedded in concrete footings in the earth shall ~~conform to the requirements of~~ be in accordance with Sections ~~1805.7.1 through 1805.7.3~~ 1807.3.1 through 1807.3.3.

~~1805.7.1~~ **1807.3.1 Limitations.** The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B), and for round timber posts (Commodity Specification B, Use Category 4B).

~~1805.7.2~~ **1807.3.2 Design criteria.** The depth to resist lateral loads shall be determined ~~by~~ using the design criteria established in Sections ~~1805.7.2.1 through 1805.7.2.3~~ 1807.3.2.1 through 1807.3.2.3, or by other methods approved by the building official.

~~1805.7.2.1~~ **1807.3.2.1 Nonconstrained.** The following formula shall be used in determining the depth of embedment required to resist lateral loads where no lateral constraint is provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where no lateral constraint is provided above the ground surface, such as by a structural diaphragm.

$$d = 0.5\,A\,\{1 + [1 + (4.36\,h / A)]^{1/2}\} \qquad \textbf{(Equation 18-1)}$$

where:

A = $2.34\ P / S_1\ b$.
b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).
d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.
h = Distance in feet (m) from ground surface to point of application of "P."
P = Applied lateral force in pounds (kN).
S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1804.3 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

~~1805.7.2.2~~ **1807.3.2.2 Constrained.** The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or pavement.

$$d^2 = 4.25\,(P\,h / S_3\,b) \qquad \textbf{(Equation 18-2)}$$

or alternatively

$$d^2 = 4.25\,(M_g / S_3\,b) \qquad \textbf{(Equation 18-3)}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).
S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1804.3 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

~~1805.7.2.3~~ **1807.3.2.3 Vertical load.** The resistance to vertical loads shall be determined ~~by~~ using the ~~allowable soil-bearing~~ vertical foundation pressure set forth in Table 1804.2.

~~1805.7.3~~ **1807.3.3 Backfill.** The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with an ultimate strength of 2,000 psi (13.8 MPa) at 28 days. The hole shall not be less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

2. Delete without substitution:

~~**1805.5.6 Foundation wall drainage.** Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1807.4.2 and 1807.4.3.~~

~~**1805.6 Foundation plate or sill bolting.** Wood foundation plates or sills shall be bolted or strapped to the foundation or foundation wall as provided in Chapter 23.~~

Reason: Code clarification.

Makes terminology in 1610.1 consistent with Chapter 18; the IBC does not recognize "basement walls," instead calling them "foundation walls." Moves the loading requirement of Section 1805.5.6 to 1610.1, where the related loading requirements occur. Makes the scoping language of the Section 1610.1 exception consistent with the sections concerning foundation walls (current Section 1805.5); the key condition is that walls are "laterally supported at the top", not that the walls are "supporting" a floor. Also, "flexible floor systems" are undefined, but "flexible diaphragms" are defined.

Editorial reorganization to group requirements related to laterally loaded elements (foundation walls, retaining walls, and embedded posts and poles). Recognizes the distinction between foundation walls and foundations. Moves reference to design lateral soil loads from footnotes to text. Moves the definition of unbalanced backfill height from the prescriptive design requirements to a general section. Moves the general requirements related to rubble stone out of the prescriptive design requirements where it does not apply (as rubble stone is not laid in running bond).

Moves requirements related to permanent wood foundation systems to this section on foundation walls. According to AF&PA PWF-06, such systems are "engineered to support lateral soil pressures as well as dead, live, snow, wind, and seismic loads," where the foundation wall behavior is primary and vertical load behavior is secondary. That document also repeated refers to "foundation walls" (for instance, see Figures 3 and 4).

Makes footnotes for prescriptively designed concrete and masonry foundation walls more consistent. Separates prescriptive design requirements for concrete and masonry foundation walls.

In each of the tables, clarifies the important footnote related to applicability of 30 and 45 psf design loads. Where the unbalanced backfill height exceeds 8 feet, Section 1610.1 requires that foundation walls be designed for at-rest pressures. Where lateral soil loads from Table 1610.1 are used, values of 30 and 45 psf occur only for active pressure. Therefore, where both of these conditions are satisfied, the prescriptive design table entries for 30 and 45 psf cannot be used.

For prescriptively designed masonry foundation walls, the revision to item 7 (running bond) was in 1805.5.1.2, item 9 was in Section 1805.5.4, and item 10 was in Section 1805.5.1.1.

Section 1805.6 is not needed. As that section indicates, the requirements for sill plate anchorage appear in Chapter 23 (Sections 2305.3.11 and 2308.6).

The safety factor for stability of retaining walls predates modern load combinations. The revised text makes clear that load combinations do not apply to consideration of retaining wall sliding and overturning.

Correlation note: In Section 1704.5 exception 2 change "Table 1805.5(1), 1805.5(2), 1805.5(3) or 1805.5(4)" to "Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4)".

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

S150-07/08: Replace the proposal with the following:

S150–07/08

1801.2, 1801.2.1, 1805, 1808, 1809, 1809.2.1, 1908.2.2.5, 1809.2.3.5, 1810.1.1, 1810.1.3, 1810.2.5, 1810.3.4, 1810.4.4, 1810.6.5, 1812.3, 1812.5, 1812.10, 1812.7, 1808.2.23.2, 1809.2.3.1, 1810.3.4, 1810.5.4, 1810.6.4, 1810.7.2, 1810.7.4, 1810.7.6, 1810.8.2

Proponent: Edwin T. Huston, Smith & Huston, Inc., representing the National Council of Structural Engineering Associations

1. Revise as follows:

1801.2 Design <u>basis</u>. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in Section 1605.3. The quality and design of materials used structurally in excavations~~, footings~~ and foundations shall ~~conform to~~ <u>comply with</u> the requirements specified in Chapters 16, 19, 21, 22 and 23 of this code. Excavations and fills shall also comply with Chapter 33.

SECTION ~~1805~~ <u>1808</u>
~~FOOTINGS AND~~ FOUNDATIONS

<u>1808.1 General.</u> <u>Foundations shall be designed and constructed in accordance with Sections 1808.2 through 1808.9. Shallow foundations shall also satisfy the requirements of Section 1809. Deep foundations shall also satisfy the requirements of Section 1810.</u>

~~**1805.4 Footings.** Footings shall be designed and constructed in accordance with Sections 1805.4.1 through 1805.4.6.~~

~~**1805.4.1**~~ **1808.2 Design for capacity and settlement.** ~~Footings~~ Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. ~~The minimum width of footings shall be 12 inches (305 mm). Footings~~ Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section ~~1805.8~~ 1808.6.

~~**1805.4.1.1**~~ **1808.3 Design loads.** ~~Footings~~ Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605.2 or 1605.3. The dead load is permitted to include the weight of foundations~~, footings~~ and overlying fill. Reduced live loads, as specified in Sections 1607.9 and 1607.11, ~~are~~ shall be permitted to be used in the design of ~~footings~~ foundations.

~~**1801.2.1**~~ **1808.3.1 ~~Foundation design for~~ Seismic overturning.** Where ~~the foundation is~~ foundations are proportioned using the load combinations of Section 1605.2, and the computation of seismic overturning ~~moment~~ effects is by ~~the~~ Equivalent Lateral Force ~~method~~ Analysis or ~~the~~ Modal Analysis ~~method~~, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

~~**1805.4.1.2**~~ **1808.4 Vibratory loads.** Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the ~~footing~~ foundation design to prevent detrimental disturbances of the soil.

~~**1805.2.3**~~ **1808.5 Shifting or moving soils.** Where it is known that the shallow subsoils are of a shifting or moving character, ~~footings~~ foundations shall be carried to a sufficient depth to ensure stability.

~~**1805.8**~~ **1808.6 Design for expansive soils.** ~~Footings or~~ Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section ~~1805.8.1 or 1805.8.2~~ 1808.6.1 or 1808.6.2.

Exception: ~~Footing or~~ Foundation design need not comply with Section ~~1805.8.1 or 1805.8.2~~ 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section ~~1805.8.3, nor where~~ 1808.6.3; or
2. The building official approves stabilization of the soil in accordance with Section ~~1805.8.4~~ 1808.6.4.

~~**1805.8.1**~~ **1808.6.1 Foundations.** ~~Footings or~~ Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

~~**1805.8.2**~~ **1808.6.2 Slab-on-ground foundations.** Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-ground Foundations* or *PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils*. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI Standard Requirements for Design of Shallow Post-tensioned Concrete Foundations on Expansive Soils*. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab, as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

~~**1805.8.3**~~ **1808.6.3 Removal of expansive soil.** Where expansive soil is removed in lieu of designing ~~footings or~~ foundations in accordance with Section ~~1805.8.1 or 1805.8.2~~ 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1803.5 or 1803.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

~~**1805.8.4**~~ **1808.6.4 Stabilization.** Where the active zone of expansive soils is stabilized in lieu of designing ~~footings or~~ foundations in accordance with Section ~~1805.8.1 or 1805.8.2~~ 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

~~**1805.3**~~ **1808.7 ~~Footings~~ Foundations on or adjacent to slopes.** The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall ~~conform to~~ comply with Sections ~~1805.3.1 through 1805.3.5~~ 1808.7.1 through 1808.7.5.

~~**1805.3.1**~~ **1808.7.1 Building clearance from ascending slopes.** In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided ~~for~~ in Section ~~1805.3.5~~ 1808.7.5 and Figure ~~1805.3.1~~ 1808.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

FIGURE ~~1805.3.1~~ 1808.7.1
FOUNDATION CLEARANCES FROM SLOPES

(No changes to Figure)

~~**1805.3.2**~~ **1808.7.2 ~~Footing~~ Foundation setback from descending slope surface**. ~~Footings~~ Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the ~~footing~~ foundation without detrimental settlement. Except as provided for in Section ~~1805.3.5~~ 1808.7.5 and Figure ~~1805.3.1~~ 1808.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

~~**1805.3.3**~~ **1808.7.3 Pools.** The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

~~**1805.3.4**~~ **1808.7.4 Foundation elevation.** On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

~~**1805.3.5**~~ **1808.7.5 Alternate setback and clearance.** Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a registered design professional to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

~~**1805.4.2**~~ **1808.8 Concrete ~~footings~~ foundations.** The design, materials and construction of concrete ~~footings~~ foundations shall comply with Sections ~~1805.4.2.1 through 1805.4.2.6~~ 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.

Exception: Where ~~a specific design is not provided,~~ concrete footings supporting walls of light-frame construction are ~~permitted to be~~ designed in accordance with Table ~~1805.4.2~~ 1809.7, a specific design in accordance with Chapter 19 is not required.

~~**1805.4.2.1**~~ **1808.8.1 Concrete or grout strength and mix proportioning.** Concrete or grout in ~~footings~~ foundations shall have a specified compressive strength ($f'c$) ~~of~~ not less than ~~2,500 pounds per square inch (psi) (17 237 kPa) at 28 days~~ the largest applicable value indicated in Table 1808.8.1.

~~**1810.1.1 Materials.** Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa).~~ Where concrete is placed through a funnel hopper at the top of a deep foundation element ~~the pile~~, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 6 inches (152 mm). Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture ~~concrete~~.

TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH, f'_c, OF CONCRETE OR GROUT

CONDITION	SPECIFIED COMPRESSIVE STRENGTH, $f'c$
1. Foundations for structures assigned to Seismic Design Category A, B, or C	2,500 psi (17.24 MPa)
2a. Foundations for Group R or U occupancies of light-framed construction, two stories or less in height, assigned to Seismic Design Category D, E, or F	2,500 psi (17.24 MPa)
2b. Foundations for other structures assigned to Seismic Design Category D, E, or F	3,000 psi (20.68 MPa)
3. Precast nonprestressed driven piles	3,000 psi (20.68 MPa)
4. Socketed drilled shafts	4,000 psi (27.58 MPa)
5. Micropiles	4,000 psi (27.58 MPa)
6. Precast prestressed driven piles	5,000 psi (34.48 MPa)

1808.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be no less than that specified in Table 1808.8.2. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered the concrete surface.

TABLE 1808.8.2
MINIMUM CONCRETE COVER

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 7.7 of ACI 318
2. Precast nonprestressed deep foundation elements [a] Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	 3 inches (76 mm) 2 inches (51 mm) In accordance with Section 7.7.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	 2.5 inches (64 mm) In accordance with Section 7.7.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube, or permanent casing	2.5 inches (64 mm)
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube, or permanent casing	1 inch (25 mm)
6. Structural steel core within a steel pipe, tube, or permanent casing	2 inches (51 mm)

a. Longitudinal bars spaced less than 1.5 inches (38 mm) clear distance apart shall be considered bundled bars for which the minimum concrete cover shall be equal to that for the equivalent diameter of the bundled bars.

~~**1805.4.2.4**~~ **1808.8.3 Placement of concrete.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized foundation. Concrete ~~footings~~ shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence

of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or poured in a rapid and continuous operation through a funnel hopper centered at the top of the element.

~~1805.4.2.5~~ **1808.8.4 Protection of concrete.** Concrete ~~footings~~ foundations shall be protected from freezing during depositing and for a period of not less than five days thereafter. Water shall not be allowed to flow through the deposited concrete.

~~1805.4.2.6~~ **1808.8.5 Forming of concrete.** Concrete ~~footings~~ foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require ~~forming~~ form work. Where ~~forming~~ form work is required, it shall be in accordance with Chapter 6 of ACI 318.

~~1805.9~~ **1808.8.6 Seismic requirements.** See Section 1908 for additional requirements for ~~footings and~~ foundations of structures assigned to Seismic Design Category C, D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of ACI 318, Sections 21.10.1 ~~to 21.10.3~~ through 21.10.4, shall apply ~~when~~ where not in conflict with the provisions of ~~Section 1805~~ Sections 1808 through 1810. ~~Concrete shall have a specified compressive strength of not less than 3,000 psi (20.68 MPa) at 28 days.~~

Exceptions:

1. ~~Group R or U occupancies of light framed construction and two stories or less above grade plane are permitted to use concrete with a specified compressive strength of not less than 2,500 psi (17.2 MPa) at 28 days.~~
1. Detached one- and two-family dwellings of light-frame construction and two stories or less above grade plane are not required to comply with the provisions of ACI 318, Sections 21.10.1 through ~~to 21.10.3~~ 21.10.4.
2. Section 21.10.4.4(a) of ACI 318 shall not apply.

~~1812.7~~ **1808.9 Vertical masonry foundation elements.** ~~Where the unsupported height of foundation piers exceeds six times the least dimension, the allowable working stress on piers of unit masonry shall be reduced~~ Vertical masonry foundation elements that are not foundation piers as defined in Section 2102.1 shall be designed as piers, walls, or columns, as applicable, in accordance with ACI 530/ASCE 5/TMS 402.

1809
SHALLOW FOUNDATIONS

~~1805.1~~ **1809.1 (Supp) General.** ~~Footings and~~ Shallow foundations shall be designed and constructed in accordance with Sections ~~1805.1 through 1805.9~~ 1809.2 through 1809.13.

1809.2 Supporting soils. ~~Footings and~~ Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1803.5. CLSM shall be placed in accordance with Section 1803.6.

1809.3 Stepped footings. The top surface of footings shall be level. The bottom surface of footings ~~is~~ shall be permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope).

~~1805.2~~ **1809.4 Depth and width of footings.** The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the ~~depth of footings~~ requirements of Section 1809.5 shall also ~~conform to Sections 1805.2.1 through 1805.2.3~~ be satisfied. The minimum width of footings shall be 12 inches (305 mm).

~~1805.2.1~~ **1809.5 Frost protection.** Except where otherwise protected from frost, foundation walls~~, piers~~ and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality;
2. Constructing in accordance with ASCE-32; or
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. ~~Classified in~~ Assigned to Occupancy Category I, in accordance with Section 1604.5;

2. Area of 600 square feet (56 m^2) or less for light-frame construction or 400 square feet (37 m^2) or less for other than light-frame construction; and
3. Eave height of 10 feet (3048 mm) or less.

~~Footings~~ Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

~~1805.2.2~~ 1809.6 ~~Isolated~~ Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1809.7 Prescriptive footings for light-frame construction. Where a specific design is not provided, concrete or masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

TABLE ~~1805.4.2~~ 1809.7
PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION [a, b, c, d, e]

NUMBER OF FLOORS SUPPORTED BY THE FOOTING [f]	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8 [g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section ~~1805.2~~ 1809.4.
b. The ground under the floor ~~is~~ shall be permitted to be excavated to the elevation of the top of the footing.
c. Interior-stud-bearing walls ~~are~~ shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.
d. See Section 1908 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.
e. For thickness of foundation walls, see Section 1805.5.
f. Footings ~~are~~ shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
g. Plain concrete footings for Group R-3 occupancies ~~are~~ shall be permitted to be 6 inches thick.

~~1805.4.2.3~~ 1809.8 Plain concrete footings. The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall not be less than 8 inches (203 mm) where placed on soil.

Exception: For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

~~1805.4.3~~ 1809.9 Masonry-unit footings. The design, materials and construction of masonry-unit footings shall comply with Sections ~~1805.4.3.1 and 1805.4.3.2~~ 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings supporting walls of light-frame construction ~~are~~ shall be permitted to be designed in accordance with Table ~~1805.4.2~~ 1809.7.

~~1805.4.3.1~~ 1809.9.1 Dimensions. Masonry-unit footings shall be laid in Type M or S mortar complying with Section 2103.8 and the depth shall not be less than twice the projection beyond the wall, pier or column. The width shall not be less than 8 inches (203 mm) wider than the wall supported thereon.

~~1805.4.3.2~~ 1809.9.2 Offsets. The maximum offset of each course in brick foundation walls stepped up from the footings shall be 1.5 inches (38 mm) where laid in single courses, and 3 inches (76 mm) where laid in double courses.

~~1805.5.7~~ 1809.10 Pier and curtain wall foundations. Except in Seismic Design Categories D, E and F, pier and curtain wall foundations ~~are~~ shall be permitted to be used to support light-frame construction not more than two stories above grade plane, provided the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings bonded integrally with the exterior wall footings.

2. The minimum actual thickness of a load-bearing masonry wall shall not be less than 4 inches (102 mm) nominal or 3.625 inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced 6 feet (1829 mm) on center (o.c.).
3. Piers shall be constructed in accordance with Chapter 21 and the following:
   3.1. The unsupported height of the masonry piers shall not exceed 10 times their least dimension.
   3.2. Where structural clay tile or hollow concrete masonry units are used for piers supporting beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar.
      Exception: Unfilled hollow piers ~~are~~ shall be permitted where the unsupported height of the pier is not more than four times its least dimension.
   3.3. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or the cavities of the top course shall be filled with concrete or grout.
4. The maximum height of a 4-inch (102mm) load-bearing masonry foundation wall supporting wood frame walls and floors shall not be more than 4 feet (1219 mm) in height.
5. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry, nor 12 inches (305mm) for hollow masonry.

~~**1805.4.4**~~ **1809.11 Steel grillage footings.** Grillage footings of structural steel shapes shall be separated with approved steel spacers and be entirely encased in concrete with at least 6 inches (152 mm) on the bottom and at least 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

~~**1805.4.5**~~ **1809.12 Timber footings.** Timber footings ~~are~~ shall be permitted for buildings of Type V construction and as otherwise approved by the building official. Such footings shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B). Treated timbers are not required where placed entirely below permanent water level, or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses perpendicular to grain in untreated timber footings supported upon treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the AF&PA NDS.

(Renumber Section 1805.4.6)

~~**1805.4.2.2**~~ **1809.13 Footing seismic ties.** Where a structure is assigned to Seismic Design Category D, E or F in accordance with Section 1613, individual spread footings founded on soil defined in Section 1613.5.2 as Site Class E or F shall be interconnected by ties. Ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger footing load times the seismic coefficient S_{DS} divided by 10 unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade.

1808.2.23.2 Seismic Design Category D, E or F. Where a structure is assigned to Seismic Design Category D, E or F in accordance with Section 1613, the requirements for Seismic Design Category C given in Section 1808.2.23.1 shall be met, in addition to the following. ~~Provisions of ACI 318, Section 21.10.4, shall apply when not in conflict with the provisions of Sections 1808 through 1812. Concrete shall have a specified compressive strength of not less than 3,000 psi (20.68 MPa) at 28 days.~~

~~**Exceptions:**~~

1. ~~Group R or U occupancies of light-framed construction and two stories or less above grade plane are permitted to use concrete with a specified compressive strength of not less than 2,500 psi (17.2 MPa) at 28 days.~~
2. ~~Detached one- and two-family dwellings of light-frame construction and two stories or less in height are not required to comply with the provisions of ACI 318, Section 21.10.4.~~
3. ~~Section 21.10.4.4(a) of ACI 318 need not apply to concrete piles.~~

1809.2.3.1 Materials. Prestressing steel shall conform to ASTM A 416. ~~Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 5,000 psi (34.48 MPa).~~

1810.3.4 Reinforcement. For piles installed with a hollow-stem auger, where full-length longitudinal steel reinforcement is placed without lateral ties, the reinforcement shall be placed through the hollow stem of the auger prior to filling the pile with concrete. ~~All pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm).~~

Exception: Where physical constraints do not allow the placement of the longitudinal reinforcement prior to filling the pile with concrete or where partial-length longitudinal reinforcement is placed without lateral ties, the reinforcement is allowed to be placed after the piles are completely concreted but while concrete is still in a semifluid state.

1810.5.4 Reinforcement. ~~Reinforcement shall not be placed within 1 inch (25 mm) of the steel shell.~~ Reinforcing shall be required for unsupported pile lengths or where the pile is designed to resist uplift or unbalanced lateral loads.

1810.6.4 Reinforcement. Reinforcement steel shall conform to Section 1810.1.2. ~~Reinforcement shall not be placed within 1 inch (25 mm) of the steel casing.~~

1810.7.2 Materials. Pipe and steel cores shall conform to the material requirements in Section 1809.3. Pipes shall have a minimum wall thickness of 3/8 inch (9.5 mm) and shall be fitted with a suitable steel-driving shoe welded to the bottom of the pipe. ~~Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 4,000 psi (27.58 MPa). The concrete mix shall be designed and proportioned so as to produce a cohesive workable mix with a slump of 4 inches to 6 inches (102 mm to 152 mm).~~

1810.7.4 Structural core. The gross cross-sectional area of the structural steel core shall not exceed 25 percent of the gross area of the caisson. ~~The minimum clearance between the structural core and the pipe shall be 2 inches (51 mm).~~ Where cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

1810.7.6 Installation. The rock socket and pile shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket. ~~Concrete shall not be placed through water except where a tremie or other approved method is used.~~

1810.8.2 (Supp) Materials. ~~Grout shall have a specified compressive strength (f'_c) of not less than 4,000 psi (27.58 Mpa). The grout mix shall be designed and proportioned so as to produce a pumpable mixture.~~ Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A 615 Grade 60 or 75 or ASTM A 722 Grade 150.

The steel pipe shall have a minimum wall thickness of 3/16 inch (4.8 mm). Splices shall comply with Section 1808.2.7. The steel pipe shall have a minimum yield strength exceeding 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe.

2. Delete without substitution:

~~**1809.2.2.1 Materials.** Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 3,000 psi (20.68 MPa).~~

~~**1809.2.2.5 Concrete cover.** Reinforcement for piles that are not manufactured under plant conditions shall have a concrete cover of not less than 2 inches (51 mm).~~

~~Reinforcement for piles manufactured under plant control conditions shall have a concrete cover of not less than 1.25 inches (32 mm) for No. 5 bars and smaller, and not less than 1.5 inches (38 mm) for No. 6 through No. 11 bars except that longitudinal bars spaced less than 1.5 inches (38 mm) clear distance apart shall be considered bundled bars for which the minimum concrete cover shall be equal to that for the equivalent diameter of the bundled bars. Reinforcement for piles exposed to seawater shall have a concrete cover of not less than 3 inches (76 mm).~~

~~**1809.2.3.5 Concrete cover.** Prestressing steel and pile reinforcement shall have a concrete cover of not less than 1-1/4 inches (32 mm) for square piles of 12 inches (305 mm) or smaller size and 1-1/2 inches (38 mm) for larger piles, except that for piles exposed to seawater, the minimum protective concrete cover shall not be less than 2-1/2 inches (64 mm).~~

~~**1810.1.3 Concrete placement.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pile, the concrete shall not be chuted directly into the pile but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pile.~~

~~**1810.2.5 Concrete cover.** The minimum concrete cover shall be 2-1/2 inches (64 mm) for uncased shafts and 1 inch (25 mm) for cased shafts.~~

~~**1810.4.4 Concrete cover.** Pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm), measured from the inside face of the drive casing or mandrel.~~

~~**1810.6.5 Placing concrete.** The placement of concrete shall conform to Section 1810.1.3, but is permitted to be chuted directly into smooth sided pipes and tubes without a centering funnel hopper.~~

~~**1812.3 Materials.** Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa). Where concrete is placed through a funnel hopper at the top of the pier, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 6 inches (152 mm). Where concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.~~

~~**1812.5 Concrete placement.** Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pier, the concrete shall not be chuted directly into the pier but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pier.~~

~~**1812.10 Dewatering.** Where piers are carried to depths below water level, the piers shall be constructed by a method that will provide accurate preparation and inspection of the bottom, and the depositing or construction of sound concrete or other masonry in the dry.~~

Reason: Clarifies the scope of requirements related to design of all foundations and design of shallow foundations. Collects and unifies general requirements (for instance, related to concrete strength, concrete cover, and concrete placement) to reduce unnecessary repetition.

The revisions in new Section 1808.9 fix a conflict in the existing code. The present text refers to masonry foundation piers with an unsupported height that exceeds six times the least dimension. However, Section 2102.1 and ACI 530 define a masonry foundation pier as having a height less than or equal to 4 times its thickness. The revised text directs the reader to the pertinent definition and design requirements. Depending on the dimensions of a vertical masonry element, it is designed as a foundation pier, a pier, a wall, or a column.

Section 1812.10 is deleted because it conflicts with other requirements and unnecessarily restates other requirements. Section 1812.5 permits placement of concrete in water where proper methods are employed, so placement "in the dry" is not required. Requirements for inspection are already set forth in Chapter 17.

Correlation notes: In Section 1704.4 exception item 2.2, change "Table 1805.4.2" to "Table 1809.7". In Section 1704.4 exception item 4, change "Table 1805.5(5) to "Table 1807.1.6.2".

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:				
	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

S160-07/08: Replace the proposal with the following:

S160–07/08
1808, 1809, 1810, 1811, 1812

Proponent: Edwin T. Huston, Smith & Huston, Inc., representing the National Council of Structural Engineering Associations

1. Revise as follows:

SECTION ~~1808~~ 1802
~~PIER AND PILE~~ DEFINITIONS

~~**1808.1**~~ **1802.1 Definitions.** The following words and terms shall, for the purposes of this ~~section~~ chapter, have the meanings shown herein.

DEEP FOUNDATION. A deep foundation is a foundation element that does not satisfy the definition of a shallow foundation.

DRILLED SHAFT. A drilled shaft is a cast-in-place deep foundation element constructed by drilling a hole (with or without permanent casing) into soil or rock and filling it with fluid concrete.

Socketed drilled shaft A socketed drilled shaft is a drilled shaft with a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock.

MICROPILES. ~~Micropiles are 12 inch (305 mm) diameter or less,~~ A micropile is a bored, grouted-in-place ~~piles incorporating steel pipe (casing) and/or steel reinforcement~~ deep foundation element that develops its load-carrying capacity by means of a bond zone in soil, bedrock, or a combination of soil and bedrock.

SHALLOW FOUNDATION. A shallow foundation is an individual or strip footing, a mat foundation, a slab on grade foundation, or a similar foundation element.

~~**FLEXURAL LENGTH.** Flexural length is the length of the pile from the first point of zero lateral deflection to the underside of the pile cap or grade beam.~~

~~**PIER FOUNDATIONS.** Pier foundations consist of isolated masonry or cast-in-place concrete structural elements extending into firm materials. Piers are relatively short in comparison to their width, with lengths less than or equal to 12 times the least horizontal dimension of the pier. Piers derive their load-carrying capacity through skin friction, through end bearing, or a combination of both.~~

~~**Belled piers.** Belled piers are cast-in-place concrete piers constructed with a base that is larger than the diameter of the remainder of the pier. The belled base is designed to increase the load-bearing area of the pier in end bearing.~~

~~**PILE FOUNDATIONS.** Pile foundations consist of concrete, wood or steel structural elements either driven into the ground or cast in place. Piles are relatively slender in comparison to their length, with lengths exceeding 12 times the least horizontal dimension. Piles derive their load-carrying capacity through skin friction, through end bearing, or a combination of both.~~

~~**Augered uncased piles.** Augered uncased piles are constructed by depositing concrete into an uncased augered hole, either during or after the withdrawal of the auger.~~

~~**Caisson piles.** Caisson piles are cast-in-place concrete piles extending into bedrock. The upper portion of a caisson pile consists of a cased pile that extends to the bedrock. The lower portion of the caisson pile consists of an uncased socket drilled into the bedrock.~~

~~**Concrete-filled steel pipe and tube piles.** Concrete-filled steel pipe and tube piles are constructed by driving a steel pipe or tube section into the soil and filling the pipe or tube section with concrete. The steel pipe or tube section is left in place during and after the deposition of the concrete.~~

~~**Driven uncased piles.** Driven uncased piles are constructed by driving a steel shell into the soil to shore an unexcavated hole that is later filled with concrete. The steel casing is lifted out of the hole during the deposition of the concrete.~~

~~**Enlarged base piles.** Enlarged base piles are cast-in-place concrete piles constructed with a base that is larger than the diameter of the remainder of the pile. The enlarged base is designed to increase the load-bearing area of the pile in end bearing.~~

~~**Steel-cased piles.** Steel-cased piles are constructed by driving a steel shell into the soil to shore an unexcavated hole. The steel casing is left permanently in place and filled with concrete.~~

~~**Timber piles.** Timber piles are round, tapered timbers with small (tip) end embedded into the soil.~~

SECTION 1810
DEEP FOUNDATIONS

~~**1808.2 Piers and piles—general requirements.**~~

~~**1808.2.1 Design.** Piles are permitted to be designed in accordance with provisions for piers in Section 1808 and Sections 1812.3 through 1812.10 where either of the following conditions exists, subject to the approval of the building official:~~

~~1. Group R-3 and U occupancies not exceeding two stories of light-frame construction, or~~
~~2. Where the surrounding foundation materials furnish adequate lateral support for the pile.~~

1810.1 General. Deep foundations shall be analyzed, designed, detailed, and installed in accordance with Sections 1810.1 through 1810.4.

~~**1808.2.2**~~ **1810.1.1** ~~**General**~~ **Geotechnical investigation.** ~~Pier and pile~~ Deep foundations shall be designed and installed on the basis of a foundation investigation as defined in Section 1802, unless sufficient data upon which to base the design and installation is available. The investigation and report provisions of Section 1802 shall be expanded to include, but not be limited to, the following:

1. Recommended pier or pile types and installed capacities.
2. Recommended center-to-center spacing of piers or piles.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Pier or pile load test requirements.
7. Durability of pier or pile materials.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

~~**1808.2.18**~~ **1810.1.2 Use of existing ~~piers or piles~~ deep foundation elements.** ~~Piers or piles~~ Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the ~~piers or piles~~ elements are sound and meet the requirements of this code. Such ~~piers or piles~~ elements shall be load tested or redriven to verify their capacities. The design load applied to such ~~piers or piles~~ elements shall be the lowest allowable load as determined by tests or redriving data.

1810.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water, or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

~~**1808.2.3**~~ **1810.1.4 Special types of ~~piles~~ deep foundations.** The use of types of ~~piles~~ deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such ~~piles~~ elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

~~**1808.2.9 Lateral support.**~~

1810.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810.2.1 through 1810.2.5.

~~**1808.2.9.1**~~ **1810.2.1** ~~**General**~~ **Lateral support.** Any soil other than fluid soil shall be deemed to afford sufficient lateral support ~~to the pier or pile~~ to prevent buckling of deep foundation elements and to permit the design of the ~~pier or pile~~ elements in accordance with accepted engineering practice and the applicable provisions of this code.

~~**1808.2.9.2 Unbraced piles.** Piles standing~~ Where deep foundation elements stand unbraced in air, water, or ~~in~~ fluid soils, it shall be ~~designed as columns in accordance with the provisions of this code. Such piles driven into firm ground can be considered~~ permitted to consider them fixed and laterally supported at a point 5 feet (1524 mm) ~~below the ground surface and in soft material at~~ into stiff soil or 10 feet (3048 mm) ~~below the ground surface~~ into soft soil unless otherwise prescribed by the building official after a foundation investigation by an approved agency.

~~**1808.2.5**~~ **1810.2.2 Stability.** ~~Piers or piles~~ Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more ~~piles~~ elements connected by a rigid cap shall be considered braced, provided that the ~~piles~~ elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A ~~two-pile~~ two-element group in a rigid cap shall be considered to be braced along the axis connecting the two ~~piles~~ elements. Methods used to brace ~~piers or piles~~ deep foundation elements shall be subject to the approval of the building official.

~~Piles~~ Deep foundation elements supporting walls shall be ~~driven~~ placed alternately in lines spaced at least 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the ~~wall piles~~ foundation elements are adequately

braced to provide for lateral stability. ~~A single row of piles without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided the centers of the piles are located within the width of the foundation wall.~~

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is no less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided the centers of the elements are located within the width of the supported wall.

~~1808.2.12~~ 1810.2.3 Settlement ~~analysis~~. The settlement of ~~piers, individual piles or groups of piles~~ a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any stresses to exceed allowable values.

~~1808.2.23.1.2~~ 1810.2.4 ~~Design details~~ Lateral loads. ~~Pier or pile~~ The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as ~~recommended~~ determined by a registered design professional. Where the ratio of the depth of embedment of the ~~pile-to-pile diameter or width~~ element to its least horizontal dimension is less than or equal to six, ~~the pile may be assumed to be~~ it shall be permitted to assume the element is rigid.

~~Pile group effects from soil on lateral pile nominal strength shall be included where pile center-to-center spacing in the direction of lateral force is less than eight pile diameters. Pile group effects on vertical nominal strength shall be included where pile center-to-center spacing is less than three pile diameters. The pile uplift soil nominal strength shall be taken as the pile uplift strength as limited by the frictional force developed between the soil and the pile.~~

~~Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of the pier or pile, provisions shall be made so that those specified lengths or extents are maintained after pier or pile cutoff.~~

~~1808.2.23.2.1~~ 1810.2.4.1 ~~Design details for piers, piles and grade beams~~ Seismic Design Categories D through F. ~~Piers or piles~~ For structures assigned to Seismic Design Category D, E, or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613.5.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-~~pile~~ foundation-structure interaction coupled with ~~pier or pile~~ foundation element deformations ~~induced by lateral pier or pile resistance to structure seismic forces~~ associated with earthquake loads imparted to the foundation by the structure.

Exception: ~~Piers or piles~~ Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section ~~1809.2.3.2.2~~ 1810.3.8.3.3.
2. Cast-in-place ~~concrete piles~~ deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the ~~pile~~ element and detailed in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 as required by ~~this~~ Section 1810.3.9.4.2.2.

~~Where constructed of nonprestressed concrete such piers or piles shall be designed and detailed in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within seven pile diameters of the pile cap and within seven pile diameters of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft to medium stiff clay.~~

~~Grade beams shall comply with the provisions in Section 21.10.3 of ACI 318 for grade beams, except where they have the capacity to resist the forces from the load combinations in Section 1605.4.~~

1810.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element.

1810.3 Design and Detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810.3.1 through 1810.3.12.

1810.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810.3.1.1 through 1810.3.1.5, as applicable.

1810.3.1.1 Design methods for concrete elements. Where concrete deep foundations are laterally supported in accordance with Section 1810.2.1 for the entire height and applied forces cause bending moments no greater than those resulting from accidental eccentricities, structural design of the element using the load combinations of Section 1605.3 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the load combinations of Section 1605.2 and approved strength design methods.

1810.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load shall be limited by the capacity of the weakest section.

~~**1808.2.8.8**~~ **1810.3.1.3** ~~**Overloads on piers or piles**~~ **Mislocation.** ~~The maximum compressive load on any pier or pile due to mislocation shall not exceed~~ To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

~~**1809.2.1.1**~~ **1810.3.1.4** ~~**Design and manufacture**~~ **Driven piles.** Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

~~**1810.5.1**~~ **1810.3.1.5** ~~**Materials**~~ **Casings.** ~~Pile shells or~~ Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently water tight to exclude any foreign materials during the placing of concrete. ~~Steel shells shall have a sealed tip with a diameter of not less than 8 inches (203 mm).~~ Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810.3.6.

1810.3.2 Materials. The materials used in deep foundations elements shall satisfy the requirements of Sections 1810.3.2.1 through 1810.3.2.8, as applicable.

~~**1810.2.1**~~ **1810.3.2.1** ~~**Materials**~~ **Concrete.** Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate ~~for concrete~~ shall be 3/4 inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E, or F in accordance with Section 1613, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in Section 21.1 of ACI 318, and shall be turned into the confined concrete core.

1810.3.2.2 Prestressing steel. Prestressing steel shall conform to ASTM A 416.

~~**1809.3.1**~~ **1810.3.2.3** ~~**Materials**~~ **Structural steel.** Structural steel piles, steel pipe and fully welded steel piles fabricated from plates shall conform to ASTM A 36, ASTM A 252, ASTM A 283, ASTM A 572, ASTM A 588, ASTM A 690, ASTM A 913 or ASTM A 992.

~~**1809.1**~~ **1810.3.2.4 Timber** ~~**piles.**~~ Timber ~~piles~~ deep foundation elements shall be designed as piles or poles in accordance with the AF&PA NDS.

~~**1809.1.1 Materials.**~~ Round timber ~~piles~~ elements shall conform to ASTM D 25. Sawn timber ~~piles~~ elements shall conform to DOC PS-20.

~~**1809.1.2**~~ **1810.3.2.4.1 Preservative treatment.** Timber ~~piles~~ deep foundation elements used to support permanent structures shall be treated in accordance with this section unless it is established that the tops of the untreated timber ~~piles~~ elements will be below the lowest ground-water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWPA U1 (Commodity Specification E, Use Category 4C) for round timber ~~piles~~ elements and AWPA U1 (Commodity Specification A, Use Category 4B) for sawn timber ~~piles~~ elements. Preservative-treated timber ~~piles~~ elements shall be subject to a quality control program administered by an approved agency. ~~Pile~~ Element cutoffs shall be treated in accordance with AWPA M4.

~~1808.2.17~~ **1810.3.2.5 Protection of ~~pile~~ materials.** Where boring records or site conditions indicate possible deleterious action on ~~pier or pile~~ the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the ~~pier or pile materials~~ elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the ~~piles~~ elements so as not to be rendered ineffective by ~~driving~~ installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1810.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810.3.2.6.

TABLE 1810.3.2.6
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS [a]
1. Concrete or grout in compression [b]	
Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7	$0.4\ f'_c$
Cast-in-place in a pipe, tube, or other permanent casing	$0.33\ f'_c$
Cast-in-place without a permanent casing	$0.3\ f'_c$
Precast nonprestressed	$0.33\ f'_c$
Precast prestressed	$0.33\ f'_c - 0.27\ f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4\ f_y \le 30{,}000$ psi
3. Structural steel in compression	
Cores within concrete-filled pipes or tubes	$0.5\ F_y \le 32{,}000$ psi
Pipes, tubes, or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \le 32{,}000$ psi
Pipes or tubes for micropiles	$0.4\ F_y \le 32{,}000$ psi
Other pipes, tubes, or H-piles	$0.35\ F_y \le 16{,}000$ psi
4. Nonprestressed reinforcement in tension	
Within micropiles	$0.6\ f_y$
Other conditions	$0.5\ f_y \le 24{,}000$ psi
5. Structural steel in tension	
Pipes, tubes, or H-piles, where justified in accordance with Section 1810.3.2.8	$0.5\ F_y \le 32{,}000$ psi
Other pipes, tubes, or H-piles	$0.35\ F_y \le 16{,}000$ psi
6. Timber	In accordance with the AF&PA NDS

a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area within the concrete surface. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the concrete surface.

~~1810.5.2~~ **1810.3.2.7 ~~Allowable stresses~~ Increased allowable compressive stress for cased cast-in-place elements.** The allowable ~~design~~ compressive stress in the concrete ~~shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable concrete compressive stress shall be 0.40 (f'_c) for that portion of the pile meeting the conditions specified in Sections 1810.5.2.1 through 1810.5.2.4.~~ shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. ~~**1810.5.2.1 Shell thickness.**~~ The thickness of the ~~steel shell~~ casing shall not be less than manufacturer's standard gage No. 14 ~~gage~~ (0.068 inch) (1.75 mm) ~~minimum~~.
4. ~~**1810.5.2.2 Shell type.**~~ The ~~shell~~ casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. ~~**1810.5.2.3 Strength.**~~ The ratio of steel yield strength (F_y) to ~~28-day~~ specified compressive strength (f'_c) shall not be less than six.
6. ~~**1810.5.2.4 Diameter.**~~ The nominal ~~pile~~ diameter of the element shall not be greater than 16 inches (406 mm).

~~1808.2.10~~ **1810.3.2.8** ~~**Use**~~ **Justification of higher allowable ~~pier or pile~~ stresses.** Use of allowable stresses greater than those specified ~~for piers or for each pile type in Sections 1809 and 1810 are~~ in Section 1810.3.2.6 shall be permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A soils investigation in accordance with Section 1802~~.~~; and
2. ~~Pier or pile~~ Load tests in accordance with Section ~~1808.2.8.3~~ 1810.3.3.1.2, regardless of the load supported by the ~~pier or pile~~ element.

The design and installation of the ~~pier or pile~~ deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and ~~pier or pile~~ deep foundations who shall certify to the building official that the ~~piers or piles~~ elements as installed satisfy the design criteria.

~~1808.2.8.1~~ **1810.3.3 Determination of allowable loads.** The allowable axial and lateral loads on ~~piers or piles~~ deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

1810.3.3.1 Allowable axial load. The allowable axial load on a deep foundation element shall be determined in accordance with Section 1810.3.3.1.

~~1808.2.8.2~~ **1810.3.3.1.1 Driving criteria.** The allowable compressive load on any ~~pile~~ driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate ~~pile~~ driveability ~~of~~ for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section ~~1808.2.8.3~~ 1810.3.3.1.2. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven ~~piles~~ elements. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

~~1808.2.8.3~~ **1810.3.3.1.2 Load tests.** Where design compressive loads ~~per pier or pile~~ are greater than those ~~permitted by Section 1808.2.10 or~~ determined using the allowable stresses specified in Section 1810.3.2.6 where the design load for any ~~pier or pile~~ deep foundation element is in doubt, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test ~~piers or piles~~ elements shall be tested in accordance with ASTM D 1143 or ASTM D 4945. At least one ~~pier or pile~~ element shall be ~~test loaded~~ load tested in each area of uniform subsoil conditions. Where required by the building official, additional ~~piers or piles~~ elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test ~~pier or pile~~ element as assessed by one of the published methods listed in Section ~~1808.2.8.3.1~~ 1810.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section ~~1808.2.12~~ 1810.2.3. In subsequent installation of the balance of deep foundation ~~piles~~ elements, all ~~piles~~ elements shall be deemed to have a supporting capacity equal to that of the control ~~pile~~ element where such ~~piles~~ elements are of the same type, size and relative length as the test ~~pile~~ element; are installed using the same or comparable methods and equipment as the test ~~pile~~ element; are installed in similar subsoil conditions as the test ~~pile~~ element; and, for driven ~~piles~~ elements, where the rate of penetration (e.g., net displacement per blow) of such ~~piles~~ elements is equal to or less than that of the test ~~pile~~ element driven with the same hammer through a comparable driving distance.

~~1808.2.8.3.1~~ **1810.3.3.1.3 Load test evaluation methods.** It shall be permitted to evaluate ~~pile~~ load tests ~~with~~ of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90% Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

~~1808.2.8.4~~ **1810.3.3.1.4 Allowable frictional resistance.** The assumed frictional resistance developed by any ~~pier or~~ uncased cast-in-place ~~pile~~ deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1804.2, up to a maximum of 500 psf (24 kPa), unless a greater value is allowed by the building official ~~after~~ on the basis of a soil investigation as specified in Section 1802 is submitted or a greater value is substantiated by a load test in accordance with Section ~~1808.2.8.3~~ 1810.3.3.1.2. Frictional resistance and bearing resistance shall not be assumed to act simultaneously unless recommended by a soil investigation as specified in Section 1802.

~~1808.2.8.5~~ **1810.3.3.1.5 Uplift capacity of a single deep foundation element.** Where required by the design, the uplift capacity of a single ~~pier or pile~~ deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D 3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section ~~1808.2.8.3~~ 1810.3.3.1.2 divided by a factor of safety of two.

1810.3.3.1.6 Uplift capacity of grouped deep foundation elements. For ~~pile groups~~ grouped deep foundation elements subjected to uplift, the allowable working uplift load for the group shall be the lesser of:

1. The proposed individual ~~pile~~ uplift working load times the number of ~~piles~~ elements in the group.
2. Two-thirds of the effective weight of the ~~pile~~ group and the soil contained within a block defined by the perimeter of the group and the length of the ~~pile~~ element.

~~1808.2.8.6~~ **1810.3.3.1.7 Load-bearing capacity.** ~~Piers, individual piles and groups of piles~~ Deep foundation elements shall develop ultimate load capacities of at least twice the design working loads in the designated load-bearing layers. Analysis shall show that no soil layer underlying the designated load-bearing layers causes the load-bearing capacity safety factor to be less than two.

~~1808.2.8.7~~ **1810.3.3.1.8 Bent ~~piers or piles~~ deep foundation elements.** The load-bearing capacity of ~~piers or piles~~ deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative ~~pier or pile~~ element.

~~1808.2.9.3~~ **1810.3.3.2 Allowable lateral load.** Where required by the design, the lateral load capacity of a ~~pier, a~~ single ~~pile~~ deep foundation element or a ~~pile~~ group thereof shall be determined by an approved method of analysis or by lateral load tests to at least twice the proposed design working load. The resulting allowable load shall not be more than one-half of that test load that produces a gross lateral movement of 1 inch (25 mm) at the ground surface.

~~1808.2.11~~ **1810.3.4 ~~Piles in~~ Subsiding ~~areas~~ soils.** Where ~~piles~~ deep foundation elements are installed through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces that may be imposed on the ~~piles~~ elements by the subsiding upper strata.

Where the influence of subsiding fills is considered as imposing loads on the ~~pile~~ element, the allowable stresses specified in this chapter ~~are~~ shall be permitted to be increased where satisfactory substantiating data are submitted.

1810.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810.3.5.1 through 1810.3.5.3, as applicable.

~~1809.2.1.2~~ **1810.3.5.1 ~~Minimum dimension~~ Precast.** The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square ~~piles~~ elements shall be chamfered.

1810.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810.3.5.2.1 Cased. Cast-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

~~1810.3.2~~ **1810.3.5.2.2 ~~Dimensions~~ Uncased.** Cast-in-place deep foundation elements without a permanent casing shall have a diameter of not less than 12 inches (305 mm). The ~~pile~~ element length shall not exceed 30 times the average diameter. ~~The minimum diameter shall be 12 inches (305 mm).~~

Exception: The length of the ~~pile~~ element is permitted to exceed 30 times the diameter, provided ~~that~~ the design and installation of the ~~pile foundation~~ deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and ~~pile~~ deep foundations. The registered design professional shall certify to the building official that the ~~piles~~ elements were installed in compliance with the approved construction documents.

1810.3.5.2.3 Micropiles. Micropiles shall have an outside diameter of 12 inches (305 mm) or less. There is no minimum diameter for micropiles.

1810.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

~~**1809.3.3**~~ **1810.3.5.3.1** ~~**Dimensions of**~~ **H-piles.** Sections of H-piles shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall not be less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall not be less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of 3/8 inch (9.5 mm).

~~**1809.3.4**~~ **1810.3.5.3.2** ~~**Dimensions of**~~ **Steel pipes** ~~**piles**~~ **and tubes.** Steel ~~pipe piles driven open ended~~ pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). ~~The pipe~~ Where steel pipes or tubes are driven open-ended, they shall have a minimum of 0.34 square inch (219 mm^2) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete filled steel pipes or tubes in structures assigned to Seismic Design Category C, D, E, or F shall have a wall thickness of not less than 3/16 inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than 3/8 inch (9.5 mm), and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. ~~**1810.6.3 Minimum dimensions.** Piles shall have a nominal outside diameter of not less than 8 inches (203 mm) and a minimum wall thickness in accordance with Section 1809.3.4.~~ For mandrel-driven pipes or tubes ~~piles~~, the minimum wall thickness shall be 1/10 inch (2.5 mm).

~~**1808.2.7**~~ **1810.3.6 Splices.** Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the ~~pier or pile~~ deep foundation element during installation and subsequent thereto and shall be of adequate strength to transmit the vertical and lateral loads and moments occurring at the location of the splice during driving and under service loading. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the ~~least capacity of the pier or pile in~~ bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

~~In addition,~~ Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of ~~the pier or pile~~ an element shall be capable of resisting at allowable working stresses the moment and shear that would result from an assumed eccentricity of the ~~pier or pile~~ axial load of 3 inches (76 mm), or the ~~pier or pile~~ element shall be braced in accordance with Section ~~1808.2.5~~ 1810.2.2 to other ~~piers or piles~~ deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810.3.6.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E, or F, splices of deep foundation elements shall develop the lesser of the following:

1. The full strength of the deep foundation element; and
2. The axial and shear forces and moments from the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7.

1810.3.7 Top of pile detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

~~**1809.2 Precast concrete piles.**~~

~~**1809.2.1**~~ **1810.3.8** ~~**General**~~ **Precast concrete piles.** ~~The materials, reinforcement and installation of~~ Precast concrete piles shall ~~conform to~~ be designed and detailed in accordance with Sections ~~1809.2.1.1 through 1809.2.1.4~~ 1810.3.8.1 through 1810.3.8.3.

~~**1809.2.1.3**~~ **1810.3.8.1 Reinforcement.** Longitudinal steel shall be arranged in a symmetrical pattern and be laterally tied with steel ties or wire spiral spaced center to center as follows:

1. At not more than 1 inch (25 mm) for the first five ties or spirals at each end; then
2. At not more than 4 inches (102 mm) ~~apart, center to center,~~ for ~~a distance of~~ the remainder of the first 2 feet (610 mm) from ~~the ends of the pile~~ each end; and then
3. At not more than 6 inches (152 mm) elsewhere ~~except that at the ends of each pile, the first five ties or spirals shall be spaced 1 inch (25 mm) center to center~~.

The size ~~gage~~ of ties and spirals shall be as follows:

1. For piles having a ~~diameter~~ least horizontal dimension of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).
2. For piles having a ~~diameter~~ least horizontal dimension of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).
3. For piles having a ~~diameter~~ least horizontal dimension of 20 inches (508 mm) and larger, wire shall not be smaller than 0.25 inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

~~1809.2.2~~ 1810.3.8.2 Precast nonprestressed piles. Precast nonprestressed concrete piles shall ~~conform to~~ comply with the requirements of Sections ~~1809.2.2.1 through 1809.2.2.5~~ 1810.3.8.2.1 through 1810.3.8.2.3.

~~1809.2.2.2~~ 1810.3.8.2.1 Minimum reinforcement. ~~The minimum amount of~~ Longitudinal reinforcement shall ~~be 0.8 percent of the concrete section and shall consist of at least four bars~~ consist of at least four bars with a minimum longitudinal reinforcement ratio of 0.008.

~~1809.2.2.2.1~~ 1810.3.8.2.2 Seismic reinforcement in Seismic Design ~~Category~~ Categories C through F. ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category C, D, E, or F in accordance with Section 1613, ~~the following shall apply~~ precast nonprestressed piles shall be reinforced as specified in this section. The minimum longitudinal reinforcement ~~with a minimum steel~~ ratio ~~of~~ shall be 0.01 ~~shall be provided~~ throughout the length ~~of precast concrete piles~~. ~~Within three pile diameters of the bottom of the pile cap, the longitudinal reinforcement shall be confined with~~ Transverse reinforcement shall consist of closed ties or spirals ~~of~~ with a minimum 3/8 inch (9.5 mm) diameter. ~~Ties or spirals shall be provided at a maximum spacing of~~ Spacing of transverse reinforcement shall not exceed the smaller of eight times the diameter of the smallest longitudinal bar ~~not to exceed~~ or, 6 inches (152 mm) within a distance of three times the least pile dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 6 inches (152 mm) throughout the remainder of the pile~~, the closed ties or spirals shall have a maximum spacing of 16 times the smallest longitudinal bar diameter, not to exceed 8 inches (203 mm)~~.

~~1809.2.2.2.2~~ 1810.3.8.2.3 Additional seismic reinforcement in Seismic Design ~~Category~~ Categories D through~~, E or~~ F. ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category D, E or F in accordance with Section 1613, ~~the requirements for Seismic Design Category C in Section 1809.2.2.2.1 shall apply except as modified by this section. Transverse confinement reinforcement consisting of closed ties or equivalent spirals shall be provided in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within three pile diameters of the bottom of the pile cap. For other than Site Class E or F, or liquefiable sites and where spirals are used as the transverse reinforcement, it shall be permitted to use a volumetric ratio of spiral reinforcement of not less than one-half that required by Section 21.4.4.1(a) of ACI 318~~ transverse reinforcement shall be in accordance with Section 1810.3.9.4.2.

~~1809.2.3~~ 1810.3.8.3 Precast prestressed piles. Precast prestressed concrete piles shall ~~conform to~~ comply with the requirements of Sections ~~1809.2.3.1 through 1809.2.3.5~~ 1810.3.8.3.1 through 1810.3.8.3.3.

~~1809.2.3.2~~ 1810.3.8.3.1 ~~Design~~ Effective prestress. ~~Precast prestressed piles shall be designed to resist stresses induced by handling and driving as well as by loads.~~ The effective prestress in the pile shall not be less than 400 psi (2.76MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

~~1809.2.3.2.1~~ 1810.3.8.3.2 ~~Design~~ Seismic reinforcement in Seismic Design Category C. ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category C in accordance with Section 1613, ~~the following shall apply~~ precast prestressed piles shall have transverse reinforcement in accordance with this section. The ~~minimum~~ volumetric ratio of spiral reinforcement shall not be less than ~~0.007 or~~ the amount required by the following formula for the upper 20 feet (6096 mm) of the pile.

$$\rho_s = 0.12 f'_c / f_{yh} \qquad \textbf{(Equation 18-4)}$$

where:

f'_c = Specified compressive strength of concrete, psi (MPa)
f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).
ρ_s = Spiral reinforcement index (vol. spiral/vol. core).

At least one-half the volumetric ratio required by Equation 18-4 shall be provided below the upper 20 feet (6096 mm) of the pile.

~~The pile cap connection by means of dowels as indicated in Section 1808.2.23.1 is permitted. Pile cap connection by means of developing pile reinforcing strand is permitted provided that the pile reinforcing strand results in a ductile connection.~~

~~1809.2.3.2.2~~ 1810.3.8.3.3 ~~Design~~ Seismic reinforcement in Seismic Design ~~Category~~ Categories D through~~, E or F.~~ ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category D, E or F in accordance with Section 1613, ~~the requirements for Seismic Design Category C in Section 1809.2.3.2.1 shall be met, in addition to~~ precast prestressed piles shall have transverse reinforcement in accordance with the following:

1. Requirements in ACI 318, Chapter 21, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand, or 8 inches (203 mm), whichever is ~~smaller~~ smallest.
4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of ~~the~~ each spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Sec. 12.14.3 of ACI 318.
5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:

$$\rho_s = 0.25(f'_c / f_{yh})(A_g / A_{ch} - 1.0)[0.5 + 1.4P/(f'_c A_g)] \quad \textbf{(Equation 18-5)}$$

but not less than:

$$\rho_s = 0.12(f'_c / f_{yh})\,[0.5 + 1.4P/(f'_c A_g)] \geq 0.12\, f'_c / f_{yh} \quad \textbf{(Equation 18-6)}$$

and need not exceed:

$$\rho_s = 0.021 \quad \textbf{(Equation 18-7)}$$

where:
A_g = Pile cross-sectional area, square inches (mm^2).
A_{ch} = Core area defined by spiral outside diameter, square inches (mm^2).
f'_c = Specified compressive strength of concrete, psi (MPa)
f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).
P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and ~~16-6~~ 16-7.
ρ_s = Volumetric ratio (vol. spiral/ vol. core).

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

6. ~~When~~ Where transverse reinforcement consists of rectangular hoops and cross ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacing, s, and perpendicular ~~to~~ dimension, h_c, shall conform to:

$$A_{sh} = 0.3s\, h_c\, (f'_c / f_{yh})(A_g / A_{ch} - 1.0)[0.5 + 1.4P/(f'_c A_g)] \quad \textbf{(Equation 18-8)}$$

but not less than:

$$A_{sh} = 0.12s\, h_c\, (f'_c / f_{yh})\,[0.5 + 1.4P/(f'_c A_g)] \quad \textbf{(Equation 18-9)}$$

where:

f_{yh} = ≤ 70,000 psi (483 MPa).
h_c = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).
s = Spacing of transverse reinforcement measured along length of pile, inch (mm).
A_{sh} = Cross-sectional area of tranverse reinforcement, square inches (mm^2)
f'_c = Specified compressive strength of concrete, psi (MPa)

The hoops and cross ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.

1810.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3\sqrt{f'_c} S_m \qquad \textbf{(Equation 18-10)}$$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa)
S_m = Elastic section modulus, neglecting reinforcement and casing, in^3 (mm^3)

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of Section 1605.2 exceeds the design cracking moment determined in accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

~~**1810.1.2**~~ **1810.3.9.3 Placement of reinforcement.** ~~Except for steel dowels embedded 5 feet (1524 mm) or less in the pile and as provided in Section 1810.3.4,~~ Reinforcement where required shall be assembled and tied together and shall be placed in the ~~pile~~ deep foundation element as a unit before the reinforced portion of the ~~pile~~ element is filled with concrete ~~except in augered uncased cast-in-place piles. Tied reinforcement in augered uncased cast-in-place piles shall be placed after piles are concreted, while the concrete is still in a semifluid state~~.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. ~~**1810.3.4 Reinforcement.**~~ For ~~piles~~ deep foundation elements installed with a hollow-stem auger ~~where full-length~~, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal ~~steel~~ reinforcement ~~is placed~~ without lateral ties~~, the reinforcement~~ shall be placed either through the hollow stem of the auger prior to ~~filling the pile with concrete~~ concreting or after concreting, while the concrete is still in a semifluid state. ~~All pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm).~~

   ~~**Exception:** Where physical constraints do not allow the placement of the longitudinal reinforcement prior to filling the pile with concrete or where partial length longitudinal reinforcement is placed without lateral ties, the reinforcement is allowed to be placed after the piles are completely concreted but while concrete is still in a semifluid state.~~

3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided the construction method can be demonstrated to the satisfaction of the building official.

~~**1812.4**~~ **1810.3.9.4** ~~**Reinforcement**~~ **Seismic reinforcement.** ~~Except for steel dowels embedded 5 feet (1524 mm) or less in the pier, reinforcement where required shall be assembled and tied together and shall be placed in the pier hole as a unit before the reinforced portion of the pier is filled with concrete~~ Where a structure is assigned to Seismic

Design Category C reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E, or F reinforcement shall be provided in accordance with Section 1810.3.9.4.2.

~~**Exception:** Reinforcement is permitted to be wet set and the 2-1/2 inch (64 mm) concrete cover requirement be reduced to 2 inches (51 mm) for Group R-3 and U occupancies not exceeding two stories of light-frame construction, provided the construction method can be demonstrated to the satisfaction of the building official.~~

~~Reinforcement shall conform to the requirements of Sections 1810.1.2.1 and 1810.1.2.2.~~

Exceptions:

1. Isolated ~~piers~~ deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction ~~are~~ shall be permitted to be reinforced as required by rational analysis but with not less than ~~a minimum of~~ one No. 4 bar, without ties or spirals, ~~when~~ where detailed so the ~~pier~~ element is not subject to lateral loads and the soil ~~is determined to be of adequate stiffness~~ provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated ~~piers~~ deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction ~~are~~ shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, ~~when~~ where the lateral load, *E*, to the top of the ~~pier~~ element does not exceed 200 pounds (890 N) and the soil ~~is determined to be of adequate stiffness~~ provides adequate lateral support in accordance with Section 1810.2.1.
3. ~~Piers~~ Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction ~~are~~ shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, ~~when it can be shown the concrete pier will not rupture when designed for the maximum seismic load, E_m,~~ where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7 and the soil ~~is determined to be of adequate stiffness~~ provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section ~~1810.1.2.2~~ 1810.3.9.4.2 ~~are~~ shall be permitted to be limited to the top 3 feet (914 mm) of ~~the piers~~ deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

~~**1810.1.2.1**~~ **1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C.** For ~~Where a~~ structures ~~is~~ assigned to Seismic Design Category C in accordance with Section 1613, ~~the following shall apply~~ cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided ~~for uncased cast-in-place concrete drilled or augered piles, piers or caissons in the top~~ throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the ~~pile~~ element length;
2. A ~~minimum length~~ distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2. ~~below the ground or that required by analysis, whichever length is greatest. The minimum reinforcement ratio, but no less than that ratio required by rational analysis, shall be continued throughout the flexural length of the pile. There shall be a minimum of four longitudinal bars with~~

Transverse reinforcement shall consist of closed ties ~~(~~or ~~equivalent~~ spirals~~)~~ ~~of~~ with a minimum 3/8 inch (9.5 mm) diameter ~~provided at 16 longitudinal bar diameter maximum spacing. Transverse confinement reinforcement with a maximum~~. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters~~, whichever is less, shall be provided~~ within a distance ~~equal to~~ of three times the least ~~pile~~ element dimension ~~of~~ from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.

2. A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

~~1810.1.2.2~~ 1810.3.9.4.2 Seismic reinforcement in Seismic Design ~~Category~~ Categories D~~, E or~~ through F. For ~~Where a~~ structures ~~is~~ assigned to Seismic Design Category D, E or F in accordance with Section 1613, ~~the requirements for Seismic Design Category C given above shall be met, in addition to the following~~ cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

A minimum of four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005 shall be provided ~~for uncased cast-in-place drilled or augered concrete piles, piers or caissons in the top~~ throughout the minimum reinforced length of the element as defined below starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the ~~pile~~ element length;
2. A ~~minimum length~~ distance of 10 feet (3048 mm);
3. Three times the least element dimension; and
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of Section 1605.2.

~~below ground or throughout the flexural length of the pile, whichever length is greatest. The flexural length shall be taken as the length of the pile to a point where the concrete section cracking moment strength multiplied by 0.4 exceeds the required moment strength at that point. There shall be a minimum of four longitudinal bars with transverse confinement reinforcement provided in the pile in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within three times the least pile dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 21.4.4.1(a) of ACI 318 for other than Class E, F or liquefiable sites is permitted. Tie spacing throughout the remainder of the concrete section shall not exceed 12 longitudinal bar diameters, one-half the least dimension of the section, nor 12 inches (305 mm). Ties shall be a minimum of No. 3 bars for piles with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger piles.~~

Transverse reinforcement shall consist of closed ties or spirals no smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters;
2. One-half the least dimension of the element; and
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. ~~**1810.5.4.1 Seismic reinforcement.** Where a structure is assigned to Seismic Design Category C, D, E or F in accordance with Section 1613, the reinforcement requirements for drilled or augered uncased piles in Section 1810.3.5 shall be met.~~
   ~~**Exception:**~~ A spiral-welded metal casing of a thickness not less than manufacturer's standard gage No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or ~~equivalent~~ spirals ~~required in an uncased concrete pile~~. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C, or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within three times the least element dimension of the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Section 21.4.4.1(a) of ACI 318 shall be permitted.

1810.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft to medium stiff clay.

~~1812.6~~ **1810.3.9.5 Belled ~~bottoms~~ drilled shafts.** Where ~~pier foundations~~ drilled shafts are belled at the bottom, the edge thickness of the bell shall not be less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

~~1810.7.1~~ **1810.3.9.6 ~~Construction~~ Socketed drilled shafts.** ~~Caisson piles shall consist of a shaft section of concrete-filled pipe extending to bedrock with an uncased socket drilled into the bedrock and filled with concrete.~~ Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. ~~The caisson pile~~ Socketed drilled shafts shall have a full-length structural steel core or a stub core installed in the rock socket and extending into the pipe portion a distance equal to the socket depth.

~~1810.7.3 Design.~~ The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the ~~caisson pile~~ element with a minimum safety factor of two, but the depth shall not be less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket. ~~The minimum outside diameter of the caisson pile shall be 18 inches (457 mm), and the diameter of the rock socket shall be approximately equal to the inside diameter of the pile.~~

~~1810.7.4 Structural core.~~ The gross cross-sectional area of the structural steel core shall not exceed 25 percent of the gross area of the ~~caisson~~ drilled shaft. ~~The minimum clearance between the structural core and the pipe shall be 2 inches (51 mm). Where cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.~~

~~1810.8~~ **1810.3.10 (Supp) Micropiles.** Micropiles shall ~~comply with the requirements of~~ be designed and detailed in accordance with Sections ~~1810.8.1 through 1810.8.5~~ 1810.3.10.1 through 1810.3.10.4.

~~1810.8.1~~ **1810.3.10.1 (Supp) Construction.** ~~Micropiles shall consist of a grouted section reinforced with steel pipe or steel reinforcement.~~ Micropiles shall develop their load-carrying capacity ~~through~~ by means of a bond zone in soil, bedrock or a combination of soil and bedrock. ~~The steel pipe or steel reinforcement shall extend the full length of the micropile.~~ Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by at least their tension development length.

~~1810.8.2~~ **1810.3.10.2 (Supp) Materials.** ~~Grout shall have a specified compressive strength (f'_c) of not less than 4,000 psi (27.58 Mpa). The grout mix shall be designed and proportioned so as to produce a pumpable mixture.~~ Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A 615 Grade 60 or 75 or ASTM A 722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of 3/16 inch (4.8 mm). Splices shall comply with Section ~~1808.2.7~~ 1810.3.6. The steel pipe or tube shall have a minimum yield strength ~~exceeding~~ of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

~~1810.8.4~~ **1810.3.10.3 (Supp) Reinforcement.** For micropiles or portions thereof ~~piles~~ grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry at least 40 percent of the design compression load. Micropiles or portions thereof ~~piles~~ grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

~~1810.8.4.1~~ **1810.3.10.4 (Supp) Seismic reinforcement.** ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category C, a permanent steel casing shall be provided from the top of the micropile down ~~a minimum of 120 percent of the flexural length~~ to the point of zero curvature. ~~Where a~~ For structures ~~is~~ assigned to Seismic Design D, E or F, the micropile shall be considered as an alternative system in accordance with Section 104.11. The alternative ~~pile~~ system design, supporting documentation and test data shall be submitted to the building official for review and approval.

~~1808.2.4~~ **1810.3.11 Pile caps.** Pile caps shall be of reinforced concrete, and shall include all elements to which ~~piles~~ vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load. The tops of ~~piles~~ vertical deep foundation elements shall

be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend at least 4 inches (102 mm) beyond the edges of ~~piles~~ the elements. The tops of ~~piles~~ elements shall be cut or chipped back to sound material before capping.

~~1808.2.23.1.1~~ 1810.3.11.1 ~~Connection to pile cap~~ Seismic Design Categories C through F. ~~Concrete piles and concrete-filled steel pipe piles~~ For structures assigned to Seismic Design Category C, D, E, or F in accordance with Section 1613, concrete deep foundation elements shall be connected to the pile cap by embedding the ~~pile~~ element reinforcement or field-placed dowels anchored in the ~~concrete pile~~ element into the pile cap for a distance equal to ~~the~~ their development length in accordance with ACI 318. It shall be permitted to connect precast prestressed piles to the pile cap by developing the element prestressing strands into the pile cap provided the connection is ductile. For deformed bars, the development length is the full development length for compression, or tension~~,~~ in the case of uplift, without reduction ~~in length~~ for excess ~~area~~ reinforcement in accordance with Section 12.2.5 of ACI 318. Alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the ~~pile will~~ element shall be permitted provided the design is such that any hinging occurs in the confined region.

~~Ends of hoops, spirals and ties shall be terminated with seismic hooks, as defined in Section 21.1 of ACI 318 turned into the confined concrete core.~~ The minimum transverse steel ratio for confinement shall not be less than one-half of that required for columns.

For resistance to uplift forces, anchorage of steel ~~pipe (round HSS sections), concrete-filled steel pipe or~~ pipes, tubes, or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the tension development length of the reinforcement.

> ~~**Exception:** Anchorage of concrete-filled steel pipe piles is permitted to be accomplished using deformed bars developed into the concrete portion of the pile.~~

~~Splices of pile segments shall develop the full strength of the pile, but the splice need not develop the nominal strength of the pile in tension, shear and bending when it has been designed to resist axial and shear forces and moments from the load combinations of Section 1605.4.~~

~~1808.2.23.2.2~~ 1810.3.11.2 ~~Connection to pile cap~~ Seismic Design Categories D through F. For ~~piles required to resist~~ structures assigned to Seismic Design Category D, E, or F in accordance with Section 1613, deep foundation element resistance to uplift forces or ~~provide~~ rotational restraint~~, design of anchorage of piles into the pile cap shall be provided~~ shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop a minimum of 25 percent of the strength of the ~~pile~~ element in tension. Anchorage into the pile cap shall be capable of developing the following:

1. In the case of uplift, the ~~lesser~~ least of the following: nominal tensile strength of the longitudinal reinforcement in a concrete ~~pile~~ element~~,~~; ~~or~~ the nominal tensile strength of a steel ~~pile~~ element~~,~~; ~~or~~ the ~~pile uplift soil nominal strength factored~~ frictional force developed between the element and the soil multiplied by 1.3; ~~or~~ and the axial tension force resulting from the load combinations of Section 1605.4.
2. In the case of rotational restraint, the lesser of the following: the axial ~~and~~ force, shear forces, and bending moments resulting from the load combinations of Section 1605.4; ~~or~~ and development of the full axial, bending and shear nominal strength of the ~~pile~~ element.

~~1808.2.23.2.3 Flexural strength.~~ Where the vertical lateral-force-resisting elements are columns, the ~~grade beam or~~ pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and ~~grade beams or~~ pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be capable of resisting forces and moments from the load combinations of Section 1605.4.

1810.3.12 Grade beams. For structures assigned to Seismic Design Category D, E, or F in accordance with Section 1613, grade beams shall comply with the provisions in Section 21.10.3 of ACI 318 for grade beams, except where they have the capacity to resist the forces from the load combinations with overstrength factor in Section 12.4.3.2 of ASCE 7.

~~1808.2.23.1~~ 1810.3.13 ~~(Supp) Seismic Design Category C~~ Seismic ties. ~~Where a~~ For structures ~~is~~ assigned to Seismic Design Category C, D, E, or F in accordance with Section 1613, ~~the following shall apply.~~ Individual ~~pile caps, piers or piles~~ deep foundations shall be interconnected by ties. Ties shall be capable of carrying, in tension and compression, a force equal to the product of the larger pile cap or column load times the seismic coefficient, S_{DS}, divided by 10 unless it can be demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade or confinement by competent rock, hard cohesive soils or very dense granular soils.

Exception: In Group R-3 and U occupancies of light-frame construction, ~~pier foundations~~ deep foundation elements supporting foundation walls, isolated interior posts detailed so the ~~pier~~ element is not subject to lateral loads, or exterior decks and patios are not subject to interconnection ~~if it can be shown~~ where the soils are of adequate stiffness, subject to the approval of the building official.

1810.4 Installation. Deep foundations shall be installed in accordance with Section 1810.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

~~**1808.2.6**~~ **1810.4.1 Structural integrity.** ~~Piers or piles~~ Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that may adversely affect the structural integrity of ~~piles~~ adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

~~**1809.2.2.4**~~ **1810.4.1.1** ~~**Installation**~~ **Compressive strength of precast concrete piles.** A precast concrete pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the ~~28-day~~ specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810.4.1.2 Casing. Where cast-in-place deep foundation elements are formed through unstable soils and concrete is placed in an open-drilled hole, a casing shall be inserted in the hole prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

~~**1810.4.3**~~ **1810.4.1.3** ~~**Installation**~~ **Driving near uncased concrete.** ~~Piles~~ Deep foundation elements shall not be driven within six ~~pile~~ element diameters center to center in granular soils or within one-half the ~~pile~~ element length in cohesive soils of ~~a pile~~ an uncased element filled with concrete less than 48 hours old unless approved by the building official. If the concrete surface in any completed ~~pile~~ element rises or drops, the ~~pile~~ element shall be replaced. ~~Piles~~ Driven uncased deep foundation elements shall not be installed in soils that could cause ~~pile~~ heave.

~~**1810.5.3**~~ **1810.4.1.4** ~~**Installation**~~ **Driving near cased concrete.** ~~Steel shells shall be mandrel driven their full length in contact with the surrounding soil.~~

~~The steel shells shall be driven in such order and with such spacing as to ensure against distortion of or injury to piles already in place. A pile~~ Deep foundation elements shall not be driven within four and one-half average ~~pile~~ diameters of a ~~pile~~ cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in ~~steel shells~~ casings within heave range of driving.

~~**1809.1.3**~~ **1810.4.1.5 Defective timber piles.** Any substantial sudden increase in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden increase in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

~~**1808.2.20**~~ **1810.4.2 Identification.** ~~Pier or pile~~ Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

~~**1808.2.21**~~ **1810.4.3** ~~**Pier or pile**~~ **Location plan.** A plan showing the location and designation of ~~piers or piles~~ deep foundation elements by an identification system shall be filed with the building official prior to installation of such ~~piers or piles~~ elements. Detailed records for ~~piers or individual piles~~ elements shall bear an identification corresponding to that shown on the plan.

~~**1808.2.13**~~ **1810.4.4 Preexcavation.** The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for ~~piers or piles~~ deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the ~~piers or piles~~ elements already in place or damage adjacent structures. ~~Pile~~ Element tips shall be driven below the preexcavated depth until the required resistance or penetration is obtained.

~~**1808.2.15**~~ **1810.4.5** ~~**Use of**~~ **Vibratory** ~~**drivers**~~ **driving**. Vibratory drivers shall only be used to install ~~piles~~ deep foundation elements where the ~~pile~~ element load capacity is verified by load tests in accordance with Section ~~1808.2.8.3~~ 1810.3.3.1.2. The installation of production ~~piles~~ elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure ~~pile~~ element capacities equal or exceed those of the test ~~piles~~ elements.

~~**1808.2.19**~~ **1810.4.6 Heaved ~~piles~~ elements.** ~~Piles~~ Deep foundation elements that have heaved during the driving of adjacent ~~piles~~ elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the ~~pile~~ element shall be verified by load tests in accordance with Section ~~1808.2.8.3~~ 1810.3.3.1.2.

1810.4.7 Enlarged base cast-in-place elements ~~1810.2.3 Installation.~~ Enlarged bases for cast-in-place deep foundation elements formed ~~either~~ by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. ~~Piles~~ Such elements shall be constructed in the same manner as successful prototype test ~~piles~~ elements driven for the project. ~~Pile~~ Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the ~~pile~~ shaft shall be filled sufficiently to reestablish lateral support by the soil. Where ~~pile~~ heave occurs, the ~~pile~~ element shall be replaced unless it is demonstrated that the ~~pile~~ element is undamaged and capable of carrying twice its design load.

~~**1810.3.3**~~ **1810.4.8 ~~Installation~~ Hollow-stem augered, cast-in-place elements.** ~~Where pile shafts are formed through unstable soils and concrete is placed in an open-drilled hole, a steel liner shall be inserted in the hole prior to placing the concrete. Where the steel liner is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the liner at a sufficient height to offset any hydrostatic or lateral soil pressure.~~

Where concrete is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. The auger shall be withdrawn in continuous increments. Concreting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete volumes shall be measured to ensure that the volume of concrete placed in each ~~pile~~ element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any ~~pile~~ element is interrupted or a loss of concreting pressure occurs, the ~~pile~~ element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete pressure was lost and reformed. Augered cast-in-place ~~piles~~ elements shall not be installed within six ~~pile~~ diameters center to center of ~~a pile~~ an element filled with concrete less than 12 hours old, unless approved by the building official. If the concrete level in any completed ~~pile~~ element drops due to installation of an adjacent ~~pile~~ element, the ~~pile~~ element shall be replaced.

~~**1810.7.6**~~ **1810.4.9 ~~Installation~~ Socketed drilled shafts.** The rock socket and ~~pile~~ pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket. ~~Concrete shall not be placed through water except where a tremie or other approved method is used.~~

~~**1810.8.5**~~ **1810.4.10 ~~Installation~~ Micropiles.** ~~The pile~~ Micropile deep foundation elements shall be permitted to be formed in ~~a~~ holes advanced by rotary or percussive drilling methods, with or without casing. The ~~pile~~ elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the ~~pile~~ element until grout of suitable quality returns at the top of the ~~pile~~ element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the ~~pile~~ element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to ~~check~~ verify that the flow of grout inside the casing is not obstructed.

2. For a micropile or portion thereof ~~a pile~~ grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near ~~piles~~ elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to assure grout coverage outside the casing.

~~**1808.2.22**~~ **1810.4.11 Special inspection.** Special inspections in accordance with Sections 1704.8 and 1704.9 shall be provided for ~~piles and piers~~ driven and cast-in-place deep foundation elements, respectively.

1808.2.23.2 Seismic Design Category D, E or F. ~~Where a structure is assigned to Seismic Design Category D, E or F in accordance with Section 1613, the requirements for Seismic Design Category C given in Section 1808.2.23.1 shall be met, in addition to the following.~~ Provisions of ACI 318, Section 21.10.4, shall apply when not in conflict with the provisions of Sections 1808 through 1812. Concrete shall have a specified compressive strength of not less than 3,000 psi (20.68 MPa) at 28 days.

Exceptions:

1. Group R or U occupancies of light-framed construction and two stories or less above grade plane are permitted to use concrete with a specified compressive strength of not less than 2,500 psi (17.2 MPa) at 28 days.
2. Detached one- and two-family dwellings of light-frame construction and two stories or less in height are not required to comply with the provisions of ACI 318, Section 21.10.4.
3. Section 21.10.4.4(a) of ACI 318 need not apply to concrete piles.

1809.2.3.1 Materials. ~~Prestressing steel shall conform to ASTM A 416.~~ Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 5,000 psi (34.48 MPa).

1810.5.4 Reinforcement. Reinforcement shall not be placed within 1 inch (25 mm) of the steel shell. ~~Reinforcing shall be required for unsupported pile lengths or where the pile is designed to resist uplift or unbalanced lateral loads.~~

1810.6.4 Reinforcement. ~~Reinforcement steel shall conform to Section 1810.1.2.~~ Reinforcement shall not be placed within 1 inch (25 mm) of the steel casing.

1810.7.2 Materials. ~~Pipe and steel cores shall conform to the material requirements in Section 1809.3. Pipes shall have a minimum wall thickness of 3/8 inch (9.5 mm) and shall be fitted with a suitable steel driving shoe welded to the bottom of the pipe.~~ Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 4,000 psi (27.58 MPa). The concrete mix shall be designed and proportioned so as to produce a cohesive workable mix with a slump of 4 inches to 6 inches (102 mm to 152 mm).

2. Delete without substitution:

~~**1808.2.8 Allowable pier or pile loads.**~~

~~**1808.2.14 Installation sequence.** Piles shall be installed in such sequence as to avoid compacting the surrounding soil to the extent that other piles cannot be installed properly, and to prevent ground movements that are capable of damaging adjacent structures.~~

~~**1808.2.16 Pile driveability.** Pile cross sections shall be of sufficient size and strength to withstand driving stresses without damage to the pile, and to provide sufficient stiffness to transmit the required driving forces.~~

~~**1808.2.23 Seismic design of piers or piles.**~~

~~**SECTION 1809**~~
~~**DRIVEN PILE FOUNDATIONS**~~

~~**1809.1.4 Allowable stresses**. The allowable stresses shall be in accordance with the AF&PA NDS.~~

~~**1809.2 Precast concrete piles.**~~

~~**1809.2.1.4 Installation.** Piles shall be handled and driven so as not to cause injury or overstressing, which affects durability or strength.~~

~~**1809.2.2.1 Materials.** Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 3,000 psi (20.68 MPa).~~

~~**1809.2.2.3 Allowable stresses.** The allowable compressive stress in the concrete shall not exceed 33 percent of the 28-day specified compressive strength (f'_c) applied to the gross cross-sectional area of the pile. The allowable compressive stress in the reinforcing steel shall not exceed 40 percent of the yield strength of the steel (f_y) or a maximum of 30,000 psi (207 MPa). The allowable tensile stress in the reinforcing steel shall not exceed 50 percent of the yield strength of the steel (f_y) or a maximum of 24,000 psi (165 MPa).~~

~~**1809.2.2.5 Concrete cover.** Reinforcement for piles that are not manufactured under plant conditions shall have a concrete cover of not less than 2 inches (51 mm).~~

~~Reinforcement for piles manufactured under plant control conditions shall have a concrete cover of not less than 1.25 inches (32 mm) for No. 5 bars and smaller, and not less than 1.5 inches (38 mm) for No. 6 through No. 11 bars~~

except that longitudinal bars spaced less than 1.5 inches (38 mm) clear distance apart shall be considered bundled bars for which the minimum concrete cover shall be equal to that for the equivalent diameter of the bundled bars. Reinforcement for piles exposed to seawater shall have a concrete cover of not less than 3 inches (76 mm).

1809.2.3.3 Allowable stresses. The allowable design compressive stress, f_c, in concrete shall be determined as follows:

$f_c = 0.33 f'_c - 0.27 f_{pc}$ **(Equation 18-10)**

where:

f'_c = The 28-day specified compressive strength of the concrete.
f_{pc} = The effective prestress stress on the gross section.

1809.2.3.4 Installation. A prestressed pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the 28-day specified compressive strength ($f'c$), but not less than the strength sufficient to withstand handling and driving forces.

1809.2.3.5 Concrete cover. Prestressing steel and pile reinforcement shall have a concrete cover of not less than 1-1/4 inches (32 mm) for square piles of 12 inches (305 mm) or smaller size and 1-1/2 inches (38 mm) for larger piles, except that for piles exposed to seawater, the minimum protective concrete cover shall not be less than 2-1/2 inches (64 mm).

1809.3 Structural steel piles. Structural steel piles shall conform to the requirements of Sections 1809.3.1 through 1809.3.4.

1809.3.2 Allowable stresses. The allowable axial stresses shall not exceed 35 percent of the minimum specified yield strength (F_y).

Exception: Where justified in accordance with Section 1808.2.10, the allowable axial stress is permitted to be increased above $0.35F_y$, but shall not exceed $0.5F_y$.

SECTION 1810
CAST-IN-PLACE CONCRETE PILE FOUNDATIONS

1810.1 General. The materials, reinforcement and installation of cast-in-place concrete piles shall conform to Sections 1810.1.1 through 1810.1.3.

1810.1.3 Concrete placement. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pile, the concrete shall not be chuted directly into the pile but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pile.

1810.2 Enlarged base piles. Enlarged base piles shall conform to the requirements of Sections 1810.2.1 through 1810.2.5.

1810.2.2 Allowable stresses. The maximum allowable design compressive stress for concrete not placed in a permanent steel casing shall be 25 percent of the 28-day specified compressive strength (f'_c). Where the concrete is place in a permanent steel casing, the maximum allowable concrete stress shall be 33 percent of the 28-day specified compressive strength (f'_c).

1810.2.4 Load-bearing capacity. Pile load-bearing capacity shall be verified by load tests in accordance with Section 1808.2.8.3.

1810.2.5 Concrete cover. The minimum concrete cover shall be 2-1/2 inches (64 mm) for uncased shafts and 1 inch (25 mm) for cased shafts.

1810.3 Drilled or augered uncased piles. Drilled or augered uncased piles shall conform to Sections 1810.3.1 through 1810.3.5.

1810.3.1 Allowable stresses. The allowable design stress in the concrete of drilled or augered uncased piles shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable compressive stress of reinforcement shall not exceed 40 percent of the yield strength of the steel or 25,500 psi (175.8 MPa).

1810.3.5 Reinforcement in Seismic Design Category C, D, E or F. Where a structure is assigned to Seismic Design Category C, D, E or F in accordance with Section 1613, the corresponding requirements of Sections 1810.1.2.1 and 1810.1.2.2 shall be met.

1810.4 Driven uncased piles. Driven uncased piles shall conform to Sections 1810.4.1 through 1810.4.4.

1810.4.1 Allowable stresses. The allowable design stress in the concrete shall not exceed 25 percent of the 28-day specified compressive strength (f'_c) applied to a cross-sectional area not greater than the inside area of the drive casing or mandrel.

1810.4.2 Dimensions. The pile length shall not exceed 30 times the average diameter. The minimum diameter shall be 12 inches (305 mm).

> **Exception:** The length of the pile is permitted to exceed 30 times the diameter, provided that the design and installation of the pile foundation is under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and pile foundations. The registered design professional shall certify to the building official that the piles were installed in compliance with the approved design.

1810.4.4 Concrete cover. Pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm), measured from the inside face of the drive casing or mandrel.

1810.5 Steel-cased piles. Steel-cased piles shall comply with the requirements of Sections 1810.5.1 through 1810.5.4.

1810.6 Concrete-filled steel pipe and tube piles. Concrete filled steel pipe and tube piles shall conform to the requirements of Sections 1810.6.1 through 1810.6.5.

1810.6.1 Materials. Steel pipe and tube sections used for piles shall conform to ASTM A 252 or ASTM A 283. Concrete shall conform to Section 1810.1.1. The maximum coarse aggregate size shall be 3/4 inch (19.1 mm).

1810.6.2 Allowable stresses. The allowable design compressive stress in the concrete shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable design compressive stress in the steel shall not exceed 35 percent of the minimum specified yield strength of the steel (F_y), provided F_y shall not be assumed greater than 36,000 psi (248 MPa) for computational purposes.

> **Exception:** Where justified in accordance with Section 1808.2.10, the allowable stresses are permitted to be increased to 0.50 F_y.

1810.6.4.1 Seismic reinforcement. Where a structure is assigned to Seismic Design Category C, D, E or F in accordance with Section 1613, the following shall apply. Minimum reinforcement no less than 0.01 times the cross-sectional area of the pile concrete shall be provided in the top of the pile with a length equal to two times the required cap embedment anchorage into the pile cap, but not less than the tension development length of the reinforcement. The wall thickness of the steel pipe shall not be less than 3/16 inch (5 mm).

1810.6.5 Placing concrete. The placement of concrete shall conform to Section 1810.1.3, but is permitted to be chuted directly into smooth sided pipes and tubes without a centering funnel hopper.

1810.7 Caisson piles. Caisson piles shall conform to the requirements of Sections 1810.7.1 through 1810.7.6.

1810.7.5 Allowable stresses. The allowable design compressive stresses shall not exceed the following: concrete, 0.33 f'_c, steel pipe, 0.35 F_y and structural steel core, 0.50 F_y.

1810.8.3 Allowable stresses. The allowable compressive stress in the grout shall not exceed 0.33 f'_c. The allowable compressive stress in the steel pipe and steel reinforcement shall not exceed the lesser of 0.4 F_y, and 32,000 psi (220 Mpa). The allowable tensile stress in the steel reinforcement shall not exceed 0.60 F_y. The allowable tensile stress in the cement grout shall be zero.

SECTION 1811
COMPOSITE PILES

1811.1 General. Composite piles shall conform to the requirements of Sections 1811.2 through 1811.5.

1811.2 Design. Composite piles consisting of two or more approved pile types shall be designed to meet the conditions of installation.

1811.3 Limitation of load. The maximum allowable load shall be limited by the capacity of the weakest section incorporated in the pile.

1811.4 Splices. Splices between concrete and steel or wood sections shall be designed to prevent separation both before and after the concrete portion has set, and to ensure the alignment and transmission of the total pile load. Splices shall be designed to resist uplift caused by upheaval during driving of adjacent piles, and shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section.

1811.5 Seismic reinforcement. Where a structure is assigned to Seismic Design Category C, D, E or F in accordance with Section 1613, the following shall apply. Where concrete and steel are used as part of the pile assembly, the concrete reinforcement shall comply with that given in Sections 1810.1.2.1 and 1810.1.2.2 or the steel section shall comply with Section 1810.6.4.1.

SECTION 1812
PIER FOUNDATIONS

1812.1 General. Isolated and multiple piers used as foundations shall conform to the requirements of Sections 1812.2 through 1812.10, as well as the applicable provisions of Section 1808.2.

1812.2 Lateral dimensions and height. The minimum dimension of isolated piers used as foundations shall be 2 feet (610 mm), and the height shall not exceed 12 times the least horizontal dimension.

1812.3 Materials. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa). Where concrete is placed through a funnel hopper at the top of the pier, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 6 inches (152 mm). Where concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.

1812.5 Concrete placement. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pier, the concrete shall not be chuted directly into the pier but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pier.

1812.8 Concrete. Where adequate lateral support is not provided, and the unsupported height to least lateral dimension does not exceed three, piers of plain concrete shall be designed and constructed as pilasters in accordance with ACI 318. Where the unsupported height to least lateral dimension exceeds three, piers shall be constructed of reinforced concrete, and shall conform to the requirements for columns in ACI 318.

> **Exception:** Where adequate lateral support is furnished by the surrounding materials as defined in Section 1808.2.9, piers are permitted to be constructed of plain or reinforced concrete. The requirements of ACI 318 for bearing on concrete shall apply.

1812.9 Steel shell. Where concrete piers are entirely encased with a circular steel shell, and the area of the shell steel is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1808.2.17. Horizontal joints in the shell shall be spliced to comply with Section 1808.2.7.

1812.10 Dewatering. Where piers are carried to depths below water level, the piers shall be constructed by a method that will provide accurate preparation and inspection of the bottom, and the depositing or construction of sound concrete or other masonry in the dry.

Reason: Significant clarification, update, generalization, and simplification of the code requirements for deep foundations.

Reorganizes deep foundation requirements to eliminate repetition, fix conflicting definitions, and generalize and simplify requirements where possible. Most of the changes proposed are either purely editorial or nearly editorial. The substantive and nearly editorial changes are described herewith.

Definitions: The current definitions cause confusion and conflict. For instance, consider the definitions of “pier” and “pile”. Some of the requirements for piers differ from those for piles, but the definitions only confuse matters. By the current definitions, piers must 1) be isolated, 2) be constructed of masonry or cast-in-place concrete, and 3) have a length of no more than 12 times the least horizontal dimension; piles must 1) be of concrete, wood, or steel either driven into the ground or cast in place, and 2) have a length exceeding 12 times the least horizontal dimension. As a result, foundation elements that have length less than 12 times the least horizontal dimension are **neither piers nor piles** if grouped or if constructed of wood, steel, or precast concrete. Several sections (such as 1808.2.5 and 1808.2.9.3) assume that piers are isolated, as the definition requires; Section 1812.1 addresses “isolated and multiple piers”, which conflicts with the definition. The solution is, not to revise or add definitions but, to generalize and unify the requirements to the extent possible and then describe specific conditions of concern while specifying the related requirements. In order to unify, generalize, and simplify the requirements, some minor substantive changes are produced. Where the substantive change is small but the improvement in clarity and consistency of application is great, such revisions aid the registered design professional, the building official, and the public. This change proposal groups all deep foundation systems together (by defining shallow foundations) and sets forth general rules for the analysis, design, detailing, and installation of deep foundations. Specific deep foundation types are defined only where the rules for that type are so many and so peculiar that providing verbal descriptions for scoping would become unmanageable.

The exceptions that appeared in Section 1808.2.1 are embodied in the overall revisions to the requirements for deep foundations.

In a related proposal the numbered list in Section 1810.1.1 is moved to the section for geotechnical investigations.

New Section 1810.1.3 is based on current requirements. Concrete elements with height no greater than three times the least horizontal dimension are pedestals (not pilasters) per ACI 318. The exception in current Section 1812.8 is not really an exception, as it describes a different case than that addressed in the text (laterally supported versus unsupported). The intent of that exception is carried forward in the proposed text since it permits use of unreinforced sections where lateral support is provided, moment demands are less than the design cracking moment, and seismic concerns do not govern.

Since one of the conditions of concern in Section 1810.2.1 is “fluid soils”, the revised text makes clear that the embedment required is the distance into either stiff soil or soft soil (not the distance below the ground surface). Although the terms “stiff soil” and “soft soil” are, strictly speaking, not (and never have been) defined in this code as related to this provision, they are in general agreement with the terms used in site classification (Section 1613.5.2, Site Classes D and E, respectively).

In new Section 1810.2.2 the first exception addresses a prime condition of what were previously termed “piers”—that is, permission to use isolated elements without additional lateral bracing.

New Sections 1810.2.4 and 1810.2.5 generalize requirements that were previously required for deep foundations of structures assigned to Seismic Design Category C, D, E, or F. This generalization is consistent with current practice and the recommendations of every published standard for deep foundations. Compliance is possible using traditional tables, formulas, or charts or using analysis methods that have been commonly employed for several decades.

New Section 1810.3.1.1 formalizes current practice as implied by the present text of Chapter 18 and as explicitly stated in other documents. The concrete design methods commonly employed no longer recognize allowable stress or working stress design. For many decades structural concrete design has employed the strength design method. However, there is a long tradition of using simple allowable stress design approaches for the proportioning of deep foundation elements (for both soil-foundation behavior and structural design). The proposed text is consistent with the design approaches specified in ACI 543 (Design, Manufacture, and Installation of Concrete Piles). Section 2.3 of that document reads (in part) as follows:

> “Whereas axial compression may often be the primary mode of loading, concrete piles are also frequently subjected to axial tension, bending, and shear loadings as well as various combinations of loading, as noted in Section 2.2. Concrete piles must have adequate structural capacity for all modes and combinations of loading that they will experience. For combined flexure and thrust loadings, the structural adequacy can be evaluated more readily through the use of moment-thrust interaction diagrams and strength-design methods.
>
> :... Because of the historical use of allowable capacities and stresses in piling design, however, recommendations are also provided for allowable axial service capacities for concentrically loaded, laterally supported piles. The allowable service capacities P_a recommended in Section 2.3.3 are intended specifically for cases in which the soil provides full lateral support to the pile and where the applied forces cause no more than minor bending moments resulting from accidental eccentricities. Piles subjected to larger bending moments or with unsupported lengths must be treated as columns in accordance with ACI 318-95 and the provisions given in Sections 2.3.2, 2.3.4, and 2.3.5 of this report.”

Rather than treating composite elements in a different section, this proposal generalizes the requirement that each component of the composite element must comply with the applicable provisions of the code.

The proposed text uses the term “casing” in a manner consistent with current practice and use of the terms as defined in ACI 336.1 (Specification for the Construction of Drilled Piers). The term “casing” is appropriate where the element in question resists earth and water pressures. The term “liner” (which does not appear in this proposed text) applies where the element in question resists internal concrete pressures, but is “not designed for external earth and water pressures.” Chapter 18 of the IBC does not venture so far into construction methods as to address liners. The only prior occurrences of “liner” (Section 1810.3.3) are related to “hydrostatic and lateral soil pressure,” for which the term “casing” is more appropriate. Where the current text of Chapter 18 uses “shell” interchangeably with “casing”, this proposal uses “casing” consistently.

The proposed treatment of timber deep foundation elements is more consistent both internally and with respect to the reference codes and standards. The present definition of “timber pile,” which requires that the element be round and be placed tip first conflicts with the text that addresses sawn timber piles, which are square, and the reference standard (AF&PA NDS), which permits use of piles (tip first) or poles (butt first). New Section 1810.3.2.4 acknowledges use of both piles and poles.

Allowable stresses: The treatment of allowable stresses in this proposal is simple, clear, consistent, and even-handed as applied to deep foundation elements of different types. In generalizing and treating consistently, minor substantive changes result. The table below compares the allowable stresses specified in ACI 543, the 2006 IBC, and this proposal. For most types this proposal represents no change from the 2006 IBC. However, a few cases have changes of up to about 10 percent (which, practically speaking, is negligible). In the 2006 IBC, driven uncased piles and drilled or augered uncased piles have considerably different allowable stresses. This proposal splits the difference and is generally consistent with ACI 543. The real strength of the proposed approach is that it can be applied to other types of deep foundations without conflict, confusion, or question. Where the present text of Section 1808.2.3 is applied to “special types of piles” it is unclear which of the ten sets of allowable stresses should not be exceeded. Using the proposed text, which generalizes the treatment of allowable stresses, such questions have a ready, defensible answer.

Element type	ACI 543	2006 IBC	This proposal
Precast prestressed concrete piles	0.33 f'_c - 0.27 f'_{pc}	0.33 f'_c - 0.27 f'_{pc}	0.33 f'_c - 0.27 f'_{pc}
Precast nonprestressed concrete piles	0.33 f'_c 0.39 f_y	0.33 f'_c 0.4 f_y ≤ 30,000 psi	0.33 f'_c 0.4 f_y ≤ 30,000 psi
Cast-in-place, uncased, plain	0.29 f'_c	0.25 f'_c	0.3 f'_c
Cast-in-place, uncased, reinforced DRIVEN	0.28 f'_c 0.33 f_y	0.25 f'_c	0.3 f'_c 0.4 f_y ≤ 30,000 psi
Cast-in-place, uncased, reinforced DRILLED or AUGERED	0.28 f'_c 0.33 f_y	0.33 f'_c 0.4 f_y ≤ 25,500 psi	0.3 f'_c 0.4 f_y ≤ 30,000 psi
Cast-in-place, cased	0.32 f'_c	0.33 f'_c	0.33 f'_c
Cast-in-place, special casing	0.26(f'_c + 8.2$t_s f_{ys}/D$) ≤ 0.4 f'_c	0.4 f'_c	0.4 f'_c
Cast-in-place, structural steel pipe or tube	0.37 f'_c 0.43 f_{yp}	0.33 f'_c 0.35 F_y ≤ 12,600 psi up to 0.5 F_y	0.33 f'_c 0.35 F_y ≤ 16,000 psi up to 0.5 F_y ≤ 32,000 psi
Caisson (socketed drilled shaft)	0.37 f'_c 0.43 f_{yp}	0.33 f'_c 0.35 F_y (pipe or tube) 0.5 F_y (core)	0.33 f'_c 0.35 F_y ≤ 16,000 psi up to 0.5 F_y ≤ 32,000 psi 0.5 F_y (core)
Structural steel elements	---	0.35 F_y up to 0.5 F_y	0.35 F_y ≤ 16,000 psi up to 0.5 F_y ≤ 32,000 psi
Micropiles	---	0.33 f'_c 0.4 f_y ≤ 32,000 psi 0.4 F_y ≤ 32,000 psi 0.6 f_y Tension	0.33 f'_c 0.4 f_y ≤ 30,000 psi 0.4 F_y ≤ 32,000 psi 0.6 f_y Tension
Timber	---	In accordance with the AF&PA NDS	In accordance with the AF&PA NDS

The first requirement of new Section 1810.3.2.7 is consistent with current practice and the requirements of ACI 543 Table 2.2. The second requirement is moved from Section 1810.5.1; it is the sealed tip that produces a displacement pile with increased capacity.

In new Section 1810.3.3.1.2 the requirement for load testing of cast-in-place deep foundation elements with an enlarged base previously appeared in Section 1810.2.4.

For improved clarity of application and consistency with ASCE 7-05, seismic requirements are rewritten to avoid "cascading," which often led to confusion concerning scope. For instance, new Section 1810.3.8.2.2 applies to Seismic Design Categories C through F and new Section 1810.3.8.2.3 provides "additional" requirements for Seismic Design Categories D through F; in both cases the scope is clearly defined. In another instance it was possible to separate the requirements; Section 1810.3.8.3.2 applies to Seismic Design Category C and Section 1810.3.8.3.3 (with revised Equation 18-6) applies to Seismic Design Categories D through F.

The change at the end of new Section 1810.3.8.2.2 is editorial although it may not appear so. First, the 8 inch maximum spacing is changed to 6 inches since new Section 1810.3.8.1 specifies a maximum spacing of 6 inches for non-seismic cases. Then, the spacing of 16 longitudinal bar diameters can be eliminated since 16 times the smallest bar diameter (3/8") is no more stringent.

The change in new Section 1810.3.8.3.2 is editorial since Equation 18-4 produces a value greater than 0.007 where the minimum value of f'_c (5 ksi) is used with the maximum value of f_{yh} (85 ksi).

The revision to Equation 18-6 eliminates cascading requirements from the section above.

New Sections 1810.3.9.1 and 1810.3.9.1 clarify the present requirements, agree with the requirements of ACI 318-08, and allow elimination of the definition for flexural length. For both uncased and cased cast-in-place deep foundation elements (but not concrete filled pipes and tubes) reinforcement must be provided where moments exceed a reasonable lower bound for the capacity of the plain concrete section. In several sections of the 2006 IBC (and other related documents) that design cracking moment is taken as 0.4 times the "concrete section cracking moment strength." Section 9.5.2.3 of ACI 318 defines the cracking moment strength as 7.5 times the square root of f'_c times the elastic section modulus of the gross section (0.4 × 7.5 = 3). Using Chapter 22 of ACI 318-08, one would take □ = 0.6 times 5.0 times the square root of f'_c times the elastic section modulus of the gross section (0.6 × 5.0 = 3). The proposed text is consistent with the current requirement and paves the way for use of a reference standard in the future. The proposed sections are also used in place of the less clear phrase "not rupture" in Exception 3 of new Section 1810.3.9.4.

Editorial note: Where metric units are used, Equation 18-10 should be shown as $\phi M_n = 0.25\sqrt{f'_c} S_m$.

The proposed revisions in new Section 1810.3.10.1 clarifies the intent to permit the pipe or tube casing to terminate above the bond zone, with deformed bar reinforcement continuing below. It also specifies a splice condition for that transition.

In new Section 1810.3.10.4 "120 percent of the flexural length" is changed to "the point of zero curvature" for two reasons. First, with the revisions related to design cracking moment, this is the only section that uses the current definition of flexural length (first point of zero lateral deflection). Second, the distance to the point of zero curvature, which is also used in new Section 1810.3.8.3.3, is approximately equal to 120 percent of the distance to the point of zero deflection.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF