MARICOPA ASSOCIATION of GOVERNMENTS
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November 6, 2012

TO: Members of the MAG Building Codes Committee

FROM: Michael Williams, Tempe, Chair

SUBJECT: MEETING NOTIFICATION AND TRANSMITTAL OF TENTATIVE AGENDA

Wednesday, **November 14, 2012** - 2:00 pm
MAG Office, Second Floor, Ironwood Room
302 North 1st Avenue, Phoenix

A meeting of the MAG Building Codes Committee (BCC) has been scheduled for the time and place noted above. Members of the MAG Building Codes Committee may attend in person, by videoconference or by telephone conference call. Those attending by telephone conference call must make arrangements with Steve Gross at MAG at (602) 254-6300 at least one day prior to the meeting.

If you drive to the meeting, please park in the garage under the building and bring your ticket to the meeting; parking will be validated. For those using transit, the Regional Public Transportation Authority will provide transit tickets for your trip. For those using bicycles, please lock your bicycle in the bike rack in the garage.

Pursuant to Title II of the Americans with Disabilities Act (ADA), MAG does not discriminate on the basis of disability in admissions to or participation in its public meetings. Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, by contacting Scott Wilken at the MAG office. Requests should be made as early as possible to allow time to arrange for accommodation.

Please be advised that under procedures approved by the MAG Regional Council on June 26, 1996, all MAG committees must have a quorum to conduct business. A quorum is a simple majority of the membership, or 12 people for the MAG Building Codes Committee. If you are unable to attend the meeting, please send a proxy from your jurisdiction or agency to represent you.

If you have any questions or require additional information, please contact Scott Wilken at (602) 254-6300 or swilken@azmag.gov.

TENTATIVE AGENDA
MAG Building Codes Committee Meeting
November 14, 2012

1. Call to Order	
2. Introductions	2. For information.
3. September 19, 2012 Meeting Minutes	3. Review and approve the minutes of the September 19, 2012 meeting.
4. Call to the Audience Members of the public may request to speak on items that fall under the jurisdiction of the MAG Building Codes Committee (BCC) and are not scheduled on the agenda; or, on items on the agenda for discussion but not for action. A total of 15 minutes will be provided for the Call to the Audience, with a limit of three minutes per speaker, unless the Chair requests an exception to this limit. Those requesting to comment on action agenda items may be provided an opportunity to do so at the time the agenda item is heard.	4. For information and discussion.
5. Comments From the Committee An opportunity will be provided for Building Codes Committee members to present a brief summary of current events. The Building Codes Committee is not allowed to propose, discuss, deliberate or take action at the meeting on any matter in the summary, unless the specific matter is properly noticed in accordance with the Arizona Open Meeting Law.	5. For information and discussion.
6. 2012 IECC Testing Requirements Daran Wastchak with D.R. Wastchak, LLC will discuss the new testing requirements in the IECC 2012 and present recommendations on the use of RESNET (Residential Energy Services Network) sample testing and inspection procedures to meet these requirements. Please see **Attachment One**.	6. For information and discussion.

7. MAG Building Code Amendments and Standards Book

Discussion about committee members' review of code amendments and building construction standards not included in national codes, focusing on documents that have previously been tabled for further research.

The following items will be available for discussion (reference numbers relate to Original Documents below):

Ref #4 – MAG Special Inspections Manual
Ref #10 – Straw bale and rammed earth construction
Ref #16 – Gas line relocation
Ref #19 – Commercial solar installations
Ref #20 – Residential solar installations
Ref #27 – Dryer label
Ref #31 – Single-family pad certification
Ref #32 – Deco drain below weep screed
Ref #33 – Cable outside SES
Ref #34 – Storage space under stairs
Ref #37 – Post-tension design and construction

Please see **Attachment Two** for updated draft copies of these documents. Please see **Attachment Three** for the full table of documents.

For copies of the Original Documents – MAG BCC Code Amendments and Standards, please visit the MAG webpage at:
http://www.azmag.gov/addons/MAG/download.asp?ID=11330

7. For information, discussion and possible action.

8. Updated MAG Building Codes Committee Membership

We are requesting that Committee members review **Attachment Four**, Committee Roster, sent with this agenda. Please forward any changes to Scott Wilken prior to the meeting or provide them at the meeting.

8. For information and discussion.

9. Update Survey of Code Adoption

Attachment Five identifies the codes that member agencies have adopted. Please review this information and provide any updates or corrections to Scott Wilken.

9. For information and discussion.

10. Topics for Future Agendas

Potential topics for the next meeting will be discussed. Please think of any items of discussion or presentations that you would be interested in hearing about at future meetings.

The next meeting is scheduled for Wednesday January 16, 2013 at 2:00 p.m. in the MAG Ironwood Room.

11. Adjournment

10. For information and discussion.

MINUTES OF THE
MARICOPA ASSOCIATION OF GOVERNMENTS
BUILDING CODES COMMITTEE

September 19, 2012

Maricopa Association of Governments Office
302 N. 1st Ave
Chaparral Room
Phoenix, AZ

COMMITTEE MEMBERS

Michael Williams, Tempe, Chair
Randal Westacott, Avondale
Phil Marcotte, Buckeye
*Mike Tibbett, Carefree
Mike Baxley, Cave Creek
A-Mike DeWys for Martin Perez, Chandler
Mary Dickson, El Mirage
*Jason Field, Fountain Hills
Larry Taylor, Gilbert
Tom Paradise, Glendale
Ed Kulik, Goodyear
*Chuck Ransom, Litchfield Park
Tom Ewers, Maricopa County
A-Steven Hether, Mesa
Bob Lee, Paradise Valley
A-Dennis Chase for Dennis Marks, Peoria
Julie Belyeu, Phoenix
Dustin Schroff for Michael Clack, Scottsdale
*Dale Crandell, Tolleson
*Rick DeStefano, Wickenburg
A-Jim Fox, Youngtown
Jackson Moll, Home Builders Association
Sharon Bonesteel, Salt River Project

OTHERS IN ATTENDANCE

Jami Garrison, MAG
Steve Gross, MAG
Blaine Miller, Office of Energy Policy
Trisha Ekenberg, GUEP
Ken Kirschmann, Southwest Gas
Rob Runge, Phoenix
Joel Dickinson, SRP
David Felix, SRP

*Those members neither present nor represented by proxy.
A-Those members participating via audioconference

1. Call to Order

Michael Williams, Chair, called to order the September 19, 2012 meeting of the MAG Building Codes Committee (BCC) at 2:00 p.m.

2. Introductions

Voting member Dennis Chase, Mike DeWys, Jim Fox, and Steven Hether attended via telephone conference call. All members and guests introduced themselves.

3. August 15, 2012 Meeting Minutes

Bob Lee made a motion to approve the August 15, 2012 minutes. Mike Baxley seconded the motion, and the motion passed unanimously.

4. Call to the Audience

There were no comments from the audience.

5. Comments From the Committee

Bob Lee said that the AZBO Education Institute will take place October 15-19. He said there will be a lot of new classes, and encouraged members to register. He said that the International Code Council (ICC) Annual Business Meeting (ABM) is taking place in Portland from October 18-28. He said that for the ICC ABM it is important to register as a representative of a jurisdiction in order to have full voting rights at the code hearings. He also said that the Arizona Department of Emergency Management (ADEM) held a roll out for disaster recovery framework. He said that ADEM is putting together a shareholders' meeting. He said that he will be at the meeting representing building officials, but would appreciate additional participation.

Randal Westacott said he attended a training class on Manuals J, S, and D. He said it was very informative and showed what to look for in the 2012 codes. He thanked SRP for sponsoring the class. Michael Williams said that he also attended the class, and thanked SRP for putting it on. He said that the ACCA has the Manual J video on their website. Sharon Bonesteel said that SRP was glad they were able to put on the class. She said that SRP believes this will be a key piece in making sure that mechanical units are properly sized for residential structures to ensure the best energy efficiency. Michael Williams said that one thing that came out of the class is retrofitting of air conditioning units and the associated ductwork.

Tom Paradise asked if Randal Westacott had gotten answers about pad certifications. Randal Westacott said that he had sent out an email asking how people would view a subdivision that has been sitting for several years, and now someone is ready to build on the lots that are existing. He said that he received a lot of responses, and many people said that asking for a new pad certification would be a good practice. Bob Lee pointed out that that Reference Number 31 on the Building Code Amendments and Standards list deals with this issue. He said that the committee had previously voted to require a current pad certification report for each single family lot at the time of footing inspection. Larry Taylor said that Gilbert requires a time limit to be put on the pad certification. He said that some engineers are comfortable with including an indefinite time limit, while others give a specific number of days. Randal Westacott said the

shorter time frames are often for pads that will have post-tension slabs, and the engineers usually like for pre-wetting to be done within a recent period before the work is done on the lot. He said the consensus was that a new pad certification should be done. He said that he also asked if a new soils investigation should be done. He said that most people said to see if there was an expiration date on the original soils investigation. He said that he's going to check the soils investigation through Engineering, and require a new certification at the foundation stage.

6. Arizona Rooftop Solar Challenge

Blaine Miller gave a presentation on the Arizona Rooftop Solar Challenge. He said that the Governor's Office of Energy Policy (OEP) received a grant from the US Department of Energy with the goals of identifying best practices in permitting, net-metering and interconnection, planning and zoning, and financing, as well as adoption of best practices like online permitting, reduction in solar access barriers, and providing additional solar financing options. He said OEP is partnering with the City of Flagstaff, City of Phoenix, City of Tucson, ASU Global Institute of Sustainability and Sustainable Cities Network, and AZ SmartPower. He said that ASU has sent out a number of surveys to different cities regarding permitting and zoning practices related to solar. He said that the goal is to create a more uniform process across the state. He said that they want to reduce the time it takes to install solar facilities and the work involved, and allow contractors to know what the requirements are regardless of local jurisdiction. He said the grant runs through February, and currently focuses on gathering information and best practices. He said there will be a phase two, which will focus on implementation. He said that the eventual goal will be to have state-wide online permitting for solar equipment.

Blaine Miller said that for the implementation process, they are working with the utility companies, who are interested in how the process can be streamlined for contractors. He said that eventually they would like for this process to be online, as well.

Blaine Miller said that among the deliverables they need to have by the end of the grant in February are: adoption of an online system in 5 jurisdictions that allows for over-the-counter and same-day permit review; a roll-out of a form of solar financing in 3 jurisdictions; and model language for planning/zoning and solar access, with 5 jurisdictions modifying codes to enhance solar development. He said that if these goals are achieved they hope to score well enough to apply for the phase two grant. He said there is a financial aspect to the program, as well. He said Phoenix has been successful with a $25 million leasing program. He said that they will use that as a model for the rest of the jurisdictions in the state. He summarized the program by saying that the main goal is the make it simplified, easy, and quick to install solar on residential and small commercial.

Tom Ewers said that Maricopa County has already achieved most of the goals of the program. He said that most jurisdictions in the county are probably already doing these things. Blaine Miller said that they may be doing these things, but the goal is to make them the same across jurisdictions. He said that they sent out a survey to determine the differences in implementation between different cities. He said that they hope to get the phase two grant to help jurisdictions implement an online system, and that they have a company in Tucson that is working on software that could be used by smaller jurisdictions.

Bob Lee said that Paradise Valley will probably wait for the software to be finished, rather than create their own system. He said that he wouldn't want to have a different process for everything. He said that their intention is to take the software and process and use it for other

projects, as well as solar. Blaine Miller said that other jurisdictions have done the same thing. He said that solar installation is much simpler than other things, like installing a pool, for example. Bob Lee said that in Paradise Valley they have a 24 foot height limit, and adding a solar array to a house near that limit could be denied for violating the height limit. Blaine Miller said that this is one of the zoning issues they are trying to address.

Sharon Bonesteel said that this issue is so new that planning and zoning departments haven't addressed it yet. She said that a number of jurisdictions are updating their master plans, and suggested that the OEP write some language that could be adopted as part of the new plans. Blaine Miller said that they are working on something like this.

Michael Williams asked if the OEP has worked on standard electrical plans for houses. Blaine Miller said they have, and that will be part of the online permitting process. Sharon Bonesteel recommended not getting caught up trying to make a system that works for everything. She said simply creating a system where most residential solar installations can be handled online is a great accomplishment. Blaine Miller said that this is why they'll have two phases of the grant, to allow beta testing with a number of different types of jurisdictions in the first phase.

7. <u>MAG Building Code Amendments and Standards Book</u>

Michael Williams said that next on the agenda was the building codes amendments and standards book. He said that the first discussion item will be Item 7, and that Sharon Bonesteel had done some research on this item. Sharon Bonesteel said that she looked at what the initial source of the problem was that created a need for this item. She said that problem appeared to be unmetered lights installed on private property. She said she reviewed SRP's standards, and their electrical service specifications. She said the standards state that most local jurisdictions have regulations that require that the property owner obtain approval from the local jurisdiction prior to energizing the load side. She said that on the subject of SRP getting permits, SRP maintains that they are not subject to having to get permits. She said that SRP proposed updated language specifying that it is the responsibility of the property owner to obtain permits and inspections from the local jurisdiction. She said that SRP cannot support the item as previously written.

Tom Ewers said that there are statutory exemptions for work by public utility companies. He said that the proposed update says what local codes already say. He suggested that this item may be no longer needed. Sharon Bonesteel said that SRP would accept that the document is not needed, or the wording that has been proposed.

Michael Williams said that the proposal could go either way and have the same effect. He said that the proposed language makes it clear the owner has to obtain the permits, while the existing language has some ambiguity as to who get the permits.

Tom Ewers made a motion that Item 7 be included as Historic. Ed Kulik seconded the motion.

Randal Westacott asked if this item was initial created because electrical service was turned on without proper permits. Michael Williams said that is correct. He said that, despite the current codes addressing the issue, it might be a good idea to incorporate the SRP suggested language to make the statement in the code clear. He said to avoid confusion it might be a good idea to keep the proposed language. Sharon Bonesteel said that it is better to have a clear MAG standard than to rely on the code alone. She encouraged the inclusion of the proposed language. Dennis Chase asked if utility companies could agree to not energize until appropriate permits are approved.

Sharon Bonesteel said that the SRP process is that when a customer requests service, SRP provides service, and that, where appropriate, they ask if appropriate permits have been obtained. She said that it is not SRP's intention to energize where it is unsafe. She said that if the committee wants to make it clear, they could reference the SRP ESS standard in the section.

Mike Baxley asked where the lights in question would be installed – on the utility side or after the meter on the customer side. Michael Williams said that there would be no meter in these situations, and it is on private property and owned by the utility.

Rob Runge said that Phoenix has had agreements with SRP and APS for this type of work. He said the agreements consider each light pole to be a service. He said there is a utility portion up to the point of the service disconnect, which is typically an inline fuse. He said downstream of that falls under the jurisdiction of the city, so a permit is required if it is on private property. Michael Williams said that there was a standard developed with Phoenix in the lead that follows this description. He said the issue was that there was not a single service disconnect. He said the option was given to have the service point at each pole with a hand hold that used tamper-resistant screws and ground each light pole. He said that cities that accepted that standard would issue a permit for that installation for however many poles were on the site. He said that in those situations in Tempe the owner obtained the permits. He said he would be concerned if permits were not issued because there would be no record of what standard they were installed to. Sharon Bonesteel said that she does not have that agreement. She said that if she could get a copy of the agreement and the City of Phoenix standard she would do further research to find their current status. Rob Runge asked to clarify the position of SRP, saying it sounds like SRP isn't saying a permit is not required, but that the property owner, and not SRP, should obtain the permit. Sharon Bonesteel said that the issue is not whether or not a permit is required, but if SRP is required to get the permit. Michael Williams said that the standard he referenced earlier is a technical document that has specific requirement for installation.

Bob Lee said that a few years ago a company came to Paradise Valley and installed 43 unmetered cell phone nodes in town right-of-way (ROW), some of which were in SRP territory. He said that SRP never agreed to them being unmetered, but APS did agree. Afterward, APS said that they would not allow unmetered installations anymore. He said that he might agree with the motion that the language is no longer necessary.

Dennis Chase said that in the last six months, in APS territory, they have had some irrigation pedestals that have been unmetered.

Tom Paradise asked to clarify what the update proposed by SRP is. He said that the proposed text indicates that SRP would not be required to obtain a permit, and that the burden would be on the property owner to comply with all requirements of the local jurisdiction. He said that every local jurisdiction requires a permit and inspection for a light installation, and asked if SRP would need to see an approval by the local jurisdiction to power a light pole or would they simply power the light when asked by the property owner. He asked how SRP will know when the light has been properly inspected. Sharon Bonesteel said that the department that handles energizing these types of installations typically gets an email from the local jurisdiction that it is clear and ready to be energized. Tom Paradise said that typically power is not turned on unless there is that clearance from the local jurisdiction. He asked if the language needs to specify that a clearance is required, or if a new policy for this is even necessary, as it is covered by the local building codes. He said that he believes this language is no longer needed.

Sharon Bonesteel said that the original language says that the utility company installing lighting is required to obtain permits. She said that SRP's position is that they are exempt from having to get permits. She said that if this is no longer applicable, then SRP would accept that. She said that if the committee wishes to clarify the position, she suggested that the language be broadened to include electrical services, pedestals, lighting, or any electrical item as subject to permits and specify that the property owner is responsible for obtaining any required permits.

Tom Ewers said that Maricopa County has some subdivisions with private streets, so street lights are directly serviced by the utility company, but he doesn't think it's still done.

Tom Paradise asked for the motion to be read again. Tom Ewers restated the motion that Item 7 be included as Historic. Bob Lee said he would be more comfortable if he knew that the utility companies were not going to energize anything without an inspection downstream of the service disconnect. Tom Ewers said that might be grounds for future discussion, but with regard to the specific Item 7, the committee could vote to move it to Historic and then discuss other things in the future. Tom Paradise said that this particular item would not necessarily prevent things from getting energized without inspection. He said that the original item required a permit to be obtained, but that current codes already require that, so this item is no longer needed as written.

Sharon Bonesteel referred to the last sentence of the electrical service specification, which says "if no jurisdictional authority exists, SRP must receive a certificate in lieu of electrical clearance, including the notarized signature and license number of the qualified electrical contractor stating that the facility meets the National Electric Code (NEC) requirements prior to receiving SRP's electrical service." She said that this is a strong statement in SRP's standard policy that requires a permit or a notarized statement from the contractor. She said that this could provide backup that if a permit was required and not obtained, at least SRP has the statement from the responsible contractor. Michael Williams said that the issue was that these installations do not meet the NEC, so they cannot be certified as meeting the code. He said that they don't have a main point of disconnect or six main disconnects. He said that is why the standard was created originally – in lieu of meeting the NEC the standard could be used. Tom Ewers suggested that a future discussion should be about that specific standard and if it should be adopted as a MAG standard. Michael Williams asked how many of these types of installations SRP is installing. Sharon Bonesteel said that she could find out, but does not know.

Michael Williams called for a vote on the motion to include Item 7 as Historic. The motion passed unanimously.

Michael Williams said that the next discussion item will be Item 10, and that Randal Westacott had done some research on this item. Randal Westacott said that he had reviewed the current Pima County earthen wall and straw bale construction codes and found a number of housekeeping issues to update. He said that the earthen wall regulations would be an addition to the IRC. He said there are some references to IBC section 21.14, which is a new section that Pima County added to the IBC for commercial earthen structures. He said he recommends adopting section 21.14 in its entirety. He said for straw bale construction there were a few minor references that needed to be corrected.

Bob Lee made a motion to update Item 10 to a final version and bring it back to the committee for a final vote. Tom Ewers seconded the motion. The motion passed unanimously.

Michael Williams introduced Item 19 and Item 20, and said that Sharon Bonesteel researched both items. He said that the two items were regarding residential and commercial solar photovoltaic installation. He said that the representatives from the OEP wanted to take the items back to their group for further research and provide comment at a later meeting. Sharon Bonesteel said that she put her solar contacts at SRP in touch with the OEP, so that they could work together to provide a comprehensive document that addresses the current issues. Bob Lee made a motion to table Item 19 and Item 20 to allow the OEP to provide their comments. Randal Westacott seconded the motion and the motion passed unanimously.

Bob Lee asked about Item 16, which he had updated and sent to Scott Wilken prior to the meeting. Michael Williams said he had not seen an update. Bob Lee suggested that it could have been sent after the agenda was finalized. He said that Item 16 was regarding when Southwest Gas needs to relocate a gas meter, and the original document did not have a specific distance that a meter could be moved without a permit. He said that the standard used to be 10 feet. Ken Kirschmann said that his understanding is that the distance was 20 feet, which is the length of one single stick of straight pipe that can be added. Bob Lee said that he would update the document to reflect 20 feet and allow no elbows or bends in the pipe.

8. Updated MAG Building Codes Committee Membership

Jami Garrison said that Rick DeStephano has retired from Wickenburg. She said that staff is working to get his official replacement appointed to the committee.

9. Update Survey of Code Adoption

There were no updates.

10. Topics for Future Agendas

Tom Paradise asked if other jurisdictions have seen interest in the Ecotality electric vehicle charging stations. Bob Lee said that Paradise Valley has issued several permits and they may install a charging station at Town Hall. Mike Baxley said that Cave Creek has issued several, and has three stations at Town Hall. Dustin Schroff said that Scottsdale has issued dozens of residential and commercial permits. Tom Paradise said that Glendale has had some residential permits, but no commercial permits. Michael Williams said that Tempe has had some commercial permits. Randal Westacott said that the car dealerships in Avondale have some. Dennis Chase said that Peoria has had some commercial stations and some at city facilities. Tom Paradise said that he wasn't asking for this to be discussed at a future meeting.

Michael Williams said that the next scheduled meeting conflicts with the AZBO fall meetings and will be cancelled, and the next date conflicts with Thanksgiving. Bob Lee made a motion to hold the next meeting on November 14, 2012. Phil Marcotte seconded and the motion passed unanimously.

11. Adjournment

Randal Westacott made a motion to adjourn. Ed Kulik seconded the motion and the motion passed unanimously. The meeting was adjourned at 3:29 pm.

"IECC Testing Protocol Recommendations"

Maricopa Association of Governments (MAG)

Presented by

Daran Wastchak
D.R. Wastchak, LLC

November 14, 2012

D.R. Wastchak, LLC

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Presentation Outline

- Background and History on RESNET Sampling
- High-lights of Sampling Standard (Chapter 6)
- RESNET Sampling Provider Requirements
- Testing Protocols for IECC 2012
- Recommendations

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Background and History on RESNET Sampling

- Where sampling started/came from
  - The great debate
- EPA Proposed Protocol
  - Published and in effect January 1, 2004
  - Requested that RESNET create and adopt an accreditation standard for Sampling Providers
- RESNET Sampling Task Force
  - March 1st 2004 – "Sampling Standard Drafting Committee" first meeting at RESNET Conference
  - April 2004 – December 2006 – Monthly/weekly teleconferences to create new Standard (Chapter 6)

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Background and History on RESNET Sampling

- RESNET Sampling Task Force (cont'd)
  - Vetting of New Standard
    - Full Taskforce (40+ members)
    - EPA (initial + 2 pre-public comment periods)
    - Two (2) public comment periods
  - Effective date: January 1, 2008
- Recognizing Entities
  - EPA – ENERGY STAR for Homes program
  - DOE – Builders Challenge program
  - IRS – Federal New Homes Tax Credits
- RESNET ANSI approval for sampling

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High-lights of RESNET Sampling Standard

- 603 – Technical Requirements
  - 603.5 - Creating a "Sample Set" (i.e. "batch")
    - Homes to be sampled can be selected within the same subdivision or metropolitan area and climate zone
    - All "sampling controls" (i.e. tests and inspections) for a sample set at a particular stage of construction, must be completed within 30 days
    - Sample sets do not have to consist of the same 7 homes through out all the stages of construction
    - Participating subdivisions must be subject to "sampling controls" at least once every 90 days and have a minimum of 1 home start every 90 days

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High-lights of RESNET Sampling Standard

- 603 – Technical Requirements (cont'd)
  - 603.7 – Sampling Controls
    - Sample controls must be completed at a minimum ratio of one (1) test or inspection per seven (7) homes
    - A certified Rater must oversee the sampling process
    - Sampling controls can be completed on a single home or several homes within a given sample set
    - Builders qualify for sampling by first completing seven (7) consecutive homes without failure

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High-lights of RESNET Sampling Standard

- 603 – Technical Requirements (cont'd)
  - 603.7 – Sampling Controls (cont'd)
    - New subdivisions require three (3) consecutive homes to pass without failure before starting sampling
    - "When a failure occurs, the failed item(s) shall be tested or inspected in two (2) additional homes"
    - "When an additional failure occurs, in one or more of the two (2) additional homes, the failed item(s) shall be tested or inspected in the remaining four (4) homes" in the sample set
    - "Until the failure is corrected in all identified (failed) homes in the sample set, none of the homes shall be deemed to meet the threshold or labeling criteria"

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High-lights of RESNET Sampling Standard

- 603 – Technical Requirements (cont'd)
  - 603.8 – Multiple "Additional Failures"
    - If three (3) "additional failures" occur within a ninety (90) day period <u>on the same item</u>, the <u>failed item</u> must pass in seven (7) consecutive homes before it can be sampled again
    - If three (3) "additional failures" occur within a ninety (90) day period <u>on several different items</u>, the builder must re-qualify to sample by completing seven (7) consecutive homes without failure,

      or

      Builder can do a "root cause analysis"

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RESNET Sampling Provider Requirements

- Must first be accredited as a RESNET Rating Provider
- Separate application and approval process to become a RESNET Accredited Sampling Provider
  - Knowledge of sampling process
  - Minimum general and professional liability insurance requirements
  - Specific requirements in Operations Policies and Procedures for sampling
- Raters and Rating Field Inspectors are not eligible to sample homes unless working under an Accredited Sampling Provider
- RESNET Quality Assurance provisions for Sampling Providers/Raters updated for 2013

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Testing Protocols for IECC 2012

- Section 402.4 – Air Leakage (mandatory)
  - Building Thermal Envelope
    - Table R402.4.1.1 – Thermal and Air Barrier Checklist

      Where required by the code official, an approved third-party shall inspect all components and verify compliance.

    - 402.4.1.2 – Blower Door Testing – Minimum 5 ACH50

      Where required by the code official, testing shall be conducted by an approved third-party.

- Section 403.2 – Duct leakage (mandatory)
  - 4% total leakage (no leakage to outside requirement specified)
  - No testing required if air handler and ducts located entirely within the thermal envelope

    No specification regarding third-party testing

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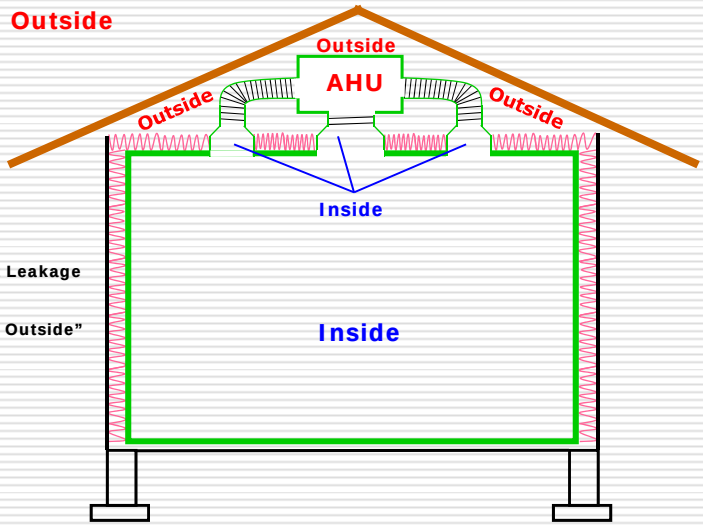
Testing Protocols for IECC 2012



"Total" Duct Leakage
vs
Leakage "To Outside"

IECC Testing Protocol Recommendations

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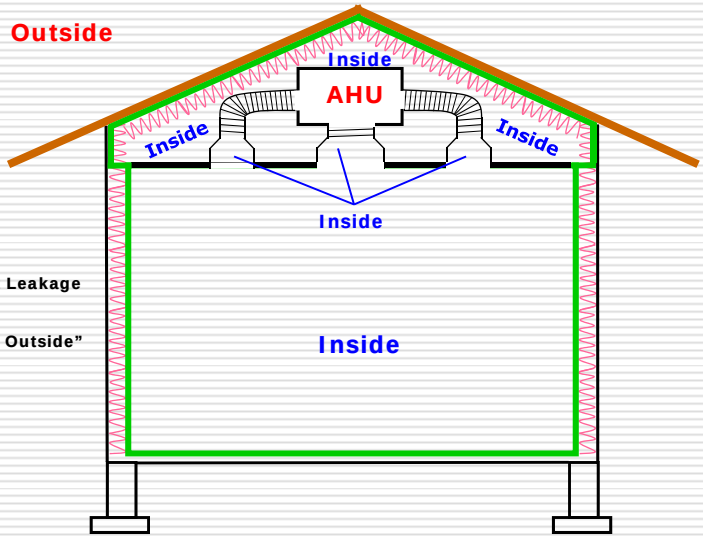
Testing Protocols for IECC 2012



"Total" Duct Leakage
vs
Leakage "To Outside"

IECC Testing Protocol Recommendations

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Recommendations

- Require third-party testing and inspections
  - Building Envelope – thermal and air barrier checklist
  - Blower-door Testing
  - Duct Leakage Testing
- All testing and inspections must follow RESNET Standards
  - Chapter 6 – Sampling
  - Chapter 8 – Performance testing
- Third-party testing and inspections must be completed by RESNET certified Raters or Rating Field Inspectors
- Testing and inspections subject to RESNET Quality Assurance Field Review procedures

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Introduction

Special Inspection, as required by the 1994 Uniform Building Code (UBC) Section 1701, is best defined as the monitoring of the materials and workmanship which are critical to the integrity of the building structure or building service equipment and require special attention. This requires inspection by persons with specially-developed skills to check the material and workmanship against the approved plans, specifications and contract documents.

This document will be revised from time to time as dictated by experience gained in its implementation and as necessary due to changing practice and technology.

This manual is a descriptive procedure for special inspection administration. It defines the duties and responsibilities of the engineer or architect of record, special inspector, contractor, building official, and project owner.

This manual is divided into six sections as follows:

1. Special Inspection – An Overview:
   Gives an overview of jobsite quality control through special inspection.
2. General Program Guidelines:
   Describes overall purposes for special inspection, and respective duties and responsibilities of project owners, engineer or architect of record, special inspectors, building officials and contractors.
3. Procedures for Special Inspection – Job Task Analysis:
   List of job tasks required of special inspectors.
4. Procedures for Materials Sampling and Testing:
   Lists basic tests in use locally that supplement or alter the national standards and are considered local standard practice.
5. Special Inspector Qualifications:
   Lists competency and experience standards, and references performance standards for special inspectors. These suggested qualifications are designed to assist the building official in determining the special inspector's competence to perform specific tasks as listed in the 1994 UBC Section 1701.5.
6. Special Inspection Forms.

Section 1: Special Inspection – An Overview

Under this program, the owner is required to provide specially qualified inspectors for inspection during construction in addition to called inspections provided by the local jurisdiction and in addition to periodic site visits provided by the architect/engineer.

The use of special inspectors is not discretionary. The 1994 UBC Section 1701 clearly states the conditions under which they must be utilized, but there is a provision for the building official to waive special inspection for work of a minor nature.

The code intent is to provide continuous inspection at all times work requiring special inspection occurs except "some inspections may be made on a periodic basis and satisfy the requirements of continuous

inspection, provided this periodic scheduled inspection is performed as outlined in the project plans and specifications and is approved by the building official." Additionally, some exceptions are specifically listed in the inspection codes as indicated in the 1994 UBC (see Section 1701.5).

Continuity of inspection is very important and is best provided by using one individual as Special Inspector for each discipline that requires special inspection. This paragraph is intended to discourage the use of multiple inspectors performing a given task.

An additional provision allows the building official to use discretion for the requirement of a special inspector in other cases where it is deemed appropriate.

The use of special inspectors is reserved for complex installations requiring certain specially developed inspection skills for the following types of work:

Inspection Code (as listed in the 1994 UBC 1701.5)

1. Concrete – during the taking of test specimens and placing of reinforced concrete and pneumatically placed concrete.

2. Bolts installed in concrete – during installation of bolts and placing of concrete around such bolts

3. Special moment resisting concrete frames

4.1 Pre-stressing steel tendons – during stressing and grouting of pre-stressed concrete and placing of reinforcing steel, placing of tendons, and pre-stressing steel.

4.2 Reinforcing steel – prior to placement of concrete.

5.0 Structural welding – of ductile moment-resisting steel frames for structural welding and for lateral diaphragm metal decks.

5.1 General welding – any member designed to resist loads and forces.

5.2 Special moment resisting frames.

5.3 Welding of reinforcement steel.

6. High-strength bolting – during all bolt installations and tightening operations.

7.0 Structural masonry – during preparation of masonry wall prisms, sampling, and placing of masonry units, placement of reinforcement, inspection of grout spaces, and during all grouting operations.

7.1 Masonry other than fully grouted open-end hollow unit block.

7.2 Masonry fully grouted open-end hollow unit block.

8. Reinforced gypsum concrete – when cast-in-place Class B gypsum concrete is being mixed and placed.

9. Insulating concrete fill – during the application of insulating concrete fill when used as part of a structural system.

10. Spray-applied fireproofing.

11. Piling, drilled piers and caissons – during driving and testing of piles and construction of cast-in-place drilled piles or caissons.

12. Shotcrete – during the taking of test specimens and placing of shotcrete.

13. Special grading, excavation, and filling.

14. Smoke control system.

15. Adhered veneer.

16. Anchored veneer.

17. Accessibility for the disabled.

18. Complex electrical installation.

19. Special cases – work, when in the opinion of the Building Official involves special conditions or unusual hazards. (Examples: poke through penetrations, window and spandrel walls, architectural precast connections, structural light gauge metal structures.)

Section 2: General Guidelines

A. Duties and Responsibilities of the Engineer or Architect of Record (E/AR)
The Engineer or Architect of Record (E/AR) shall be the design professional who sealed the calculations and plans for the types of work requiring special inspection as defined in Section 1 of this document. Structural special inspectors are required for work types 1, 2, 3, 4A, 4B, 5, 6, 7, 8, 9, 12, 15, and 16. Architectural special inspectors are required for Inspection Codes 10 and 17. Geotechnical special inspectors are required for Inspection Codes 11 and 13. Electrical special inspectors are required for work type 18. Mechanical and fire special inspections are required for Inspection Code 14. Duties and responsibilities or the E/AR shall include the following:

1. Identify the need for special inspection services.
   The project plans which are submitted to the building official shall clearly indicate the design parameters, material selection and where special inspection is necessary in accordance with the Code.
2. Determine the qualification(s) of all special inspectors.
3. Coordination of inspection activities.
   a. The E/AR shall be responsible for designation and coordination of the activities of the Special Inspector for the items for which he is responsible.
   b. The E/AR shall certify his special inspector(s) as meeting Stage 1 minimum qualification requirements. (See Staging Criteria).
4. Chair pre-conditioning meeting.
   Coordinate attendees with General Contractor. Establish agenda, review duties and responsibilities of attendees, establish reporting requirements, and review special cases.
5. Site visits required.
   The E/AR(s) shall visit the site at least monthly during the construction of the inspection code items for which he is responsible. This is in addition to the special inspections performed by the field inspector(s).

6. Specification of testing and test procedures.
   The E/AR shall be responsible for defining and specifying tests and testing procedures as may be required for the E/AR's work.
7. Submission of required reports.
   The E/AR shall submit, under his seal, all the required reports to the Building Department.
8. Document all revisions.
   The E/AR shall document all plan revisions to the Building Department.
9. Designated Engineer of Record (DE/AR).
   With concurrence of the Building Official and the E/AR, or Project Owner, a Designated Engineer of Record may assume the responsibilities and duties of items 2, 3, 4, 6, and 9 for E/AR.
10. Submit Special Inspection Certificate.
    Upon completion of all requirements, the E/AR shall submit the sign Special Inspection Certificate and other documentation as may be necessary to the Building Department for all items for which this professional was responsible. The Special Inspection Certificate shall be sign by the E/AR.

B. Duties and Responsibilities of the Special Inspector
The special inspector shall be the E/AR or his designated representative(s) working under his direct supervision who observes those critical features which they are qualified to inspect. Duties of special inspectors include the following:

1. Signify presence at jobsite.
   Special inspectors shall notify contractor personnel of their presence and responsibilities at the jobsite.
2. Inspect all work for which they are responsible.
   Special inspectors shall inspect all work for conformance with the official building department approved drawings and specifications, and applicable provisions of the Construction Code.
3. Separately identify all nonconforming work.
   Special inspectors shall bring all nonconforming items to the immediate attention of the contractor. If any such item is not resolved in a timely manner, or is about to be incorporated in the work, the building official and the E/AR shall be notified immediately by telephone or in person, and the special inspector shall issue a discrepancy notice.
4. Issue discrepancy notice.
   The special inspector shall post the discrepancy notice at the jobsite. This notice shall contain, as a minimum, the following information about each nonconforming item:
   a. Description and exact location.
   b. Reference to applicable detail of approved plans/specifications.
   c. Name and title of each individual notified and method of notification.
   d. Resolution or corrective action.
5. Provide daily reports
   The special inspector shall complete written inspection reports for each inspection visit. These reports shall be organized on a daily format and a copy shall remain at the jobsite with the contractor. Special inspectors shall:
   a. Describe inspections and tests made with applicable locations.
   b. List all nonconforming items, parties notified, time and method of notification.
   c. Indicate how nonconforming items were resolved.
   d. List unresolved items.

e. Provide daily reports to the contractor for retention on jobsite.

6. Provide semi-monthly report.
   Building Department and Owner shall receive copies of the following documents mailed each month on the 15th and last day of the month:
   a. Sealed form commenting on testing results and listing the dates of all special inspections made.
   b. Attached all special documents and testing results received to date.
   c. All current design changes and corrections documented and sealed.
7. Provide final reports.
   a. When construction reaches the point that inspections are only required to verify discrepancy corrections, the semi-monthly report shall be noted "Final Report." This Final Report shall list all unresolved discrepancies.
   b. E/AR or D/EAR will only sign Special Inspection Certificate after all outstanding issues are resolved.

C. Duties and Responsibilities of the General Contractor
The general contractor's (as designated on the building permit) duties include the following:

1. Responsible for setting up the pre-construction conference.
   a. Prior to construction establish date and location for meeting. Coordinate attendee list with the E/AR. Attendees shall include: all E/ARs for required inspection codes, General Contractor, building official, Special Inspector, and others as necessary.
   b. In cases where the earthwork begins before the building permit is issued, the General Contractor shall call two meetings. The first meeting shall include the Geotechnical E/AR, General Contractor, Special Inspector, Building Structural Engineer, Earthwork Subcontractor and other as necessary. The second meeting is after the building permit is issued and is the same as paragraph a.
   c. In case of multiple building permits, more than two meetings may be required.
2. Notify the special inspector.
   The contractor is responsible for notifying the special inspector of the work progress and when construction items are ready for inspection. Adequate notice shall be provided so that the special inspector has time to schedule all inspections.
3. Provide access to the project.
   The contractor is responsible for providing the special inspector access to the jobsite at the work.
4. Retain records on jobsite.
   The contractor is responsible for retaining at the jobsite approved city drawings, all special inspection records, and reports by the special inspector. Upon request he shall provide these documents for review by the building official.
5. Notification.
   The contractor shall, in addition to calling for special inspections, notify the building department of all other required inspections in accordance with UBC Section 305 which will result in an inspection by the building official.
6. Performance of the Work.
   The contractor is charged with the construction of the project in compliance with the official plans approved by the Building Official. The contractor is responsible for installation of all items in accordance with applicable Codes and Standards. If a conflict arises between the Code and the official plans, this conflict will immediately be brought to the attention of the E/AR.

D. Duties and Responsibilities of the Building Official

The specific provisions of providing for special inspection services are mandatory under Section 108.1 which states, "All construction or work for which a permit is required shall be subject to inspection by the building official." In addition, certain types of construction shall have continuous or periodic inspection as specified in Section 1701.5 in addition to local required inspections.

1. Review and examine plans, specifications and other contract documents for compliance with special inspection requirements
   The building official is charged with the legal authority to review the plans and specifications for compliance with the requirements of the UBC (Code reference: UBC Sections 302b, 303a, AND 306A).
2. Communicate special inspection requirements to the E/AR, contractor and project owner.
   Once special inspection requirements are identified in the plan approval process, the building official shall require the owner and E/AR to sign the Special Inspection Certificate.
3. Monitor the special inspection activities.
   The building official shall monitor the jobsite to see that special inspection is provided as required and that an adequate number of special inspection staff is present depending upon extent and complexity of the project. (Code reference: UBC Section 108.1 and 1701.5)
4. Review inspection reports.
   The building official receives and makes the semi-monthly inspection reports part of the inspection records (Code reference: UBC Section 1701.3).
5. Inspection of jobsite.
   The building official shall perform all inspections required under Section 108. Failure to have the required Special Inspector's inspection reports available to the building official shall be cause for the building official to stop work on those items requiring special inspection until such time that all required reports are provided.
6. Issue Certificate of Occupancy/Final Acceptance.
   The building official shall perform a final inspection and issue a Certificate of Occupancy or final acceptance, where applicable. This inspection and issuance shall not be done until after the final report has been received and accepted by the building official and the Special Inspection Certificate has been signed and sealed by the E/AR.

E. Duties and Responsibilities of the Project Owner.

The project owner is responsible for employing special inspection services (Code Reference: UBC Section 1701.1).

1. Participate in choosing the special inspector when designated engineer or architect is assigned.
2. Notify the design engineer in the event a D/EAR is chosen to provide the special inspection duties as described in paragraph A.8, Duties and Responsibilities of the E/AR.
3. Amend the Special Inspection Certificate and forward to the building official.

F. Pre-Job Conference.

For Determination of Responsibility

1. Refer to Duties of the E/AR, page 2-1.
2. Refer to Duties of the Contractor, page 2-4.

Section 3: Special Inspector Job Task Listing

The job tasks listed in this section are intended to represent the basic inspection tasks and do not necessarily describe every detail of the job descriptions. For more specific analysis consult your local codes or regulations applicable to the task in question. Inspection codes shown refer to inspection codes listed on pages 1-1, 1-2.

A. Reinforced and Prestressed Concrete Job Tasks
UBC Codes 1, 2, 3, 4A and B.

1. Concrete preparation
   a. Mix Design
      Check with the E/AR in order to verify concrete product codes.
   b. Batch Plant
      Verify that batch plant has current annual inspection by an accepted inspection agency for conformance to National Ready Mixed Concrete Association recommendations.
   c. Trip Ticket
      Determine that mixer truck delivery ticket specifies required mix and batch time.
2. Concrete Reinforcement
   a. Rebar Type and Grade
      Inspect type, grade, and visual conformity of rebar with specifications.
   b. Rebar Condition
      Inspect that rebar is free of oil, dirt, excessive rust and damage in shipment to jobsite.
   c. Rebar Tying and Bracing
      Inspect that rebar is adequately tied, chaired, and supported to prevent displacement during concrete placement.
   d. Rebar Clearance
      Inspect minimum and maximum clear distances between bars and minimum structural distance to outside of concrete and to surface of concrete.
   e. Rebar Placement
      Inspect the size, location, and quantity of rebar. Verify bar laps for proper length and stagger, and bar bends for minimum diameter, slope, and length.
   f. Rebar Welding
      Inspect that welding of rebar is with proper rods and procedures.
3. Concrete Formwork and Embedded Items
   a. Concrete Construction Joints.
      Inspect proper preparation of construction joint surface prior to placing.
   b. Formwork Construction
      Inspect that the formwork is tight to prevent leakage. Generally inspect inside dimensions of formwork.
   c. Embedded Items
      Inspect that embedded items are properly spaced and sized.
   d. Prestressing Steel Anchorage
      Inspect location, size and placement of prestressing steel anchorage as detailed in plans and specifications.
4. Concrete Preparation, Placement, Curing and Protection

a. Prepour Base Moisture
   Inspect that the concrete base is properly wetted and standing water is removed before concrete is placed.
b. Concrete Placement
   Inspect that concrete conveyance and depositing avoids segregation due to rehandling or flowing and proper joint construction.
c. Concrete Vibrated
   Inspect that concrete is vibrated
d. Concrete Curing
   Inspect that appropriate curing is performed.
e. Protection
   Determine that appropriate hot- and cold-weather measures are taken for protection of the concrete and grout.

5. Samples and Tests
   a. Test Type
      Determine the type and number of concrete, grout, and reinforcing steel tests required.
   b. Test samples
      Observe sampling of fresh concrete and grout, slump tests, and molding of test specimens.
   c. Hardened Concrete Test Samples
      Observe removal of test samples and perform other test procedures on hardened concrete.
   d. Specimen Handling/Protection
      Observe proper handling, field curing, and place specimens in protected area after preparation and arrangement for transportation of specimens to test facility.
6. Prestressing Steel.
   a. Prestressing Steel Type and Grade.
      Determine that prestressing steel type, size, and grade, and tendon fabrication in conformance with specifications.
   b. Prestressing Steel Condition.
      Determine that prestressing steel is free of oil, dirt, scale, pitting, excessive rust; is free from damage; and is properly wrapped as required.
   c. Prestressing Steel Ties and Supports.
      Determine that prestressing steel tendons and post-tensioning ducts are adequately tied, chaired and supported to prevent displacement during concrete placement, and are adequate for intended stresses.
   d. Prestressing Steel Clearance.
      Inspect for minimum and maximum clear distances between prestressing steel and minimum structural distance to outside of concrete and to surface of concrete.
   e. Prestressing Steel Placement.
      Inspect placement of prestressing steel, tendons, or ducts as detailed in plans and specifications.
   f. Post-tensioning Ducts.
      Verify that post-tensioning ducts are correctly sized, are mortar-tight and nonreactive with concrete, tendons and filler materials.

g. Prestressing Steel Anchorage.
Inspect location, size, and placement of prestressing steel anchorage as detailed in plans and specifications.

7. Prestressing and Grouting
   a. Calibration of Stressing Ram.
   Review the calibration documentation for the steel stressing ram.
   b. Steel Stressing.
   Inspect that steel is prestressed at the proper time using proper techniques, including stressing locations, sequence, and with proper records of stressing and steel elongation.
   c. Grout Mix Design and Placement.
   Determine that mixer truck delivery ticket specifies required grout mix and batch time. Inspect placement of grout into post-tensioning ducts for bonded prestressing tendons.
   d. Tendon Finishing.
   Inspect correct trimming of excess tendon length after stressing. Inspect filling of stressing pockets.

B. Structural Masonry Job Tasks
UBC Inspection Code 7

1. Masonry Material – Storage and Certifications
   a. Masonry Material Certifications
   Inspect masonry material certifications or other documentation of masonry units, cement, lime, and additives for compliance with plans and specifications. Determine materials are in acceptable condition.
   b. Storage of Materials
   Reject cement and lime that has been exposed to excessive moisture. Reject aggregates that are contaminated.
   c. Masonry Reinforcing Material Certifications
   Inspect masonry reinforcing materials certifications, or other documentation of masonry reinforcement, for compliance with codes, plans, and specifications. Check that reinforcing materials are in acceptable condition.
2. Mortar Mix
   a. Mortar Aggregate
   Determine sand is clean.
   b. Mortar Cement
   Inspect mortar cement for dryness, type, and conformance to specified requirements.
   c. Mortar Water
   Inspect job-mix mortar proportioning of cement, aggregates, and admixtures for quantity and mixing time.
   d. Ready-mix Mortar
   Inspect ready-mixed mortar for type and conformance to specified requirements.
3. Masonry Preparation and Placement.
   a. Dowels/Anchors
   Inspect alignment of dowels and anchors extending out of the footings for masonry walls.

b. Base Conditions
   Inspect that masonry footing surfaces are clean.
c. Condition of Units
   Inspect that masonry units are clean and sound.
d. Placement
   Inspect the laying of masonry units, checking temperature, laying of masonry units, for stack or running bond or variations as per plans. Check that there is no deep furrowing of bed joints. Inspect mortar joints for proper thickness and tooling.
e. Joints
   Inspect construction, expansion, and contraction joints in accordance with details on approved drawings.

4. Masonry Reinforcement
   a. Vertical Reinforcement
      Inspect the placement and alignment of vertical bars and dowels for size, grade, and spacing. Inspect length of lap splices, clearances between bars, clearances to masonry units and positioning of steel.
   b. Horizontal Reinforcement
      Inspect horizontal joint reinforcement (HJR) steel and stagger, bond beam reinforcement bars for size, length of lap splices, dowels, clearances between bars, clearance to masonry units and positioning of steel.
   c. Ties
      Inspect ties in masonry for straightness, embedment, spacing, and size.
   d. Anchor Connections
      Inspect the installation of masonry anchor bolts, joist anchors, insert and straps.
5. Grout Mix
   a. Ready-mix Grout
      Inspect ready-mixed grout for conformance with mix design and workability.
   b. Grout Use
      Determine elapsed time since mixing of grout.
6. Masonry Grouting
   a. Grout Spaces
      Inspect that grout spaces are correctly sized and clean, cleanouts, when required, are closed after inspection and grout barriers are in place before grouting.
   b. Grouting
      Inspect proper grouting techniques including mechanical vibration to approved height of grout space.
   c. Dry Packing
      Inspect proper applications of dry packing.
7. Sample and Tests
   a. Test Prisms
      Inspect the construction of test prisms including those required prior to beginning construction. Check that test prisms contain the same masonry units, moisture content, mortar and workmanship as used in the building.
   b. Tests and Specimens
      Determine the type and number of masonry, mortar, grout and reinforcing steel tests required.

c. Specimen Handling/Protection
Observe protection of test specimens and arrangements for pickup or delivery of specimens to appropriate persons.

d. Masonry Samples
Observe removal of test specimens from completed masonry.

C. Structural Steel and Welding Job tasks
UBC Inspection Code 5, 6

1. Steel and Welding Materials

a. Structural Steel Materials
Review mill test reports (MTR), steel identification markings, or other documentation of structural steel for compliance with plans and specifications. Visually inspect bolts, nuts, and washers for conformance.

b. Welding Consumables
Review welding consumables for identification markings, or other documentation of welding materials for compliance with plans and specifications. Inspect rod containers for damage.

2. Welding

a. Qualification of Welders
Review qualification of welders, welding operators and tackers for conformance with the appropriate AWS code and the plans and specifications.

b. Welding Consumable Storage
Review Low Hydrogen Electrode storage conditions to determine material has been purchased in a hermetically sealed container and that storage ovens meet the minimum temperature and utilization requirements.
Review procedures for maintaining maximum atmospheric exposure times for Low Hydrogen consumable utilization.

c. Welding and Joint Preparation
Inspect that the material to be welded is smooth, uniform, free from fins, tears, and cracks, and that cut edges are acceptable and free from foreign material.

d. Welding Procedures
Visually review that welding is done in conformance with AWS requirements for process, materials, workmanship, number of passes, preheat and interpass temperatures, cleaning between passes, weld lengths, welding technique and welding sequence. Review specifications for unusual requirements.

e. Weld Repairs and Heat Straightening
Inspect that weld repairs and heat straightening of structural members is done in compliance with approved procedures and AWS standards.

f. Welding of Reinforcing Steel
Review the Welding Procedure Specification and the Welding Procedure Qualification for compliance with AWS D1.4 and the contract documents. Note: There are no pre-qualified welding procedures for welding reinforcing bars; a Procedure Qualification Record (PQR) is required.

3. Steel Erection

a. Base Plates and Anchor Bolts
Inspect anchor bolt size and pattern size of base plates and anchor bolt hole pattern and size. Inspect the setting of the base plate for proper nut tightening and thread projection.

b. Members
Inspect to determine size and dimensions for weight, determine the weight, general location, shape, and proper connection of structural members.

c. Faying Surfaces
Inspect faying surfaces on connections utilizing high-strength bolts for compliance to applicable standards.

d. Bolts
1. Inspect correct type, location, and size of bolts, size of bolt holes and alignment in connections.
2. Inspect tightness of high strength bolts to applicable standards.

4. Samples and Nondestructive Tests
a. Bolt and Nut Sampling
Observe and sample bolts, nuts, and washers for testing, if required.

b. Nondestructive Testing
Observe nondestructive testing in accordance with approved procedures.

D. Anchored Veneer Job Tasks
UBC Inspection Code 16

1. Veneer Material Certifications and Storage
a. Veneer Material Certifications
Inspect veneer material certifications including material strength test results, or other documentation of veneer units, cement, lime, additives, and stone backing. Determine materials are in acceptable condition.

b. Construction Documents
Inspect installation design documents to determine that they have been properly sealed and approved by the Engineer of Record and the City.

c. Veneer Connection Material Certifications
Review veneer connection material certifications, or other documentation of connectors and corrosive protection. Determine that connection materials and connectors are in acceptable condition.

d. Storage of Materials
Reject cement and lime that has been exposed to excessive moisture. Reject aggregates that are contaminated.

2. Mortar Mix
Requirements same as structural masonry, Section 2.b.

3. Veneer Preparation and Placement.
a. Dowels/Anchors/Ties
Inspect alignment of dowels, anchors, and ties extending out of the footing or walls.

b. Base Conditions
Determine that bearing surfaces are clean and level.

c. Condition of Units
Determine that veneer units are required size and thickness, clean, sound, and free of cracks or chips that may adversely affect their attachment.

d. Placement
Inspection the setting of veneer units, for stack or running bond or variations as per plans. Determine that there is no deep furrowing of bed joints. Inspect mortar joints for proper thickness and tooling. Do not allow the installation of saturated or frozen veneer.

e. Joints
Inspect construction, expansion, and contraction joints for locations and as detailed.

4. Veneer Connectors
   a. Inspect the placement and alignment of connectors for size, type material and spacing. Inspect for required bearing lengths and widths, size and depth of embedment, straightness, edge and end distances of dowels and connectors in both the veneer and backup structural supports.
   b. Inspect mortar spot backups at connectors for size, location, and soundness.
   c. Inspect epoxy anchorages for type epoxy to be used and manufacturer's requirements for installation. Inspect size, depth of embedment, straightness and cleanness of surfaces to receive epoxy.
5. Veneer Ventilation
   Inspect the placement, size, type of material and location of weep holes. Inspect that weep holes are not clogged or obstructed, preventing their use.
6. Veneer Dampproofing
   a. Inspect veneer backing for compliance with manufacturer's requirements.
   b. Inspect flashing, gauge, shape, material, and installation.
7. Samples and Tests
   a. Field Mockup
      Inspect the materials and construction of field mockup, when required, prior to commencing with installation of veneer on structure.
   b. Test Prisms
      Witness the construction, when required, of test specimens, including those required prior to beginning construction.

E. Adhered Veneer Job Tasks
UBC Inspection Code 15
1. Pre-Application Verification
   Inspect the backing membrane for preparation and weatherproofing. Verify that height of adhered veneer does not exceed 30 feet, or size and weight limitations.
2. Application
   a. Inspect the mortar and epoxy bed for code and manufacturer conformance and check for absorption.
   b. Observe the placement of units closely for workmanship and provide necessary testing to determine adequacy of unit strength.

F. Accessibility for the Disabled Job Tasks
UBC Inspection Code 17
1. At this time, there are no specific requirements for job tasks. Generally the E/AR is responsible to provide inspection of the entire project for conformance with applicable local laws for compliance with handicap provisions.
2. Specialty areas requiring systems not generally inspected by the building official (e.g. hearing impairment, Braille, audio/visual).

G. Electrical Installation Job Tasks
UBC Inspection Code 18
1. Grount-Fault Protection Performance Test
   a. Visual Inspection
      1. Inspect for physical damage and compliance with engineered drawings and specifications.

2. Verify proper nameplate markings and ratings.
3. Verify integrity of grounded conductor.
4. Verify pickup and time delay settings are in accordance with settings provided by the engineer.

b. Mechanical Inspection
1. Inspect for proper mechanical operation.

c. Electrical Tests
1. Tests shall comply with engineered plans and specifications.
2. Tests shall be performed in accordance with manufacturer's recommendations or nationally recognized standards and practices.
3. Test grounded conductor insulation resistance to ground.
4. Test relay pickup current by current injection at the sensor and operate the circuit-interrupting device.
5. Test relay timing.
6. Test primary control voltage at not more than 57 percent of its rated voltage.

2. Switchboards, Panelboards, Motor Control Centers and other Equipment Rated 1000 Amperes or more, or over 600 Volts.

a. Visual Inspection
1. Inspect for physical damage and compliance with engineered drawings and specifications.
2. Verify proper nameplate markings and ratings.
3. Inspect proper anchorage, support, and alignment.
4. Verify barrier installation.
5. Verify connection and termination points for proper torque and alignment.

b. Mechanical Inspection
1. Inspect interlocks, switches, draw-out breakers, and auxiliary devices for proper mechanical operation.

c. Electrical Tests
1. Tests shall comply with engineered plans and specifications.
2. Tests shall be performed in accordance with manufacturer's recommendations or nationally recognized standards and practices.
3. Test grounded conductor insulation resistance and verify continuity of equipment grounding system.
4. Perform insulation resistance test on each bus and protective device. Test phase-to-phase and phase-to-ground.
5. Perform phase test on double ended systems.
6. Test control power transformer, control power circuits and potential circuits.
7. Test control and protective devices for proper operation.

3. Transformers Rated 100 KVA or More Single Phase and 300 KVA or More Three Phase

a. Visual Inspection
1. Inspect for physical damage and compliance with engineered drawings and specifications.
2. Verify proper nameplate markings and ratings.
3. Inspect for proper anchorage and support.
4. Inspect for proper equipment and core grounding.

5. Verify compliance with manufacturer's installation requirements.

b. Mechanical Inspection
   1. Inspect auxiliary devices for proper mechanical operation.

c. Electrical Tests
   1. Tests shall comply with engineered plans and specifications.
   2. Tests shall be performed in accordance with manufacturer's recommendations or nationally recognized standards and practices.
   3. Perform insulation resistance test on each winding. Test winding-to-winding and windings-to-ground.
   4. Perform a turns-ratio test for each winding at all tap settings.
   5. Test control power transformer, control power circuits and potential circuits.
   6. Test control and protective devices for proper operation.

4. Conductors that Supply Equipment Rated at 1000 Amperes or More, or Over 600 Volts
   a. Visual Inspection
      1. Inspect for physical damage and compliance with engineered drawings and specifications.
      2. Verify proper markings and ratings.
   b. Electrical Tests
      1. Tests shall comply with engineered plans and specifications.
      2. Tests shall be performed in accordance with manufacturer's recommendations or nationally recognized standards and practices.
      3. Perform insulation resistance test on each conductor. Test phase-to-phase and phase-to-ground.
      4. Perform dc high-potential test on each conductor. Test phase-to-phase and phase-to-ground.

5. Emergency and Standby Power Systems: Switchboards, Panelboards, Distribution Boards, Transfer Equipment, Power Source, Conductors, Fire Pumps, Exhaust and Ventilation Fans
   a. Visual Inspection
      1. Inspection for physical damage and compliance with engineered drawings and specifications.
      2. Verify proper markings, ratings, and signs.
      3. Inspect equipment for proper anchorage and support.
      4. Inspection for proper barriers, separation, protection, and location.
      5. Verify instruction manuals, special tools, testing devices, and manufacturer recommended spare parts are available.
      6. Verify maintenance and operation testing program is in place and maintained on the premises.
   b. Mechanical Inspection
      1. Inspect equipment for proper mechanical operation.
      2. Verify functional operation of system. Perform manual transfer operation.
   c. Electrical Tests
      1. Tests shall comply with engineered plans and specifications.
      2. Tests shall be performed in accordance with manufacturer's recommendations or nationally recognized standards and practices.
      3. Test control and protective devices for proper operation.

4. Perform phase rotation test.
5. Perform insulation resistance test on feeder conductors and equipment. Test phase-to-phase and phase-to-ground.
6. Perform automatic load transfer test. Test normal and emergency power, or normal and standby power, or both. Simulate loss of emergency and normal power, or standby and power, or both. Simulate all forms of single-phase condition.
7. Conduct operational test on system under load conditions.

H. Special Cases Job Tasks

UBC Inspection Code 19

1. The special case shall be identified by the building official before obtaining permits.
   a. The building official, with the E/AR's assistance, shall establish, prior to the special case construction, a job task analysis in writing for the specific area concerned.
2. The building official reserves the right to require special inspection when unusual or unanticipated conditions arise during the course of construction. The building official, with assistance from the E/AR, shall establish the job tasks required in these situations.
3. Sewer Installation
   This Special Inspection shall apply to the installation of sewer lines where it is impractical due to the depth of the street sewer or to the structural features or to the arrangement of any building or structure, to obtain the minimum slope required by the Uniform Plumbing Code Section 1106.
   a. Inspect sewer for proper material, support, alignment, and uniform slope.
   b. Verify that the sewer has been installed in accordance with the approved design and to the grades shown on the approved plans.
4. Unlisted Mechanical Equipment
   Reports which are submitted to the building official, as an alternative to a listing agency approval for those products or equipment which require approval, are not acceptable unless they provide at least the following:
   a. Date issued.
   b. Address at which the product or equipment is installed.
   c. General description of the product or equipment which is the subject of the report.
   d. Proposed objective to be achieved as a result of this examination.
   e. Data plate information which shall include at least the following:
      1. Manufacturer's name.
      2. Model and serial number.
      3. Type of fuel for fuel burning devices – input/output ratings.
      4. Electrical rating – volts, amps, phase (if applicable).
      5. Operating pressures (if applicable).
   f. Listing of specific test criteria:
      1. ASTM Standards
      2. ANSI Standards
      3. UL Standards
      4. AGA Standards
      5. Other standards
   g. Description of specific tests performed.

h. Evaluation of the product examined, including recommendations regarding correction of deficiencies if appropriate, or a statement that the device was in compliance with all applicable standards at the time of examination.
i. Submit drawing or photograph of the equipment which this report addresses.
j. Sign and seal all documents and other submittals.

I. Piling, Drilled, Piers, and Caissons Job Tasks

UBC Inspection Code 11

1. Driven Piles
   a. Materials and Equipment Verification
      To inspect pile material, splices, tip reinforcement, pile type, pile sizes, length, quality and straightness are as specified, and that leads, hammers, cushioning and other equipment are as specified.
   b. Pile Installation Verification
      Verify that horizontal and vertical locations of the piles are as specified, and that pile orientation and plumbness are as specified.
   c. Pile Driving
      Inspect the driving of the piles by recording the blow counts per foot of penetration, that the terminating blow count and/or pile tip elevation are as specified and that no damage, defects, or variation of specifications are observed during driving.
2. Auger-Cast-Piles
   a. Materials and Equipment Verification
      Inspect all materials, quality of material and equipment type and size are as specified. Have al concrete materials sampled and tested as required in section of this part.
   b. Pile Installation Verification
      Verify and inspect that vertical and horizontal pile locations are as specified, that plumbness, size, and tip elevation are as specified and that installation procedure, pump pressure and auger withdrawal during casting are as specified.
3. Drilled Piers and Caissons
   a. Installation Verification
      Inspect and verify that all drilling and cleaning operations are as specified, that shaft diameter, shaft length, shaft plumbness, underreemed diameter, underreemed height, underreemed shape are as specified, that bearing surface is cleaned as specified, and that the bearing material and penetration into the bearing material are as specified.
   b. Material Verification
      Inspect so the steel reinforcement and concrete placement are as specified in accordance with sections of this part.

J. Special Grading, Excavation, and Filling Special Inspection Job Tasks

UBC Inspection Code 13

1. Site Preparation Verification
   Inspect clearing and grubbing for conformity to plans and specifications and that excavation slopes are as specified.
2. Overexcavation and Scarification Verification
   Inspect, observe, and test as required all overexcavations required in foundation areas to the size, location, and depths as specified and that scarification, moisture conditioning and compaction are as specified.

3. Fill Placement Verification
   Inspect, observe, and test as required all fill placement, moisture conditioning, and compactions are as specified and that all fill slope configurations are as specified.
4. Utility Excavations and Backfilling Verification
   Inspect, observe, and test as required the location, placement, moisture conditioning and compaction of backfills within specified areas of the site for conformance with plans and specifications.
5. Foundation Excavation Verification
   Inspect, observe, and test as required all foundation excavations as to depth, size, bearing material, depth into bearing material, and cleaning of bearing surface for conformance with plans and specifications.
6. Material Verifications
   Inspect the steel reinforcement and concrete placement as specified in accordance with sections of this part.

K. Reinforced Gypsum Concrete Job Task
   UBC Inspection Code 8
   1. The inspection of reinforced gypsum concrete shall be as determined by the E/AR and the building official and be defined at the pre-job conference.

L. Shotcrete Job Tasks
   UBC Inspection Code 12
   1. General
      a. Shotcrete shall be defined as mortar or concrete pneumatically projected at high velocity onto a surface.
      b. Shotcrete placed for swimming pools and shotcrete work fully supported on earth and minor repairs, when in the opinion of the building official presents no special hazard, shall be exempt from special inspection.
   2. Concrete Mix Verification
      a. Mix Design
         Review proposed concrete mix design, that cement type is as specified, that aggregate type, weight and size are as specified and that admixture are correct.
      b. Preconstruction Verification
         A test panel shall be shot, cored, examined and tested prior to commencement of operations for the purpose of verifying the mix design and to qualify the nozzleman. The test panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same concrete mix design, the same equipment, and the same nozzleman that will be used on the project.
      c. Delivery Ticket
         Redi-mix Concrete: Determine that mixer truck delivery ticket specifies required mix and batch time.
      d. On-site Materials
         Concrete mixed on-site: Review certifications or other documentation of aggregates, cement and additives for compliance with plans and specifications. Determine that materials are in acceptable condition.
      e. Storage of Materials
         Reject cement or additives that have been exposed to excessive moisture. Reject aggregate that are contaminated.

f. Reinforcing Material Certifications
Inspect reinforcing materials certifications, or other documents for compliance with codes, plans and specifications. Check reinforcing materials for acceptable conditions.

M. Spray Applied Fireproofing Job Tasks
UBC Inspection Code 10

1. General
This Inspection shall apply to direct contact spray applied fire protection materials, such as “sprayed fiber” or “cementitious mixtures.”
2. Application
Sprayed products shall be inspected and tested when applied to members such as beams, columns, floor systems and related components.
3. Inspection Procedures
    a. Condition of Substrates
    Surfaces of substrates to receive the sprayed fire protection material shall be free of dirt, oil, grease, release agents, loose scale, loose paint and any extraneous materials.
    b. Thickness of Application
    Thickness of spray applied fire protection shall be determined in accordance with ASTM E605-77.
    c. Floor and Wall Sections
    A thickness test shall be conducted for every 2,500 square feet. Each unit or bay shall be divided into quarters. In each quarter, a 12 inch square shall be laid out and thickness measurements as described in ASTM E605-77 taken at each corner, averaged and reported as a single measurement.
    d. Beams and Columns
    Four sets of random measurements shall be taken for each bay or unit. The test locations on individual members shall be conducted as described in ASTM E605-77.
    e. Density
    Density of the fire protection material shall be tested in accordance with ASTM E605-77. Samples for density determination shall be one for each 10,000 square feet of floor area, but shall be no less than two per floor.
4. Condition of Finished Application
Inspect sprayed fire protection materials upon drying and curing. They shall be free of deep or wide cracks, voids, spalls, or any exposure of the substrate.
5. Patching
The special inspector shall insure that corrective measures have been applied to areas requiring re-spraying or patching where materials have been deliberately removed for testing, been damaged, or removed by other trades.

Approved Standard for Earthen IRC Structures

Earthen Wall Structures

Section R614.1 General. Earthen wall structures in Seismic Design Category A, B or C with basic wind speed of 90 mph or less with wind exposure category of A, B, or C may be designed and constructed in accordance with the provisions of this Section R614.

This Section shall supersede the limitations of Section R301.2.2 and structures complying with the provisions of Section R614 shall have complied with the seismic requirements of this code.

Exception: Structures with any site conditions may be designed with accepted engineering practice for earthen wall structures and the provisions of the IBC Section 2114 as amended.

Section R614.1.1 Earthen materials. This section shall establish minimum standards for safety for construction of earthen materials structures, collectively known as adobe, rammed earth, and hydraulic pressed unit construction.

Section R614.1.2 Professional registration not required. When the empirical design provisions of this section are used to design wall systems, project drawings, typical details and specifications are not required to bear the seal of an architect or engineer, unless otherwise required by the state law of the jurisdiction having authority or as required by Section R614.1.3.

Section R614.1.3 Professional registration required. When the earthen structure is over 12 feet (3638 mm) in height, as measured by Table R602.2.1, or is over 1 story, the plans and specifications shall be prepared by a registered professional architect or engineer licensed in the state for which the project is to be constructed. All such projects shall be designed in accordance with accepted engineering practice for earthen wall structures and in accordance the International Building Code Section 2114 as amended.

Section R614.2 Dimensions of earth walls. The <u>actual measured</u> thickness of earthen walls shall conform to the requirements of Section R614.

Section R614.2.1 Thickness and Height. The minimum thickness and maximum height of earthen walls and parapets shall be in accordance with Tables R614.2.1 (1 to 6) based upon the Sds value for the site of the project. Wall thickness shall be measured from face to face of walls with concave joints. Walls with rake joints shall be measured surface of joint to surface of joint. The thickness of wall sections shall not be combined without full cross bonding of the masonry units throughout the wall.

<u>Exception:</u> Walls supported only at ground level and only supported at the base of the wall shall be limited to a height of ½ that allowed by Tables R614.2.1 (1 to 6).

Table R614.2.1 (1)

Seismic Sites w/ Sds 0.00 TO 0.25

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	83	99	116	135	144	144	144	144	144	144
Interior	127	140	144	144	144	144	144	144	144	144	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #4	2 - #4	2 - #5	2 - #5	2 - #5	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #4	2 - #4	2 - #4	2 - #4	2 - #4
Exterior Wall w/ Full Parapet											
Type “A”	2 - #4	2 - #4	2 - #5	2 - #5	2 - #5	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #4	2 - #4	2 - #4	2 - #4	2 - #4
Interior Wall w/ infill between beams											
Type “A”	2 - #4	2 - #4	2 - #5	2 - #5	2 - #5	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #4	2 - #4	2 - #4	2 - #4	2 - #4

NP = This Wall is Not Permitted

Table R614.2.1 (2)

Seismic Sites w/ Sds 0.25 TO 0.30

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	83	99	116	135	144	144	144	144	144	144
Interior	106	116	127	137	144	144	144	144	144	144	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #4	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #5	2 - #5	2 - #4	2 - #4	2 - #4
Exterior Wall w/ Full Parapet											
Type “A”	2 - #4	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #5	2 - #5	2 - #4	2 - #4	2 - #4
Interior Wall w/ infill between beams											
Type “A”	2 - #4	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4	2 - #4
Type “B”	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #5	4 - #5	2 - #5	2 - #4	2 - #4	2 - #4

Bond Beam Load	46	61	79	100	125	125	108	80	42	0	0
Bond Beam Load	81	103	130	160	194	204	198	194	183	171	203
Bond Beam Load	84	100	118	137	150	151	152	155	158	161	164

NP = This Wall is Not Permitted

Table R614.2.1 (3)

Seismic Sites w/ Sds 0.30 TO 0.35

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	83	99	116	127	136	144	144	144	144	144
Interior	91	100	109	118	127	136	144	144	144	144	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “B”	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #5	4 - #4	2 - #5	2 - #4
Exterior Wall w/ Full Parapet											
Type “A”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “B”	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #5	4 - #4	2 - #5	2 - #4
Interior Wall w/ infill between beams											
Type “A”	2 - #5	2 - #5	2 - #5	4 - #4	4 - #4	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “B”	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #4	2 - #4
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #5	4 - #4	2 - #5	2 - #4

Bond Beam Load	53	71	92	117	137	157	176	156	127	88	40
Bond Beam Load	94	121	151	186	218	250	281	289	291	287	277
Bond Beam Load	86	103	120	140	160	182	203	206	210	213	216

NP = This Wall is Not Permitted

Table R614.2.1 (4)

Seismic Sites w/ Sds 0.35 TO 0.40

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	83	95	103	111	119	127	143	144	144	144
Interior	79	87	95	103	111	119	127	143	144	144	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #5
Type “B”	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #5	4 - #5	2 - #5
Exterior Wall w/ Full Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #5
Type “B”	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #5	4 - #5	2 - #5
Interior Wall w/ infill between beams											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5	2 - #5
Type “B”	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4	2 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #5	4 - #5	2 - #5

Bond Beam Load	61	81	101	118	137	157	179	227	211	181	142
Bond Beam Load	108	138	168	198	229	263	299	379	399	409	412
Bond Beam Load	89	105	123	143	163	186	209	260	268	272	276

NP = This Wall is Not Permitted

Table R614.2.1 (5)

Seismic Sites w/ Sds 0.40 TO 0.45

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	78	85	92	99	106	113	127	141	144	144
Interior	70	78	85	92	99	106	113	127	141	144	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #5	4 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #5
Exterior Wall w/ Full Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #5	4 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #5
Interior Wall w/ infill between beams											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #4
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #5	4 - #5
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #5

Bond Beam Load	68	85	101	118	137	157	179	227	280	274	243
Bond Beam Load	121	149	177	208	241	276	314	398	491	530	548
Bond Beam Load	91	108	126	146	167	189	213	265	322	339	343

NP = This Wall is Not Permitted

Table R614.2.1 (6)

Seismic Sites w/ Sds 0.45 TO 0.50

Assuming zero tension out-of-plane

Actual Wall Thickness (in)											
	10	11	12	13	14	15	16	18	20	22	24
Maximum Wall Height (in)											
Exterior	NP	70	76	82	89	95	101	114	127	140	144
Interior	63	70	76	82	89	95	101	114	127	140	144
Parapet	NP	22	24	26	28	30	32	36	40	44	48
Bond Beam Size and Steel Requirements											
All Bond Beams 8” Minimum Height											
Exterior Wall No Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #6	4 - #6
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6
Exterior Wall w/ Full Parapet											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #6	4 - #6
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6
Interior Wall w/ infill between beams											
Type “A”	2 - #5	2 - #5	4 - #4	4 - #4	4 - #4	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5
Type “B”	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #5	4 - #6	4 - #6	4 - #6
Type “C”	NP	NP	NP	NP	NP	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6	4 - #6

Bond Beam Load	70	85	101	118	137	157	179	227	280	338	345
Bond Beam Load	129	156	185	218	252	290	330	417	515	623	683
Bond Beam Load	93	110	129	149	170	193	217	269	327	390	417

NP = This Wall is Not Permitted

Section R614.2.2 Maximum length. The maximum length of any earthen wall laterally braced by Bond Beams per Section R614.5.2 shall be 20 feet (6,096 mm) between perpendicular bracing walls. Any wall in excess of 20 feet (6,096 mm) shall be designed in accordance with the amended IBC as noted in Section R614.1 above, (See Section R614.7 for required lengths of solid shear panels in walls.), or braced by a roof diaphragm roof system as required by Section R614.5.2.3.

Section R614.3 Support conditions. Earthen walls shall be supported on a solid concrete, solid masonry foundation system the width of which shall be not be less than 1/2 inch narrower than the earthen wall which it supports. Earthen structures shall not be less than 6 inches above adjacent grade.

Section R614.3.1 Moisture barrier. A moisture barrier equal to 30 lb. asphalt impregnated building paper, or equivalent moisture resistant barrier, shall be installed between the supporting foundation and the earthen wall material.

Section R614.4 Allowable stresses. Allowable compressive, tensile and shear stresses in earthen walls shall not exceed the values prescribed in Table R614.4. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account. Bolts in shear shall be limited to those values in IBC Table 2114.6.B.

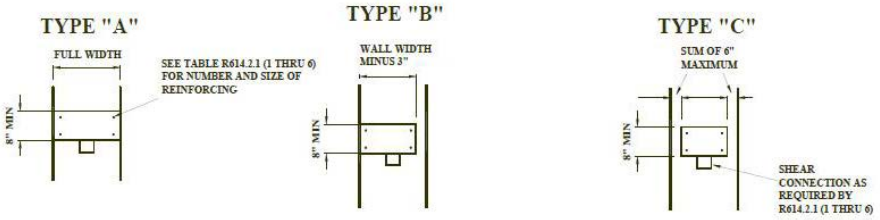
Section R614.4.1 Combined units. In walls composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the wall is composed. The net thickness of any facing unit of earthen materials used to resist stress shall not be less than 3 inches (76.2 mm).

When dissimilar materials, (e.g. concrete masonry or steel) are used to support earth wall construction, such elements shall be structurally isolated from other earth wall elements. The design shall recognize, with specific detailing, the effects shrinkage of the earth wall construction may have on the structural integrity of the structure.

Table R614.4					
Allowable Stresses for Empirical Design of Earthen Wall Structures					
			Allowable Stresses		
Strength of Unit, Gross Area			Gross Cross-Sectional Area		Note 1
Compression	300 psi		Normal Loading		30 psi
			Concentrated Loading		30 psi
Modulus of rupture	55 psi		Allowable tension without tensile reinforcing		0 psi
Shear	n/a		With special inspection		8 psi
			Without special inspection		4 psi
Modulus of Elasticity		60,000 psi Allowable deflection			Less than ½%
For SI: 1 pound per square inch = 6.895 kPa					
Notes:					
1. Gross cross-sectional area shall be calculated on the actual rather than the nominal dimensions.					

Section R614.5 Lateral support. Earthen walls constructed of earthen units shall be bonded and tied to intersecting earthen walls and laterally supported in the vertical direction in accordance with one of the methods in Section R614.5.2 or Section R614.5.3.

Section R614.5.2 Bond Beams. A continuous concrete bond beam system embedded in the earthen walls, designed to provide lateral support for the walls without the aid of additional bracing elements such as roof diaphragm. Bond beams shall be not less than the width of the wall minus 6 inches (152.4 mm) and a height of not less than 8 inches. Bond beams shall be reinforced as required by Tables R614.2.1 (1 to 6). Bars shall be placed not more than 1 ½” from the inside face of the form or veneer block as indicated in Figure R614.5.2.1.Figure R614.5.2.1



Section R614.5.2.2.1 Bond beam anchorage. Bond beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than 200 lbs. per lineal foot plus an additional 25 lbs. per lineal foot for every inch of thickness in excess of 16” thick.

Section R614.5.3 Roof diaphragm. A roof diaphragm complying with other provisions of this code adequate to provide not less than 200 lbs. per lineal foot of lateral support may be used to brace earthen walls. Earthen walls shall be anchored to roof diaphragms with connections to resist loads of not less than 200 lbs. per lineal foot plus an additional 25 lbs. per lineal foot for every inch of thickness in excess of 16” thick. This anchorage shall be tie beams as specified in Section R614.5.3.2 or other anchorage methods of equal strength.

Section R614.5.3.1 Tie beams. A tie beam is a concrete or masonry, beam built into the earthen wall for the purpose of anchoring the roof diaphragm and transferring the lateral perpendicular and parallel forces. Tie beams shall be provided for all earthen walls laterally braced by a roof diaphragm. Tie beams shall be anchored to the roof diaphragm system as required by other provisions in this code at intervals not exceeding 4 feet (1219 mm).

Tie beams shall be not less than ½ the width of the earthen wall, a minimum of 8 inches (203.2 mm) high and reinforced with 2 - #4 reinforcing bars.

Section R614.5.3.2 Tie beam anchorage. Tie beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than 200 lbs. per lineal foot plus an additional 25 lbs. per lineal foot for every inch of thickness in excess of 16” thick.

Section R614.6 Lintels. Earthen walls over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or earthen arches designed to support load imposed. Lintels shall not be supported by rigid structural columns, frames or posts with rigidities greater than the earthen wall unless the design allows for the potential for differential settlements.

Small openings less than 12” may be constructed without structural lintels.

Section R614.7 Shear walls. earthen walls subject to in-plane loads shall be designed with at least one

earthen wall shear panel, at least 4 feet long, free of openings, with a length as computed by Equation R614.7-1.

Equation R614.7-1
L = (Sqrt PL x Sds x 4)

Where:
L= Length of shear panel
PL = Sum of overall length of walls perpendicular to the panel.
Sds = Sds factor as determined by Section 1613 of the International Building Code.

Section R614.8 Jambs at openings. Portions of walls between openings or corner shall be constructed with lengths of not less than 1 ½ times the thickness of the wall in which they occur.

Section R614.9 Piers. The thickness of isolated earthen piers shall be not less than 1 ½ times those wall thickness values indicated in Table R614.2.1 (1 to 6). When structural posts or columns are provided within the pier ties or attachments shall be provided to the earthen wall system to laterally secure it a required by Section R614.11.

Section R614.9.1 Pier Cap. A solid concrete cap shall be provided at the top of load bearing piers under all concentrated loads. The cap shall cover not less than 50% of the top of the pier.

Section R614.10 Chases. Chases and recesses in earthen walls shall not be deeper than one-half the thickness of the wall thickness. The maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm), and shall have at least 8 inches (203.2 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings.

Chases and recesses in earthen walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (304.8 mm) shall be supported on noncombustible lintels.

Section R614.11 Stack bond. When the earthen wall is constructed of units, (e.g. adobe brick), units shall not be laid in stack bond. Units shall, in all locations throughout the wall system, overlap the courses below by not less than one-third the dimension of the units.

Section R614.12 Metal reinforcement. In addition to bonding earthen walls shall be anchored at their intersections, all walls shall be reinforced with joint reinforcement at vertical intervals of not more than 16 inches (406.4 mm). Horizontal reinforcement shall be continuous at the intersections. Reinforcement shall be not more than 4 inches narrower than the wall thickness.

Section R614.13 Veneer. All veneers using earthen materials shall be installed in accordance with this

section. Such veneers shall be installed with a noncombustible foundation, over concrete masonry, a backing of wood or cold-formed steel and shall be limited to the first story above grade and be not less than 4 inches (101.6 mm) or greater than 8 inches (203.2 mm) in thickness. Veneers shall not exceed a height of over 20 times their thickness without structural vertical support.

Section R614.13.1 Anchorage. Earth units shall be anchored to the supporting wall with a corrosion-resistant veneer tie system mechanically attached to continuous horizontal joint reinforcement continuously installed in the veneer bed joint not less than 16 inches (406.4 mm) on center vertically. When earth mortar systems are used the tie system shall prevent the accumulation of mortar at the base of the veneer. Conventional brick ties shall not be used to anchor earth units.

Section R614.13.2 Air space. The veneer shall be separated from the sheathing by an air space of a minimum of 1 inch (25.4 mm) but not more than 2 inches (50.8 mm). A moisture-resistant barrier or 15 lb. asphalt-saturated felt as required by Section R703.2 shall be provided except when veneer is applied over concrete masonry or concrete backing.

Section R614.13.3 Flashing. Approved corrosion-resistive flashing shall be provided in the exterior wall envelop in such a manner as to prevent entry of water into the wall cavity or penetration of water into the building structural framing components. The flashing shall extend to the surface of the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Flashing shall be located beneath the first course of veneer, and at other points of support, including structural floors, shelf angles and lintels. Approved corrosion-resisting flashing shall be installed at all of the following locations:

1. At top of all exterior window and door openings in such a manner as to be leak proof.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood–frame construction.
5. At wall and roof intersections.

Section R614.13.4 Weep holes. Weep holes shall be provided in the outside withe of masonry walls at a maximum spacing of 33 inches (838.2 mm) on center. Weep holes shall not be less than 3/16 inches (4.76 mm) in diameter. Weep holes shall be located immediately above the flashing.

Section R614.13.5 Plaster veneer. Both interior and exterior faces of earthen walls which are to be plastered with cement plaster shall be lathed and plastered in accordance the Section R703.6.1.

Section R614.14 Buttresses. Earthen walls used as buttresses shall not extend beyond an average length perpendicular to the wall to be braced a distance of 6 feet (1829 mm) without consideration to out-of-plane bending of the buttress.

Section R614.15 Gable end walls. Gable end walls shall be constructed using veneer construction as required by Section 703.7 or shall be provided with lateral bracing to prevent overturn designed in accordance with the IBC as modified.

Section R614.16 Ledgers. Ledgers shall not be used to support vertical live and dead loads in excess of 75 lbs. per lineal foot.

Section R614.17 Construction documents. In addition to the provisions of Section R106 all plans for earthen structures shall include the following:

1. The Sds number of the site.
2. The wind speed and site exposure coefficient of the site.
3. The material standard to which the earthen materials will comply.
4. The foundation supporting system and moisture barrier material.
5. The length, height and thickness in the actual dimensions of all earthen walls and parapets.
6. The bond beam or tie beam construction and attachment method to the earthen wall.
7. Lintel design, construction and end bearing area.
8. Veneer dimensions, attachment methods, moisture barrier and supporting structure.
9. Flashing materials and installation.
10. Metal reinforcement type and location.

Section R614.18 Corbeled wall elements. The maximum corbeled projection beyond the face of the wall shall not be more than one fourth of the wall thickness.

Section R614.19 Material standards. The materials used in earthen wall structures shall comply with the following material standards. For each of the tests prescribed in these standards, five full size sample units shall be selected at random from each lot of units or fraction thereof produced. Mass wall systems such as rammed earth shall provide five tests for each required standard test series.

Section R614.19.1 Manufacturers of earthen materials. Established manufacturers of earthen materials shall certify compliance with these standards. Copies of their periodic testing shall be supplied to the building official when requested. Literature, advertising and other information supplied by the manufacturer to designers and users of earthen materials shall include the actual dimensions of units, not nominal dimensions.

Section R614.19.2 Onsite earthen materials. Earthen units, mortar, rammed earth wall materials mined, mixed, formulated, and or molded on site shall be tested for compliance with these standards. For individual structures, a set of tests shall be provided for the first 2500 square feet of wall and an additional test for each additional 2500 square feet or portion thereof in the structure. At least one set of tests shall be made for each structure and for each 2500 square feet of patio wall. The fabricator of the materials used in the project shall certify in writing to the building official compliance with these standards. The certification shall include the number of units site molded, size of the units, volume of material used as mortar, dates of fabrication, and results of testing of the material. If materials from

established manufacturers and onsite materials are used in the project, copies of records including sources, quantities, and location of use within the structure shall be provided to the building official upon request.

Section R614.19.3 Categories of earthen materials. Type I, II, III, and IV earthen materials are approved for use in construction of projects designed in accordance with Section 2114.
Exception: Type I adobe shall only be used for repairs and small additions in which new walls do not exceed 10% of the surface area of existing walls of Type I construction and for structures constructed of a similar material system and for projects requiring this class of materials to meet historic guidelines.

Section R614.19.3.1 Required plaster veneer. Adobe of Type I and II shall be protected on the exterior with exterior plaster meeting the requirements of IBC Section 2512 applied over wire lath. Type I and II adobe shall not be used within 4 inches (101.6 mm) of the floor or at the top of parapet walls or near potential sources of water which may affect the stability of the earth wall system. Other Types of adobe may be left unplastered and may be used without separation from the floor.

Section R614.19.3.2 Adobe units and mortar. Moisture resistant stabilized adobe units and mortar shall meet the following testing standards as indicated in Table. Type S Portland cement mortar may be used for Type II, III, and IV adobe in lieu of earth mortar.

Table R614.19.3.2

Material **Type**	Dry Compression R614.19.3.2.1	Wet Compression R614.19.3.2.2	Modulus of Rupture R614.19.3.1.3	Absorption <2.5% R614.19.3.2.4	Absorption <5.0% R614.19.3.2.5	Moisture Content R614.19.3.2.6
I	X		X			X
II	X		X		X	X
III	X		X	X		X
IV		X	X			X

X – Indicates that material must pass the test standards prescribed in this Section

Section R614.19.3.2.1 Dry compression strength. Determine the compressive strength of the required number of samples as required by Section R614.19 in accordance with the following procedures.

Section R614.19.3.2.1.1 Dry the Specimen. Dry the specimen at a temperature of 85° F.+-15° F. (29° C. +- 9°) in an atmosphere having relative humidity of not more than 50 percent. Weigh the specimen at one-day intervals until constant weight is attained.

Section R614.19.3.2.1.2 Cap the Specimen. The specimen may be suitably capped with calcined gypsum mortar or the bearing surfaces may be rubbed smooth and true. Then calcined gypsum is used for capping, conduct the test after the capping has set and the specimen has been dried to constant weight

in accordance with Item 1 of this section.

Section R614.19.3.2.1.3 Test the Specimen. Test the specimens in the position in which the earthen unit is designed to be used. And bed on and cap with a felt pad not less than 1/8 inch (3.2mm) or more than ¼ inch (6.4 mm) in thickness.

Section R614.19.3.2.1.4 Testing Equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 0.05 inch (1.27 mm) per minute.

Section R614.19.3.1.5 Reporting Results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Units shall have an average dry compressive strength of 300 psi (2068 kPa) and no individual unit may have a strength of less than 250 psi. (1724 kPa)

Section R614.19.3.2.2 Wet compression strength. Determine the compressive strength of the required number of specimen as required by Section R614.19 in accordance with the following procedures.

Section R614.19.3.2.2.1 Cap the Specimen. The specimens may be suitably capped with a capping material compatible with water saturation or the bearing surfaces may be rubbed smooth and true.

Section R614.19.3.2.2.2 Wetting the Specimen. Submerge the specimen under water for not less than 8 hours or longer as required until fully saturated.

Section R614.19.3.2.2.3 Test the Specimen. Immediately test the specimen in the position in which the earthen unit is designed to be used. And bed on and cap with a felt pad not less than 1/8 inch (3.2 mm) or more than ¼ inch (6.4 mm) in thickness.

Section R614.19.3.2.2.4 Testing Equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 0.05 inch (1.27 mm) per minute.

Section R614.19.3.2.2.5. Reporting Results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Adobe units shall have an average wet compressive strength of 300 psi (2068 kPa). Five samples shall be tested and no individual unit may have a wet compressive strength of less than 250 psi. (1724 kPa).

Section R614.19.3.2.3 Modulus of rupture. Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and no individual unit shall have a modulus of rupture of less than 35 psi (241 kPa).

Section R614.19.3.2.3.1 Support conditions. A cured unit shall be simply supported by 2-inch- diameter (50.8 mm) cylindrical supports located 2 inches (50.8 mm) in from each end and extending the full width of the unit.

Section R614.19.3.2.3.2 Loading conditions. A 2-inch-diameter (50.8 mm) cylinder shall be placed at mid-span parallel to the supports.

Section R614.19.3.2.3.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

Section R614.19.3.2.3.4 Modulus of rupture determination. The modulus of rupture shall be determined by Equation 2116.3.2.3.4-1.

Equation 2116.3.2.3.4-1
Fr = 3WLs/2bt2

Where, for the purposes of this section only:
b = Width of the test specimen measured parallel to the loading cylinder, inches (mm).
fr = Modulus of rupture, psi (Mpa).
Ls = Distance between supports, inches (mm).
T = Thickness of the text specimen measured parallel to the direction of load, inches (mm). W = The applied load at failure, pounds (N).

Section R614.19.3.2.4 Absorption less than 2.5%. A 4-inch (101.6 mm) cube, cut from an adobe unit fried to a constant weight in a ventilated oven at 212 degrees F to 239 degrees F , shall not absorb more than 2 ½ percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

Section R614.19.3.2.5 Absorption less than 5.0%. A 4-inch (101.6 mm) cube, cut from an adobe unit fried to a constant weight in a ventilated oven at 212 degrees F to 239 degrees F , shall not absorb more than 2 ½ percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

Section R614.19.3.2.6 Additional Requirements. All earthen units shall meet the following requirements.

Section R614.19.3.2.6.1 Moisture content requirements. Earthen units shall have a moisture content not exceeding 4 percent by weight at the time of use.

Section R614.19.3.2.6.2 Shrinkage cracks. All earthen units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76.2 mm) in length or 1/8 inch (3.2 mm) in width.

Section R614.19.3.2.6.3 Soil requirements. Soil used for moisture resisting adobe units and mortar shall be chemically compatible with the stabilizing material. The soil shall contain sufficient clay to bind the particles together without the aid of stabilizers. The soil shall contain not more than 0.2 percent of water-soluble salts.

Section R614.19.3.3 Cement Stabilized Rammed Earth. Cement stabilized Rammed Earth shall meet the following standards. The installer of the wall system shall comply with the requirements of Section 2114.19.2 for frequency of testing.

Section R614.19.3.3.1 Testing before Construction. The installer of cement stabilized Rammed Earth shall provide the following testing before issuance of a building permit.

Section R614.19.3.3.2 Materials from a Licensed Sand and Gravel Producer. A copy of Proctor ASTM D 698 shall be provided for each soil type and source or combination of sources. Periodic testing as provided by the supplier may be supplied to meet this requirement. The soil contain not more than 0.2 percent of water-soluble salts.

Section R614.19.3.3.3 Material Mined and Mixed on Site. A copy of ASTM D 698, ASTM C 117, ASTM C 136, and ASTM D 4318 shall be provide for each soil type and source or combination of sources. Such tests shall be repeated as required to assure that all materials to be used have been tested and are represented by the tests. The soil shall contain not more than 0.2 percent of water-soluble salts.

Section R614.19.3.3.4 Testing required during Construction. The installer of cement stabilized Rammed Earth shall provide the following tests made during the construction process. A certified testing laboratory shall provide field density tests for comparison to the pre-construction Proctor ASTM D 698, percent moisture ASTM D 2216, dry density ASTM D 698, and percent moisture ASTM D 1556. Cement Stabilized Rammed Earth walls shall meet or exceed 95% maximum dry density (ASTM D 698). Samples taken from the wall shall exceed 300 psi compression (ASTM D 1633) 14 days after placement.

Approved Standard for Earthen IBC Structures

EARTHEN STRUCTURES

Table 721.1(2) REVISE table by ADDING the following:

Material	Item	Construction	4 hour	3 hour	2 hour	1 hour
1a Earthen Walls	1a – 1.1	Solid wall construction utilizing earth as the structural wall	14	12	10	8

DELETE **Sections 2109.3** through **2109.3.4.7** Except: **Table 2109.3.3.1 Allowable shear on bolts in adobe masonry**, which shall be renumbered **Table 2114.6.B.**

ADD new section 2114 to read:
Section 2114 Earthen structures.

Section 2114.1 General. Earthen structures with any site condition may be designed with accepted engineering practice for earthen wall structures and with the provisions of this section.

Section 2114.1.1 Earthen materials. This section shall establish minimum standards for safety for construction of earthen materials structures, collectively known as adobe, burnt adobe, rammed earth, and hydraulic pressed unit construction.

Section 2114.1.2 Professional registration required. Plans and specifications designed under the provisions of Section 2114 shall be prepared by a registered professional architect or engineer licensed in the state for which the project is to be constructed.

Section 2114.2. Minimum thickness. The minimum thickness of earthen structures shall be designed to limit tension to zero unless tensile reinforcement is provided. Walls shall be designed to meet forces prescribed by Chapter 16. The measurement of height of walls shall be the distance between points of lateral support. Wall thickness shall be measured from face to face of each wall withe. The thickness of walls using raked joints shall be the surface to surface distance of the mortar joints. The withes of wall sections shall not be combined without cross bonding of the masonry units throughout the structural element. Cross bonding shall mean overlapping of not less than 1/3 of the dimension of the masonry units.

Section 2114.3 Support conditions. Earthen structures shall be supported on a solid concrete, solid masonry foundation system the width of which shall be not greater than 1/6 inch narrower than the earthen structure which it supports. Earthen structures shall not be less than 6 inches above adjacent grade.

Section 2114.4 Corbeled wall elements. The maximum corbeled projection beyond the face of the wall

shall not be more than 4 inches. Such corbeled projections shall add additional thickness to the wall, the opposite face of the wall remaining plane with the primary wall plane.

Section 2114.5 Moisture barrier. A moisture barrier equal to 30 lb. asphalt impregnated building paper, or equivalent moisture resistant barrier, shall be installed between the supporting foundation and the earthen material.

Section 2114.6 Allowable stresses. Allowable compressive, tensile and shear stresses in earthen structures shall not exceed the values prescribed in Table 2114.6.A. In determining the stresses, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be considered. Bolt values shall not exceed those set forth in Table 2114.6.B.

Section 2114.6.1 Combined units. In walls composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the wall is composed. The net thickness of any facing unit of earthen materials used to resist stress shall not be less than 3 inches (76 mm).

When dissimilar materials, (e.g. concrete masonry or steel) are used to support earth wall construction, such elements shall be structurally isolated from other earth wall elements. The design shall recognize, with specific detailing, the effects shrinkage of the earth wall construction may have on the structural integrity of the structure.

Table 2114.6.A					
Allowable Stresses for Empirical Design of Earthen Wall Structures					
			Allowable Stresses		
Strength of Unit, Gross Area			Gross Cross-Sectional Area		Note 1
Compression	300 psi		Normal Loading		30 psi
			Concentrated Loading		45 psi
Modulus of rupture	55 psi		Allowable tension without tensile reinforcing		0 psi
Shear	n/a		With special inspection		8 psi
			Without special inspection		4 psi
Modulus of Elasticity		60,000 psi Allowable deflection			Less than ½%
For SI: 1 pound per square inch = 6.895 kPa					
Notes:					
1. Gross cross-sectional area shall be calculated on the actual rather than the nominal dimensions.					

Table 2114.6.B REFER to IBC Table 2109.8.3.1

Section 2114.7 Lateral support. Earthen walls shall be laterally supported in the vertical direction and at intersection with other earthen walls. Support at the top of the wall shall in accordance with one of the methods in Section 2114.7.1 or Section 2114.7.2.

Section 2114.7.1 Bond beams. A continuous bond beam system embedded in the earthen walls, designed to provide lateral support for the walls without the aid of additional bracing elements such as roof diaphragm. Bond beams of concrete or masonry shall be not less than the width of the wall minus 6 inches (152.4 mm).

Section 2114.7.1.1 Bond beam anchorage. Bond beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than the shear forces in both directions. The shear between a cast in place concrete bond beam and the earthen wall shall not exceed 1/8 the dead load at the base of the bond beam unless alternate attachment is provided compatible with the allowable stresses in Table 2114.4.A or 2114.4.B.

Section 2114.7.2 Roof diaphragm. A roof diaphragm complying with other provisions of this code adequate to provide lateral support may be used to brace earthen walls. Anchorage shall be tie beams as specified in Section 2114.7.2.2 or other anchorage methods of equal strength.

Section 2114.7.2.1 Tie beams. A tie beam is a beam built into the earthen wall for the purpose of anchoring the roof diaphragm and transferring the lateral perpendicular and parallel forces. Tie beams shall be provided for all earthen walls laterally braced by a roof diaphragm.

Section 2114.7.2.2 Tie beam anchorage. Tie beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than the shear forces in both directions. The shear between a cast in place concrete or masonry tie beam and the earthen wall shall not exceed 1/8 the dead load at the base of the bond beam unless alternate attachment is provided compatible with the allowable stresses in Table 2114.4.A or 2114.4.B.

Section 2114.8 Lintels. Earthen walls over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or earthen material arches designed to support load imposed. Lintels shall not be supported by rigid structural columns, frames or posts with rigidities greater than the earthen wall unless the design allows for the potential for differential settlements. Small openings less than 12” may be constructed without structural lintels.

Section 2114.9 Shear walls. Earthen walls subject to in-plane loads shall be designed to be tension free unless tensile reinforcement is provided. Solid panels less than 4 feet (1219 mm) shall not be considered shear walls.

Section 2114.10 Opening jambs. Portions of walls between openings shall be constructed with lengths of not less than 1 ½ times the thickness of the wall in which they occur.

Section 2114.11 Freestanding piers. Piers independent of earthen walls shall be designed to support vertical and horizontal loads unless braced by other elements of the structure. Tensile reinforcement shall be provided where tension occurs. When structural posts or columns are provided within the pier ties or attachments shall be provided to the earthen wall system to

laterally secure it.

Section 2114.11.1 Pier cap. A solid concrete cap shall be provided at the top of load bearing piers under all concentrated loads. The cap shall cover not less than 50% of the top of the pier.

Section 2114.12 Chases. Chases and recesses in earthen walls shall not be deeper than one-third the thickness of the wall thickness. The maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm), and shall have at least 8 inches (203 mm) of earthen construction in back of the chases and recesses and between adjacent chases or recesses and at least 12 inches (305 mm) between the chase and the jambs of openings.
Chases and recesses in earthen walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Earthen walls directly above chases or recesses wider than 16 inches (305 mm) shall be supported on noncombustible lintels.

Section 2114.13 Stack bond. When the earthen wall is constructed of units, (e.g. adobe brick), units shall not be laid in stack bond. Units shall, in all locations throughout the wall system, overlap the courses below by not less than one-third the dimension of the units.

Exception: Ornamental non-structural elements may be laid in stack bond if properly tied to the main structure.

Section 2114.14 Metal reinforcement. All walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of at least 9 gage when using earthen units (e.g. adobe block). Horizontal reinforcement shall be used throughout the wall system and be continuous at the intersections. Reinforcement used throughout the wall system shall be not more than 4 inches narrower than the wall thickness.

Section 2114.15 Veneer. All veneers using earthen materials shall be installed in accordance with this section. Such veneers shall be installed with a noncombustible foundation, over concrete masonry, a backing of wood or cold-formed steel and the veneer shall be not less than 4 inches (101 mm) or greater than 8 inches (203 mm) in thickness.

Section 2114.15.1 Anchorage. Earth units shall be anchored to the supporting wall with a corrosion- resistant veneer tie system mechanically attached to continuous horizontal joint reinforcement continuously installed in the veneer bed joint not less than 16 inches (406 mm) on center vertically. When earth mortar systems are used the tie system shall prevent the accumulation of mortar at the base of the veneer. Conventional brick ties shall not be used to anchor earth units.

Section 2114.15.2 Air space. The veneer shall be separated from the sheathing by an air space of a minimum of 1 inch (25 mm) but not more than 2 inches (51 mm). A weather-resistant membrane or 15 lb. asphalt-saturated felt by shall be provided except when veneer is applied over concrete masonry or concrete backing.

Section 2114.15.3 Flashing. Approved corrosion-resistive flashing shall be provided in the exterior wall envelop in such a manner as to prevent entry of water into the wall cavity or penetration of water into the building structural framing components. The flashing shall extend to the surface of

the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Flashing shall be located beneath the first course of veneer, and at other points of support, including structural floors, shelf angles and lintels. Approved corrosion-resisting flashing shall be installed at all of the following locations:

- At top of all exterior window and door openings in such a manner as to be leak proof.
- At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
- Under and at the ends of masonry, wood or metal copings and sills.
- Where exterior porches, decks or stairs attach to a wall or floor assembly of wood – frame construction.
- At wall and roof intersections.

Section 2114.15.4 Weep holes. Weep holes shall be provided in the outside withe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weep holes shall not be less than 3/16 inches (4.8 mm) in diameter. Weep holes shall be located immediately above the flashing.

Section 2114.16 Buttresses. Earthen walls used as buttresses shall not extend beyond an average length perpendicular to the wall to be braced a distance of 6 feet (1830 mm) without consideration to out-of-plane bending of the buttress.

Section 2114.17 Gable End Walls. Gable end walls shall be constructed using veneer construction as required by Section 2114.15 or shall be provided with lateral bracing to prevent overturn.

Section 2114.18 Ledgers. Ledgers shall not be used to support vertical live and dead loads in excess of 75 lbs. per lineal foot unless the tension in the wall due to bending from out-of-plane loads and the eccentric load from the ledger is zero.

Section 2114.19 Material standards. The materials used in earthen wall structures shall comply with the following material standards. For each of the tests prescribed in these standards, five full size sample units shall be selected at random from each lot of units or fraction thereof produced. Mass wall systems such as rammed earth shall provide five tests for each required standard test series.

Section 2114.19.1 Manufacturers of earthen materials. Established manufacturers of earthen materials shall certify compliance with these standards. Copies of their periodic testing shall be supplied to the building official when requested. Literature, advertising and other information supplied by the manufacturer to designers and users of earthen materials shall include the actual dimensions of units, not nominal dimensions.

Section 2114.19.2 Onsite earthen materials. Earthen units, mortar, rammed earth wall materials mined, mixed, formulated, and or molded on site shall be tested for compliance with these standards. For individual structures, a set of tests shall be provided for the first 2500 square feet of wall and an additional test for each additional 2500 square feet or portion thereof in the structure. At least one set of tests shall be made for each structure and for each 2500 square feet of patio wall. The fabricator of the materials used in the project shall certify in writing to the building official compliance with these standards. The certification shall include the number of units site molded, size of the units, volume of material used as mortar, dates of fabrication, and results of testing of the material. If materials from established manufacturers and onsite materials are used in the project, copies of records including

sources, quantities, and location of use within the structure shall be provided to the building official upon request.

Section 2114.19.3 Categories of earthen materials. Type I, II, III, and IV earthen materials are approved for use in construction of projects designed in accordance with Section 2114.

Exception: Type I adobe shall only be used for repairs and small additions in which new walls do not exceed 10% of the surface area of existing walls of Type I construction and for structures constructed of a similar material system and for projects requiring this class of materials to meet historic guidelines.

Required plaster veneer. Adobe of Type I and II shall be protected on the exterior with exterior plaster meeting the requirements of IBC Section 2512 applied over wire lath. Type I and II adobe shall not be used within 4 inches (102mm) of the floor or at the top of parapet walls or near potential sources of water which may affect the stability of the earth wall system. Other Types of adobe may be left unplastered and may be used without separation from the floor.

Adobe units and mortar. Moisture resistant stabilized adobe units and mortar shall meet the following testing standards as indicated in Table. Type S portland cement mortar may be used for Type II, III, and IV adobe in lieu of earth mortar.

Table 2114.16.3.1

Materia *l* **Type**	Dry Compression 2114.16.3.1.1	Wet Compression 2114.16.3.1.2	Modulus of Rupture 2114.16.3.1.3	Absorption <2.5% 2114.16.3.1.4	Absorption <5.0% 2114.16.3.1.5	Moisture Content 2114.16.3.1.6
I	X		X			X
II	X		X		X	X
III	X		X	X		X
IV		X	X			X

X – Indicates that material must pass the test standards prescribed in this Section

Section 2114.19.3.3 Dry compression strength. Determine the compressive strength of the required number of samples as required by Section 2114.19 in accordance with the following procedures.

Section 2114.19.3.3.1 Dry the specimen. Dry the specimen at a temperature of 85° F.+-15° F. (29° C. +-9°) in an atmosphere having relative humidity of not more than 50 percent. Weigh the specimen at one- day intervals until constant weight is attained.

Section 2114.19.3.3.2 Cap the specimen. The specimen may be suitably capped with calcined gypsum mortar or the bearing surfaces may be rubbed smooth and true. Then calcined gypsum is used for capping, conduct the test after the capping has set and the specimen has been dried to constant weight in accordance with Item 1 of this section.

Section 2114.19.3.3.3 Test the Specimen. Test the specimens in the position in which the earthen unit is

designed to be used. And bed on and cap with a felt pad not less than 1/8 inch (3.2mm) or more than ¼ inch (6.4mm) in thickness.

Section 2114.19.3.3.4 Testing equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 0.05 inch (1.27mm) per minute.

Section 2114.19.3.3.5 Reporting results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Units shall have an average dry compressive strength of 300 psi (2068 kPa) and no individual unit may have a strength of less than 250 psi. (1724 kPa)

Section 2114.19.4 Wet compression strength. Determine the compressive strength of the required number of specimen as required by Section 2114.19 in accordance with the following procedures.

Section 2114.19.4.1 Cap the specimen. The specimens may be suitably capped with a capping material compatible with water saturation or the bearing surfaces may be rubbed smooth and true.

Section 2114.19.4.2 Wetting the specimen. Submerge the specimen under water for not less than 8 hours or longer as required until fully saturated.

Section 2114.19.4.3 Test the specimen. Immediately test the specimen in the position in which the earthen unit is designed to be used. And bed on and cap with a felt pad not less than 1/8 inch (3.2mm) or more than ¼ inch (6.4mm) in thickness.

Section 2114.19.4.4 Testing equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design.
The speed of the moving head of the testing machine shall not be more than 0.05 inch (1.27mm) per minute.

Section 2114.19.4.5 Reporting results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Adobe units shall have an average wet compressive strength of 300 psi (2068 kPa). Five samples shall be tested and no individual unit may have a wet compressive strength of less than 250 psi. (1724 kPa)

Section 2114.19.5 Modulus of rupture. Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and no individual unit shall have a modulus of rupture of less than 35 psi (241 kPa).

Section 2114.19.5.1 Support conditions. A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

Section 2114.19.5.2 Loading conditions. A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

Section 2114.19.5.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

Section 2114.19.5.4 Modulus of rupture determination. The modulus of rupture shall be determined by Equation 2116.3.1.3.4-1.

Equation 2116.3.1.3.4-1
Fr = 3WLs/2bt2

Where, for the purposes of this section only:
b = Width of the test specimen measured parallel to the loading cylinder, inches (mm).
fr = Modulus of rupture, psi (Mpa).
Ls = Distance between supports, inches (mm).
t =Thickness of the text specimen measured parallel to the direction of load, inches (mm).
W =The applied load at failure, pounds (N).

Section 2114.19.6 Absorption less than 2.5%. A 4-inch (102 mm) cube, cut from an adobe unit fried to a constant weight in a ventilated oven at 212 degrees F to 239 degrees F , shall not absorb more than 2 ½ percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

Section 2114.19.7 Absorption less than 5.0%. A 4-inch (102 mm) cube, cut from an adobe unit fried to a constant weight in a ventilated oven at 212 degrees F to 239 degrees F, shall not absorb more than 2 ½ percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

Section 2114.19.8 Additional requirements. All earthen units shall meet the following requirements.

Section 2114.19.8.1 Moisture content requirements. Earthen units shall have a moisture content not exceeding 4 percent by weight at the time of use.

Section 2114.19.8.2 Shrinkage cracks. All earthen units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76mm) in length or 1/8 inch (3.2mm) in width.

Section 2114.19.8.3 Soil requirements. Soil used for moisture resisting adobe units and mortar shall be chemically compatible with the stabilizing material. The soil shall contain sufficient clay to bind the particles together without the aid of stabilizers. The soil shall contain not more than 0.2 percent of water- soluble salts.

Section 2114.19.9 Cement stabilized rammed earth. Cement stabilized Rammed Earth shall meet the following standards. The installer of the wall system shall comply with the requirements of Section 2114.19.2 for frequency of testing.

Section 2114.19.9.1 Testing before construction. The installer of cement stabilized Rammed Earth shall provide the following testing before issuance of a building permit.

Section 2114.19.9.2 Materials from a licensed sand and gravel producer. A copy of Proctor ASTM D 698

shall be provided for each soil type and source or combination of sources. Periodic testing as provided by the supplier may be supplied to meet this requirement. The soil shall contain not more than 0.2 percent of water-soluble salts.

Section 2114.19.9.3 Material mined and mixed on site. A copy of ASTM D 698, ASTM C 117, ASTM C 136, and ASTM D 4318 shall be provided for each soil type and source or combination of sources. Such tests shall be repeated as required to assure that all materials to be used have been tested and are represented by the tests. The soil shall contain not more than 0.2 percent of water-soluble salts.

Section 2114.19.9.4 Testing required during construction. The installer of cement stabilized Rammed Earth shall provide the following tests made during the construction process. A certified testing laboratory shall provide field density tests for comparison to the pre-construction Proctor ASTM D 698, percent moisture ASTM D 2216, dry density ASTM D 698, and percent moisture ASTM D 1556.

Cement Stabilized Rammed Earth walls shall meet or exceed 95% maximum dry density (ASTM D 698). Samples taken from the wall shall exceed 300 psi compression (ASTM D 1633) 14 days after placement.

Approved Standard for Straw-Bale Construction

Straw-Bale Structures

Section 101 Purpose. The purpose of this appendix chapter is to establish minimum prescriptive standards of safety for the construction of structures which use baled straw as a load bearing or non-load bearing material.

Section 102 Scope. The provisions of this chapter shall apply to all structures utilizing straw-bales in the construction of wall systems. Load bearing structures shall be limited to Occupancy Groups R, Division 3 and U.

Section 103 Definitions. For the purpose of this chapter, certain terms are defined as follows:

STRAW is the dry stems of cereal grains left after the seed heads have been removed.

BALES are rectangular compressed blocks of straw, bound by strings or wire.

FLAKES are slabs of straw removed from an untied bale. Flakes are used to fill small gaps between the ends of stacked bales.

LAID FLAT refers to stacking bales so that the sides with the largest cross-sectional area are horizontal and the longest dimension of this area is parallel with the wall plane.

LAID ON-EDGE refers to stacking bales so that the sides with the largest cross-sectional area are vertical and the longest dimension of this area is horizontal and parallel with the wall plane.

Section 104 Materials

Section 104.1 Specifications for Bales.

Section 104.1.1 Type of Straw. Bales of various types of straw, including, but not limited to, wheat, rice, rye, barley, oats and similar plants, shall be acceptable if they meet the minimum requirements for density, shape, moisture content, and ties.

Section 104.1.2 Shape. Bales shall be rectangular in shape.

Section 104.1.3 Dimensions. Bales used within a continuous wall shall be of consistent height and width to ensure even distribution of loads within wall systems.

Section 104.1.4 Ties. Bales shall be bound with ties of either polypropylene string or baling wire. Bales with broken or loose ties shall not be used unless the broken or loose ties are replaced with ties which restore the original degree of compaction of the bale.

Section 104.1.5 Moisture Content. Moisture content of bales, at time of installation, shall not exceed 20% of the total weight of the bale. Moisture content of bales shall be determined by one of the following:

Section 104.1.5.1 Field Method. A suitable moisture meter, designed for use with baled straw or hay, and equipped with a probe of sufficient length to reach the center of the bale, shall be used to determine the average moisture content of 5 bales randomly selected from the bales to be used.

Section 104.1.5.2 Laboratory Method. A total of 5 samples, taken from the center of each of 5 bales randomly selected from the bales to be used, shall be tested for moisture content by a recognized testing lab.

Section 104.1.6 Density. Bales in load-bearing structures shall have a minimum calculated dry density of 7.0 pounds per cubic foot. The calculated dry density shall be determined after reducing the actual bale weight by the weight of the moisture content, as determined in Section 104.1.5. The calculated dry density shall be determined by dividing the calculated dry weight of the bale by the volume of the bale.

Section 104.1.7 Custom Size Bales. Where custom-made partial bales are used, they shall be of the same density, same string or wire tension, and, where possible, use the same number of ties as the standard size bales.

Section 105 Construction and General Requirements

Section 105.1 General. Bale walls, when covered with plaster, drywall or stucco shall be deemed to have the equivalent fire resistive rating as wood frame construction with the same wall-finishing system.

Section 105.2 Wall Thickness. Nominal minimum bale wall thickness shall be 14 inches.

Section 105.3 Wall Height. Bale walls shall not exceed one story in height and the bale portion shall not exceed a height to width ratio of 5.6:1 (for example, the maximum height for the bale portion of a 23 inch thick wall would be 10 feet - 8 inches), unless the structure is designed by an engineer or architect licensed by the State to practice as such, and approved by the Building Official. **Exception:** In the non-load bearing exterior end walls of structures with gable or shed roofs, an approved continuous assembly shall be required at the roof bearing assembly level.

Section 105.4 Unsupported Wall Length. The ratio of unsupported wall length to thickness, for bale walls, shall not exceed 13:1 (for a 23-inch thick wall, the maximum unsupported length allowed is 25 feet), unless the structure is designed by an engineer or architect licensed by the State to practice as such, and approved by the Building Official.

Section 105.5 Allowable Loads. The allowable vertical load (live and dead load) on the top of bale walls shall not exceed 360 pounds per square foot (psf) and the resultant load shall act at the center of the wall. Bale structures shall be designed to withstand all vertical and horizontal loads as specified in Chapter 16 of the IBC.

Section 105.6 Foundations. Foundations shall be sized to accommodate the thickness of the bale wall and the load created by the wall and roof live and dead loads. Foundation (stem) walls which support bale walls shall extend to an elevation of not less than 6 inches above adjacent ground at all points. The minimum width of the footing shall be the width of the bale it supports, except that the bales may overhang the exterior edge of the foundation by not more than 3 inches to accommodate rigid perimeter insulation. Footings shall extend a minimum of 12 inches below natural, undisturbed soil, or to frost line, whichever is lower.

Section 105.7 Wall and Roof Bearing Assembly Anchorage

Section 105.7.1 General. Vertical reinforcing bars with a minimum diameter of 1/2", shall be embedded in the foundation a minimum depth of 6 inches, and shall extend above foundation a minimum of 12 inches. These vertical bars shall be located along the centerline of the bale wall, spaced not more than 2 feet apart. A vertical bar shall also be located within 1 foot of any opening or corner, except at locations occupied by anchor bolts.

Section 105.7.2 Intersecting Walls. Walls of other materials intersecting bale walls shall be attached to the bale wall by means of one or more of the following methods or an acceptable equivalent:

1. Wooden dowels at least 5/8" in diameter of sufficient length to provide 12 inches of penetration into the bale, driven through holes bored in the abutting stud, and spaced to provide one dowel connection per bale.
2. Pointed wooden stakes, at least 12 inches in length and 1-1/2" by 3-1/2" at the exposed end, fully driven into each course of bales, as anchorage points.
3. Bolted or threaded rod connection of the abutting wall, through the bale wall, to a steel nut and steel or plywood plate washer, a minimum of 6 inches square and a minimum thickness of 3/16" for steel and 1/2" for plywood, in at least three locations.

Section 105.7.3 Anchor Bolts. Load bearing bale walls shall be anchored to the foundation by 1/2" diameter steel anchor bolts embedded at least 7 inches in the foundation at intervals of 6 feet or less. A minimum of two anchor bolts per wall shall be provided with one bolt located within 36 inches of each end of each wall. Sections of 1/2" diameter threaded rod shall be connected to the anchor bolts, and to each other, by means of threaded coupling nuts and shall extend through the roof bearing assembly and be fastened with a steel washer and nut. Bale walls and roof bearing assemblies may be anchored to the foundation by means of other methods which are adequate to resist uplift forces resulting from the design wind load. There shall be a minimum of two points of anchorage per wall, spaced not more than 6 feet apart, with one located within 36 inches of each end of each wall.

The dead load of the roof and ceiling systems will produce vertical compression of the bales. Regardless of the anchoring system used to attach the roof bearing assembly to the foundation, prior to installation of wall finish materials, bolts or straps shall be re-tightened to compensate for this compression.

Section 105.7.4 Moisture Barrier. A moisture barrier shall be used between the top of the foundation and the bottom of the bale wall to prevent moisture from migrating through the foundation into the bottom course of bales. This barrier shall consist of one of the following:

1. Cementitious waterproof coating;
2. Type 30 asphalt felt over an asphalt emulsion;
3. Sheet metal flashing, sealed at joints;
4. Other approved building moisture barrier. All penetrations through the moisture barrier, as well as all joints in the barrier, must be sealed with asphalt, caulking or an approved sealant.

Section 105.7.5 Stacking and Pinning. Bales in load-bearing walls shall be laid flat and stacked in running bond where possible, with each bale overlapping the two bales beneath it. Bales in non load- bearing

walls may be laid either flat or on-edge and stacked in running bond where possible. For non- load bearing walls, bales may be laid either flat or on-edge. Bales in load bearing walls shall be laid flat and stacked in a running bond, where possible, with each bale overlapping the two bales beneath it. Overlaps shall be a minimum of 12 inches. Gaps between the ends of bales which are less than 6 inches in width can be filled by an untied flake inserted snugly into the gap.

The first course of bales shall be laid by impaling the bales on the vertical bars or threaded rods, if any, extending from the foundation. When the fourth course has been laid, #4 rebar pins, or an acceptable equivalent, long enough to extend through all four courses, shall be driven down through the bales, two in each bale, located so that they do not pass within six inches of, or through the space between the ends of any two bales. The layout of these pins shall approximate the layout of the vertical bars extending from the foundation. As each subsequent course is laid, two such pins, long enough to extend through the course being laid and the three courses immediately below it, shall be driven down through each bale. This pinning method shall be continued to the top of the wall. In walls seven or eight courses high, pinning at the fifth course may be eliminated.

Only full-length bales shall be used at corners of load bearing walls, unless exceptions are designed by an engineer or architect licensed by the State to practice as such, and approved by the Building Official.

Vertical #4 rebar pins, or an acceptable alternative, shall be located within 1 foot of all corners or door openings.

Staples, made of #3 or larger rebar formed into a “U” shape, at least 18 inches long with two 6 inch legs, shall be used at all corners of every course, driven with one leg into the top of each abutting corner bale. In lieu of staples, corner bales may be tied together, by a method approved by the building official.

Section 105.7.5.1 Alternative Pinning Method. When the third course has been laid, vertical #4 rebar pins, or an acceptable equivalent, long enough to extend through all three courses, shall be driven down through the bales, two in each bale, located so that they do not pass within 6 inches of, or through the space between the ends of any two bales. The layout of these rebar pins shall approximate the layout of the rebar pins extending from the foundation. As each subsequent course is laid, two such pins, long enough to extend through that course and the two courses immediately below it shall be driven down through each bale. This pinning method shall be continued to the top of the wall.

Section 105.7.6 Roof Bearing Assembly. Load bearing bale walls shall have a roof bearing assembly at the top of the wall to bear the roof load and to provide a means of connecting the roof structure to the foundation. The roof bearing assembly shall be continuous along the tops of structural walls.

An acceptable roof bearing assembly option consists of two double 2” X 6”, or larger, horizontal top plates, one located at the inner edge of the wall and the other at the outer edge. Connecting the two doubled top plates and located horizontally and perpendicular to the length of the wall shall be 2” X 6” cross members spaced no more than 72 inches center to center, and as required to align with the threaded rods extending from the anchor bolts in the foundation. The double 2” X 6” top plates shall be face nailed with 16d nails staggered at 16 inches on center, with laps and intersections face nailed with four 16d nails. The cross members shall be face nailed to the top plates with four 16d nails at each end. Corner connections shall include overlaps nailed as above or an acceptable equivalent such as plywood gussets or metal plates. Alternatives to this roof bearing assembly option must provide equal or greater vertical rigidity and provide horizontal rigidity equivalent to a continuous double 2 by 4 top plate.

The connection of roof framing members to the roof bearing assembly shall comply with the appropriate sections of the IBC.

Section 105.7.7 Openings and Lintels. All openings in load bearing bale walls shall be a minimum of one full bale length from any outside corner, unless exceptions are designed by an engineer or architect licensed by the State to practice as such, and approved by the Building Official.

Section 105.7.7.1 Openings. Openings in exterior bale walls shall not exceed 50 percent of the total wall area, based on interior dimensions, where the wall is providing resistance to lateral loads, unless the structure is designed by an engineer or architect licensed by the State to practice as such, and approved by the Building Official.

Section 105.7.7.2 Lintels. Wall and/or roof load present above any opening shall be carried, or transferred to the bales below by one of the following:

1. A structural frame,
2. A lintel (such as an angle-iron cradle, wooden beam, wooden box beam). Lintels shall be at least twice as long as the opening is wide and extend at least 24" beyond either side of the opening. Lintels shall be centered over openings, and shall not exceed the load limitations of Section 105.5 by more than 25 percent.

Section 105.7.8 Moisture Protection. All weather-exposed bale walls shall be protected from water damage. An approved building moisture barrier shall be used to protect at least the bottom course of bales, but not more than the lower one-third of the vertical exterior wall surface, in order to allow natural transpiration of moisture from the bales. The moisture barrier shall have its upper edge inserted at least 6 inches into the horizontal joint between two courses of bales, and shall extend at least 3 inches below the top of the foundation. Bale walls shall have special moisture protection provided at all window sills. Unless protected by a roof, the tops of walls shall also be protected. This moisture protection shall consist of a waterproof membrane, such as asphalt-impregnated felt paper, polyethylene sheeting, or other acceptable moisture barrier, installed in such manner as to prevent water from entering the wall system at window sills or at the tops of walls.

Section 105.7.9 Wall Finishes. Interior and exterior surfaces of bale walls shall be protected from mechanical damage, flame, animals, and prolonged exposure to water. Bale walls adjacent to bath and shower enclosures shall be protected by a moisture barrier.

Cement stucco shall be reinforced with galvanized woven wire stucco netting or an acceptable equivalent. Such reinforcement shall be secured by attachment through the wall at a maximum spacing of 24 inches horizontally and 16 inches vertically, using a method approved by the Building Official.

Where bales abut other materials, the plaster/stucco shall be reinforced with galvanized expanded metal lath, or an acceptable equivalent, extending a minimum of 6 inches onto the bales.

Earthen and lime-based plasters may be applied directly onto the exterior and interior surface of bale walls without reinforcement, except where applied over materials other than straw. Weather-exposed earthen plasters shall be stabilized using a method approved by the building official.

Lime based plasters may be applied directly onto the exterior surface of bale walls without reinforcement, except where applied over materials other than straw.

Section 105.7.10 Electrical. All wiring within or on bale walls shall meet all provisions of the National Electrical Code adopted by this jurisdiction. Type NM or UF cable may be used, or wiring may be run in metallic or nonmetallic conduit systems.

Electrical boxes shall be securely attached to wooden stakes driven a minimum of 12 inches into the bales, or an acceptable equivalent.

Section 105.7.11 Plumbing. Water or gas pipes within bale walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall. Where pipes are mounted on bale walls, they shall be isolated from the bales by a moisture barrier.

Section 106 Privacy/Landscape Walls

Section 106.1 General. This section covers freestanding or attached bale privacy or landscape walls, not exceeding 6 feet in height, from final grade to top of wall. Bales may be stacked either flat or on- edge. Alternate methods, other than those listed in this section, may be approved by the building official.

Section 106.2 Foundations. The minimum foundation shall consist of an 8 inch thick reinforced concrete stem wall, over an approved footing. Minimum width of the stem wall shall be equal to the width of the bottom bale. Stem walls shall have continuous horizontal reinforcement consisting of two #4 bars with 24 inches minimum lap at splices.

Section 106.2.1 Reinforcement. Vertical reinforcing bars, a minimum 3/8" in diameter, shall be placed in the center of the stem wall, two per bale, and extend up a minimum of 24 inches, and be embedded a minimum of 4 inches into the concrete stem wall. Bales shall be pinned, using two 3/8" diameter bars per bale, and use pins long enough to provide at least one vertical bar from stem wall to top of wall, with a minimum of one full bale overlap where not continuous.

For the purpose of attaching stucco mesh to the wall, 12d or larger galvanized common double-headed nails shall be embedded in the concrete a minimum of 1 inch below the top of the stem wall, with the heads embedded a minimum of 2 inches into the concrete, and the points extending a minimum of 3/4" from the face of the stem wall, and spaced a minimum of 6" on center on both sides of the wall.

Section 106.2.2 Moisture Barrier. A moisture barrier shall be used between the top of the stem wall and the first course of bales. A moisture barrier shall also be used to protect the tops of bales at the top of walls, and shall extend 6 inches down on either side of the wall.

Section 106.2.3 Stucco Mesh. Stucco mesh, 20 gauge or heavier, shall be attached by means of clinching the embedded nails on one side of the wall, stretching a continuous piece of netting tightly over the top of the wall, and fastening the netting in the same manner on the opposite side of the wall.

Section 106.2.4 Wall Finish. Walls shall be finished with cement stucco, or stabilized mud plaster, with a minimum thickness of7/8".

To: Southwest Gas Corporation
From: _____ (Town, City or County Name)
Date: _____
Subject: House-line permitting and inspections

The _____ (Town, City or County) of _____ (Name) agrees to allow Southwest Gas Corporation and/or its contractors to extend above ground, external house-lines up to a maximum of twenty feet (20', one length of pipe with no elbows or couplings) without the need of permits or inspections - when conditions make it necessary to relocate company facilities. Southwest Gas Corporation or its contractors will not alter or make repairs to any other portion of the existing house-line without first obtaining a permit and inspection. A meter clock test or drop test will be performed on the customer's house-line and liquid leak detector (soap) will be used on all visible connections.

Southwest Gas Corporation will extend house-lines up to a maximum of twenty feet (20', one length of pipe with no elbows or couplings), without permits and inspections, only when the company generates the need. When the customer generates the need, Southwest Gas Corporation will follow the normal permitting and inspection process.

Brief Summary

Date: 11/2/2012
Agency: Registrar of Contractors
Contact: Tyler Palmer, Chief of Staff
Re: Notice of Proposed Rulemaking for Solar Contractor Licenses, R4-9-102, 103, 104

Why this rulemaking is necessary:

This rulemaking is in response to a 5-year review report on Title 4, Chapter 9, approved by the Governor's Regulatory Review Council on March 6, 2012. In the 5-year review report, the Registrar committed to amending these rules. Many contractors have expressed confusion at the existing outdated patchwork of rules regarding solar licenses. The Registrar is seeking an exception from the rule moratorium to draft rules pertaining to solar licenses consistent with and as required by A.R.S. § 32-1170.02(C), A.R.S. § 32-1104(A)(5), and A.R.S. § 44-1762(B).

Background:

As we know, the solar construction industry has grown immensely during the past few years. Unfortunately, the rules regarding solar contracting haven't changed for more than 10 years. The result is solar contractors trying to put their square peg of 2012 into the round hole of 1998. This burden on the industry can be reduced by updating the rules to be more consistent with the current needs of the industry.

Key Changes:

The Notice of Proposed Rulemaking for Title 4, Chapter 9, Article 1 proposes the following three changes.

1) The classification of contractor licenses, such as; general contractor, plumber, electrician, is established in rule. A.R.S. § 32-1170.02(C) instructs the agency to "mark or supplement" licenses of contractors who qualify as a solar contractor. Current rules do not allow for marking or supplementing existing license classifications for solar contractors. In contrast, current rules establish a patchwork of specific license classifications authorized to perform solar. For example, a "Plumbing" license cannot perform solar, but a "Plumbing, Including Solar" license can. Compare this to the "Electrical" license which can perform solar without the existence of a separate "Electrical, Including Solar" license. Neither of these licensing classifications is consistent with the above mentioned statute, which requires the license of a successful applicant to be "marked or supplemented." The agency seeks to update the rules regarding solar licenses to be consistent with statute by (a) establishing the means to "mark or supplement" contractor licenses for qualified solar contractors and (b) repealing the existing conflicting rules.
2) A.R.S. § 32-1104(A)(5) requires the agency to "…make rules…that include the adoption of minimum standards…" At this time, the agency has not adopted rules for minimum solar construction standards. Over the past year, the agency has worked with representatives from APS, SRP, TEP, Cities, Counties, and numerous solar contractors to draft these proposed minimum standards. Without minimum standards, the consumer doesn't know what to expect and the contractor doesn't know what will be required if a complaint is filed with the ROC. It could be argued that any enforcement of standards is unknown and is therefore arbitrary. The agency seeks to comply with this statutory requirement to establish rules for minimum construction standards.
3) A.R.S. § 44-1762(B) requires the agency to "adopt rules governing the readability and understandability" of a solar energy device warranty. At this time, the agency has not adopted any such rule. The agency seeks to comply with this statutory requirement.

MAG Standard for Installation of Residential Dryer Vents
February 19, 2004

International Residential Code Section M1501.3 Length limitation states:

"The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet (7620 mm) from the dryer location to the wall or roof termination. The maximum length of the duct shall be reduced 2.5 feet (762 mm) for each 45-degree (0.79 rad) bend and 5 feet (1524 mm) for each 90-degree (1.6 rad) bend. The maximum length of the exhaust duct does not include the transition duct.

> **Exception**: Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the building official, the maximum length of the exhaust, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions."

Since it is not possible to know what dryer make and model will be installed by subsequent building occupants and the intent of the code is to ensure a safe installation, a placard will be required on all installations that do not meet the 25-foot length with reductions.

A durable placard, at least 3 inches vertically and 4 inches horizontally, shall be permanently affixed near the dryer and contain the following message:

WARNING
DO NOT REMOVE

THE DRYER DUCT EXCEEDS THE LENGTH PRESCRIPTIVELY ALLOWED BY THE CODE. ALL DOMESTIC DRYERS INSTALLED AT THIS LOCATION SHALL BE MANUFACTURER APPROVED (UL LISTED) FOR CONNECTION TO AN EXHAUST DUCT THAT IS

	WITH		&	
FEET OR GREATER		90° ELBOWS		45° ELBOWS

Uniform Requirement of Pad Certifications per IRC R401.2

November 30, 2004

Whereas, the requirements of the 2003 IRC Section R401.2, states "Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice."

Upon completion of the soils investigation the testing agency may include an expiration date for pad certifications.

As local jurisdictions are unable to verify if the original pad certification is still current, each builder shall provide a current pad certification for all single-family lots in tract subdivisions at the time of the footing inspection.

Uniform Requirement of Weep Screed per IRC R703.6.2.1

November 30, 2004

Whereas, the requirements of the 2003 IRC Section R703.6.2.1, states "The weep screed shall be placed a minimum of 4 inches (102mm) above the earth or 2 inches (51 mm) above paved areas and shall be of a type that will allow trapped water to drain to the exterior of the building."

The clearance required above the paved areas cannot be maintained when the Builder provides a no step entry.

It is the purpose of this code section to allow excess moisture inside the wall to drain to the exterior of the building. As an alternate method, the installation of a deco drain directly below the weep screed meets this requirement.

Resolution

WHEREAS The Maricopa Association of Governments Building Codes Committee (heretofore referred to as the "Committee") approved the amendments to the 2002 edition of the National Electrical Code (heretofore referred to as the "Code") with the intent to promote and present a uniform set of electrical codes and amendments for jurisdictions within Maricopa County AND;

WHEREAS Sections 312.5 and 314.17 of the 2002 NEC (E3807.7 and E3806.1.1 of the 2003 IRC), that addresses cabinets, boxes and conduit bodies and the entry of said cabinets, boxes and conduit bodies by cables and conduit, have been in existence for at least two code cycles and requires the enclosure of openings through which cables enter a cabinet, box or conduit body, requires that nonmetallic cables be permitted to enter the top of a surface mounted enclosure only and that the nonmetallic cable be protected at points of entry into a cabinet, box, or conduit body from damage and abrasion, where cables are used, each cable shall be secured to the cabinet, cutout box or meter socket enclosure and has been largely ignored by installers and enforcers in the State of Arizona to this point in time AND;

WHEREAS a code change proposal has been submitted to the Code Making Panel of NFPA to validate the method of installation traditionally occurring in this region AND;

WHEREAS that code change proposal, 9-12 Log #463, was rejected by the Code Making Panel; AND

WHEREAS the immediate and strict adherence to and enforcement of in their entirety Sections 312.5 and 314.17 of the 2002 NEC (E3807.7 and E3806.1.1 of the 2003 IRC) would pose a change in standard practice in this region and both industry and the enforcement community would benefit from a "phase-in" or transition period;

BE IT SO RESOLVED by the Committee that Sections 312.5 and 314.17 of the 2002 NEC (E3807.7 and E3806.1.1 of the 2003 IRC) shall be enforced in their entirety so that each cable will be secured to the cabinet, cutout box or meter socket enclosure where it enters. This resolution shall have an effective date of December 1, 2005.

Exhibit A

Reference the 2002 National Electrical Code and replace the first paragraph with the following (The remainder of Section 312.5 to remain the same)

312.5 Cabinets, Cutout Boxes, and Meter Socket Enclosures. Conductors entering enclosures within the scope of this article shall be protected from abrasion and shall comply with 312.5(A) through (C).

Exception: For one- and two-family dwellings, cables with entirely non metallic sheaths shall be permitted to enter the back of a surface-mounted enclosure through one or more nonflexible raceways not more than 75 mm (3 in.) in diameter, and not less than 75 mm (3 in.) and not more than 600 mm (24 in.) in length, provided all of the following conditions are met:

A. Each cable is fastened within 200 mm (8 in.), measured along the sheath of the outer end of the raceway.
B. The raceway extends directly into an enclosed wall space.

C. A fitting is provided on each end of the raceway to protect the cable(s) from abrasion.
D. The raceway is sealed or plugged using approved means so as to prevent access to the enclosure through the raceway.
E. The cable sheath is continuous through the raceway and extends into the enclosure beyond the fitting not less than 50 mm (2 in.).
F. The raceway, if greater than 305 mm (12 in.) is fastened at its outer end in accordance with the applicable article.
G. The raceway shall be permitted to be filled to 60 percent of its total cross sectional area, and 310.15(B)(2)(a) adjustment factors need not apply to this condition.

Maricopa Association of Governments Building Codes Committee Resolution
Storage Space Lighting

WHEREAS The Maricopa Association of Governments Building Codes Committee (hereafter referred to as the "Committee") has reviewed the 2003 and 2006 editions of the International Residential Code and the 2002 and 2005 editions of the National Electrical Code (hereafter collectively referred to as the "Code") with the intent to promote and present uniform guidance for the installation of Luminaires in storage spaces located under stairs for jurisdictions within Maricopa County; AND

WHEREAS the storage or equipment spaces that are located underfloor or in attics would require lighting fixtures and shall be installed based on IRC E3803.4; AND

WHEREAS, some MAG jurisdictions have interpreted that under-stair spaces are to be considered as "underfloor" spaces and have required the installation of luminaires in such locations; AND

WHEREAS the committee has researched and discussed this issue and determined that the intent of the code is to require luminaires in storage spaces that are truly underfloor, namely crawl spaces only; AND

BE IT SO RESOLVED by the Committee that storage space located under stairs not be considered as underfloor spaces requiring lighting for the sake of consistency throughout Maricopa County. This resolution shall have an effective date of July 1, 2006.

Arizona Residential Post-Tensioned Round Table
Recommendations for Standards of Construction and Design #1

1/16/2008

Special Inspection

The requirements for special inspection of concrete construction are provided in the 2003 International Building Code (IBC), Section 1704.4. Table 1704.4 lists 10 different inspection items for concrete construction. Six of the items (numbers 1, 4, 5, 6, 8, and 10) could be applied to post-tensioned slabs on ground. The Arizona Residential Post-Tensioned Round Table makes the following recommendations for special inspections of residential post-tensioned slabs-on-ground:

1. Inspection of reinforcing steel, including pre-stressing tendons and placement, shall occur prior to slab pour.

4. Verifying use of required design mix shall occur periodically.

5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump tests, and determine the temperature of the concrete.

6. Inspection of concrete placement for property application and techniques shall occur for the full duration of concrete placement.

8. Verification of pre-stressing forces shall occur at the time of pre-stress application.

10. Prior to stressing of tendons in post-tensioned concrete, periodic verification of in –situ strength shall be performed per ACI 228.

The recommendations listed above satisfy the intent of the code.

Please see Appendix A for Table 1704.4

Table 1704.4
Required Verification and Inspection of Concrete Construction

Verification and Inspection	Continuous	Periodic	Referenced Standard	IBC Reference
1. Inspection of reinforcing steel, including pre-stressing tendons, and placement	-	X	ACI 318: 3.5, 7.1-7.7	1903.5, 1907.1, 1907.7, 1914.4
2. Inspection of reinforcing steel welding in accordance with Table 1704.3 Item 5B	-	-	AWS D1.4 ACI 318: 3.5.2	1903.5.2
3. Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased	X	-	-	1912.5
4. Verifying use of required design mix	-	X	ACI 318: Ch. 4, 5.2 – 5.4	1904, 1905.2-1905.4, 1914.2, 1914.3
5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	X	-	ASTM C 172 ASTM C 31 ACI 318: 5.6, 5.8	1905.6, 1914.10
6. Inspection of concrete and shotcrete placement for proper application techniques	X	-	ACI 318: 5.9, 5.10	1905.9, 1905.10, 1914.6, 1914.7, 1914.8
7. Inspection for maintenance of specified curing temperature and techniques	-	X	ACI 318: 5.11 – 5.13	1905.11, 1905.13, 1914.9
8. Inspection of pre-stressed concrete: a. Application of pre-stressing forces b. Grouting of bonded pre-stressing tendons in the seismic-force-resisting system	 X X	-	 ACI 318: 18.20 ACI 318: 18.18.4	-
9. Erection of precast concrete members	-	X	ACI 318: Ch. 16	-
10. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs	-	X	ACI 318: 6.2	1906.2

Arizona Residential Post-Tensioned Round Table
Recommendations for Standards of Construction and Design #2

1/16/2008

Evaluation and Acceptance of Concrete

The requirements for evaluation and acceptance of concrete are provided in the 2003 International Building Code (IBC) Section 1905.6. There are no exceptions to these provisions. The Arizona Residential Post-Tensioned Round Table makes the following recommendations for evaluation and acceptance of concrete for residential post-tensioned slabs on ground.

Because of the large variations in slab thickness, slab size, and scheduling of pours, the Arizona Residential Post-Tensioned Round Table recommends that cylinders be taken on every lot. This would satisfy the intent of the code and provide consistent documentation for the structural engineers and building officials.

It is recommended that a minimum of four cylinders be cast as a strength sampling for each lot: one cylinder for early strength testing, two cylinders to verify *f'c* (1905.2.4), one cylinder for a 56 day strength break if required.

Please see Appendix A for further information.

Code Reference: IBC 2003 Section 1905.6.2 Frequency of Testing

The frequency of conducting strength tests of concrete shall be as specified in Section 1905.6.2.1 through 1905.6.2.4

1905.6.2.1 Minimum Frequency
Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5,000 square feet of surface area for slabs or walls.

1905.6.2.2 Minimum Number
On a given project, if the total volume of concrete is such that the frequency of testing required by Section 1905.6.2.1 would provide less than 5 strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

1905.2.3 Small Volume
When the total volume of a given class of concrete is less than 50 cubic yards, strength tests are not required when evidence of satisfactory strength is submitted to and approved by the building official.

1905.2.4 Strength Test
A strength test shall be the average of the strength of two cylinders made from the same sample of concrete and tested at 28 days or at the test age designated for the determination of *f'c*.

The parameters stated in 1905.6.2.1 are very specific. We have observed that PT slabs vary in thickness from 6" to 10". For an average 1,800 square foot house, the concrete yardage could vary from 34 cubic yards for a 6" thick slab to 56 cubic yards for a 10" thick slab. In the large home communities with an average 2,500 square foot house, the range could be between 46 and 78 cubic yards. It is not uncommon to see houses on the same tract with different slab thicknesses as well as large variations in square footage. There are larger slabs that require over 120 cubic yards of concrete due to size and thickness.

The requirement states in 1905.6.2.1 that cylinders must be taken at least once a day, or every 150 yards or every 5,000 square feet. Collecting all of the information to meet these three criteria with the wide variety of design specifications, variety of sizes of slabs in a given subdivision and the imprecise nature of pour schedules creates considerable tracking issues. It is the position of the Arizona Residential Post-Tensioned Round Table that cylinders are taken on every lot. This procedure ensures that a record of concrete strength is provided for each post-tensioned slab and satisfies the intent of the code.

REF #	MEETING DATE	CODE AFFECTED	CODE YEAR	SECTIONS	BRIEF DESCRIPTION	Have Doc	Include As Is	Needs Update	Hist	For Review	Tabled to 11/14
1	4/22/1992	UPC	1991	N/A	A motion was passed to approve amendments to the 1991 UPC that were developed by the MAG Plumbing and Mechanical Working Group.	No			3/21		
2	1/27/1993	N/A	N/A	N/A	A motion was passed to approve a One Coat Stucco Compliance Program For MAG Member Agencies.	Yes			3/21		
3	5/19/1993	UMC	1991	N/A	A motion was passed to approve amendments to the 1991 UMC that were developed by the MAG Plumbing and Mechanical Working Group.	No			3/21		
4	5/24/1995	UBC	1994	N/A	A motion was passed approving the MAG Special Inspections Standards Manual.	Yes		3/21		11/14	
5	6/21/1995	N/A	N/A	N/A	A motion was passed stating that the Committee supports uniform reporting of information to the County Assessor as opposed to all member agencies using a uniform permitting process.	Yes			3/21		
6	4/17/1996	UBC	1994	Chapter 12	A motion was passed adopting a Model Sound Attenuation Ordinance for New Residential Construction as a MAG Standard.	Yes	3/21				
7	4/17/1996	NEC	1993	N/A	A motion was passed stating that utility companies installing lighting on private property will be subject to all MAG member agency code requirements including permits, and inspection. Management Committee supported this action on May 15, 1996 and the Regional Council supported the action on May 29, 1996.	Yes					9/19
8	10/22/1997	N/A	N/A	N/A	A motion was passed adopting MAG Model Standards for fireplaces, wood stoves or other solid fuel burning devices.	Yes	6/20				
9	10/21/1998	UBC	1997	2343.6	A motion was passed to approve the plastic tag identified at the meeting for use in marking trusses and that a committee be established to address future markings of tags. It was also noted that the Wood Truss Council of America would make the tags available.	No			6/20		
10	2/17/1999	UBC	1997	N/A	A motion was passed adopting the Pima County Standard on Strawbale Construction as a MAG standard without amending it.	Yes					9/19
11	4/19/2000	UBC	1997	2343.6	A motion was passed to approve a standard for the marking of trusses developed by the MAG Building Inspector/Plan Examiner Group.	Yes			6/20		
12	11/1/2000	UBC	1997	Chapter 11	A motion was passed to recommend compliance with the accessibility standards in the Fair Housing Act or 1997 UBC Chapter 11 either by ordinance or through the alternate design methods section of the Uniform Building Code.	Yes			5/16		
13	5/16/2001	UMC	1997	> 307.5.2	A motion was passed to approve an interpretation of the 1997 UMC that either the use of permanently installed railings on the roof, or one side railing extension would meet the intent of the code for roof access.	Yes			5/16		
14	9/12/2001	UBC	1997	Section 2306.4	A motion was passed to require pressure treated sill plates in both interior and exterior applications as required by UBC Section 2306.4	Yes			5/16		
15	11/14/2001	IRC	2000	Table R301.2 (1)	A motion was passed recommending the use of Table R 301.2 (1) with the following assumed values: Ground Snow Load: 0 psi; Wind Speed: 90 mph; Seismic Design Category: B; Weathering: NEGLIGIBLE; Frost Line Depth: 12"; Termite: Moderate to Heavy; Decay: None to slight; Winter Design Temperature: 34 degrees F; Flood Hazards: Jurisdiction Specific, as a MAG Standard. (The Winter Design Temperature was updated January 16, 2002 from 27 degrees to 34)	Yes		5/16			
16	2/20/2002	N/A	N/A	N/A	A motion was passed to accept standard language of an agreement authorizing Southwest Gas to relocate a gas line without permit or clearance requirement.	Yes		5/16		11/14	
17	3/20/2002	IRC	2000	Chapter 11	A motion was passed adopting a proposal that explains alternatives for complying with Chapter 11 of the IRC, the Energy Chapter.	Yes			5/16		

REF #	MEETING DATE	CODE AFFECTED	CODE YEAR	SECTIONS	BRIEF DESCRIPTION	Have Doc	Include As Is	Needs Update	Hist	For Review	Tabled to 11/14
18	3/20/2002	IMC	2000	Section 403.3	A motion was passed approving a resolution which stated "The MAG Building Codes Committee recognizes that the exception clause in the International Mechanical Code section 403.3 may be used in evaluating the outdoor ventilation air requirements for schools".	Yes			5/16		
19	5/15/2002	NEC	1999	Article 690	A motion was passed to approving the permit requirements for Commercial Solar Photovoltaic (PV) Installations.	Yes					9/19
20	5/15/2002	NEC	1999	Article 690	A motion was passed approving permit requirements for Residential Solar Photovoltaic (PV) Installations.	Yes					9/19
21	10/16/2002	IBC, IRC, IMC	2000	N/A	A motion was passed adopting the AZBO Code Review & Development Committee Report of Final Actions 2001-2002, dated July 15 2002, as MAG amendments.	Yes			5/16		
22	1/15/2003	IBC, IRC	2000	1202.2, R806	A motion was passed accepting the following statement, "Due to the climatic conditions in our area and recent research into the field of energy conservation, the Maricopa Association of Governments Building Codes Committee recognizes that there are circumstances and methods that allow the use of ventless attics. This recognition would encourage member jurisdictions to look at those circumstances and those methods with the goal of energy conversation in mind".	Yes			5/16		
23	4/16/2003			N/A	A motion was passed requiring a permit for Solar Water Heater Systems as a standard.	Yes	5/16				
24	5/21/2003	IRC	2000	R602.8.1.2	A motion was passed to disallow the use of foam products for fireblocking, unless they are listed as firestop material. Field testing found that foam products that were often used for fireblocking were in fact flammable.	Yes		6/20			
25	5/21/2003	I Codes	2003	N/A	A motion was passed stating that all member agencies should strive to use the 2003 International Codes with a goal of an effective date of July 2004.	No			5/16		
26	10/14/2003	N/A	N/A	N/A	A motion was passed adopting recommendations for Post-Tension Slab construction.	Yes	6/20				
27	10/14/2003	N/A	N/A	N/A	A motion was passed adopting a MAG standard that would require the attachment of a label to a dryer that informs consumers of changes or exceptions to the code that have been allowed for the installation of the dryer.	Yes		6/20		11/14	
28	11/19/2003	I Codes	2000	N/A	A motion was passed adopting the AZBO Code Review & Development Committee proposed amendments to the 2000 codes updated to the 2003 ICC codes.	Yes			6/20		
29	3/17/2004	NEC	2002	N/A	A motion was passed accepting the AZBO 2002 NEC Amendment Packet.	Yes			6/20		
30	8/18/2004	N/A	N/A	N/A	A motion was passed to adopt an interpretation allowing for the temporary use of Port-A-John, among other things, in order to meet ADA requirements in a case were a sales office or model home in a subdivision would ultimately become sold to a homeowner.	Yes	6/20				
31	12/16/2004	IRC	2003	R401.2	A motion was passed requiring that each builder provide a current pad certification report for all single family lots, in tract subdivisions, at the time of footing inspection.	Yes		6/20		11/14	
32	12/16/2004	IRC	2003	R703.6.2.1	A motion was passed to allow the installation of deco drain directly below the weep screed as an alternate method of allowing excess moisture inside the wall to drain to the exterior of the building. If the patio is integral to the post tension slab, this alternative method would not be acceptable.	Yes		6/20		11/14	
33	11/19/2005	NEC	2002	312.5; 314.17	A motion was passed that approved amendments to the 2002 National Electric Code that allows cable attachment outside an SES under certain circumstances that are specifically addressed in Exhibit “A.”	Yes		6/20		11/14	

REF #	MEETING DATE	CODE AFFECTED	CODE YEAR	SECTIONS	BRIEF DESCRIPTION	Have Doc	Include As Is	Needs Update	Hist	For Review	Tabled to 11/14
34	6/21/2006	IRC & NEC	2003 and 2006; 2002 and 2005	IRC E3803.4	A motion was passed to establish that storage space located under stairs not be considered as underfloor spaces requiring lighting for the sake of consistency throughout Maricopa County.	Yes		6/20		11/14	
35	6/21/2006	UBC or IBC	1997 UBC or any edition of the IBC	N/A	A motion was passed that member jurisdictions will recognize and accept the City of Phoenix Approved Structural Steel Fabricators program and list as meeting the special structural inspections alternatives for structural steel fabricated by an approved fabricator as allowed in the building codes.	Yes	6/20				
36	11/21/2006	IBC, IRC, IGC, IMC, IPC	2006	N/A	A motion was passed recommending the AZBO Code Review & Development Committee proposed amendments to the 2006 ICC codes be forwarded to the MAG member agencies for their consideration.	Yes			6/20		
37	1/16/2008	IBC	2003	1704.4 1905.6	A motion was passed to accept the recommendations made by the Arizona Residential Post-Tensioned Round Table (ARPTRT) so that all MAG member agencies have the same standards for inspection, evaluation and acceptance of the concrete pour for residential post-tensioned slabs-on-ground.	Yes		6/20		11/14	
38	6/18/2008	IRC supplement	2007	R301.3 Story height R602.10.4 Wall bracing	A motion was passed that the committee generally supports the 2007 supplement to the IRC for story height and wall bracing requirements.	Yes	6/20				
39	11/19/2008	I-Codes	2009	N/A	A motion was made to recommend that each jurisdiction consider adopting the 2009 family of I-codes as published by the International Code Council (ICC).	No			6/20		
	8/15/2012				9.5 Course Wall Details Exposure B and C	Yes	8/15				

MAG BUILDING CODES COMMITTEE MEMBERSHIP AS OF 11/6/2012

Voting Members				
Name	**Representing**	**Telephone #**	**Fax #**	**E-mail Address**
Michael Williams (Chair)	Tempe	480-350-8670	480-350-8677	michael_williams@tempe.gov
Mary Dickson (Vice Chair)	El Mirage	623-876-2932	623-876-4607	mdickson@cityofelmirage.org
Randal Westacott	Avondale	623-333-4026	623-333-0400	rwestacott@avondale.org
Phil Marcotte	Buckeye	623-349-6200	623-349-6221	pmarcotte@buckeyeaz.gov
Mike Tibbett	Carefree	480-488-1471	480-488-3845	mike@carefree.org
Mike Baxley	Cave Creek	480-488-6637	480-488-2263	mbaxley@cavecreek.org
Martin Perez	Chandler	480-782-3109	480-782-3110	martin.perez@chandleraz.gov
Jason Field	Fountain Hills	480-816-5127	480-837-3145	jfield@fh.az.gov
Larry Taylor	Gilbert	480-503-6958	480-497-4923	larry.taylor@gilbertaz.gov
Tom Paradise	Glendale	623-930-3143	623-915-2695	tparadise@glendaleaz.com
Ed Kulik	Goodyear	623-882-7932	623-882-7114	ekulik@goodyearaz.gov
Chuck Ransom	Litchfield Park	623-935-1066	623-535-9754	cransom@litchfield-park.org
Tom Ewers	Maricopa County	602-506-7145	602-506-3282	tomewers@mail.maricopa.gov
Steven Hether	Mesa	480-644-2039	480-644-4900	steve.hether@mesaaz.gov
Bob Lee	Paradise Valley	480-348-3631	480-951-3751	rlee@paradisevalleyaz.gov
Dennis Marks	Peoria	623-773-7232	623-773-7233	dennis.marks@peoriaaz.gov
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VACANT	Queen Creek			
Michael Clack	Scottsdale	480-312-7629	480-312-9029	mclack@scottsdaleaz.gov
VACANT	Surprise			
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Jim Fox	Youngtown	623-933-8286 x117	623-209-3026	jfox@youngtownaz.org

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(T) Temporary

Survey of Code Adoption

Jurisdiction	Building	Mechanical	Plumbing	Electric	Residential	Fire	Energy	Existing Building Code	Fuel Gas	Performance	Green Construction	Notes	URL	Anticipated Adopted Date by Council	Anticipated Effective Date for 2009 or 2012 ICC Codes (Month and Year)
Apache Junction	2006 IBC	2006 IMC	1994 UPC	2005 NEC	2006 IRC	2006 IFC							Apache Junction		
Avondale	2009 IBC	2009 IMC	2009 IPC	2008 NEC	2009 IRC	2003 IFC	2009 IECC		2009 IFGC				Avondale	January 2013	Plan to adopt 2012 codes effective 7/1/13
Buckeye	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC		2006 IFGC				Buckeye		No plans to adopt 2009 codes.
Carefree	2003 IBC	2003 IMC	1994 UPC	2002 NEC	2003 IRC	2003 IFC						Effective July 1, 2006	Carefree		Not going to adopt, staying with 2003.
Cave Creek	2009 IBC	2009 IMC	2009 IPC	2008 NEC	2009 IRC	2009 IFC	2009 IECC	2009 IEBC	2009 IFGC			Effective January 1, 2012	Cave Creek	11/21/2011	
Chandler	2009 IBC	2009 IMC	2009 IPC	2008 NEC	2009 IRC	2006 IFC	2009 IECC	2009 IEBC	2009 IFGC			Effective July 1, 2011	Chandler		
El Mirage	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC	2006 IEBC	2006 IFGC			1997 ICC/ANSI Accessibility Code with Arizonans with Disabilities Act.	El Mirage	January/February 2010	
Fountain Hills	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC					Codes adopted April 17, 2008 with town amendments available on Web site.	Fountain Hills		No plans to adopt 2009 codes.
Gila Bend	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC							Gila Bend		
Gila River	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2003 IFC	None						Gila River		
Gilbert	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC		2006 IFGC			ADAAG per state requirements	Gilbert	No date	No plans to adopt 2009 codes.
Glendale	2006 IBC	2006 IMC	2006 UPC	2005 NEC	2006 IRC	2009 IFC		2006 IEBC				With city amendments. Effective Sept. 1, 2007	Glendale	No date	No date
Goodyear	2006 IBC	2006 IMC	1994 UPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC					Adopted 5-14-2007.	Goodyear		
Guadalupe	1997 UBC	1997 UMC	1994 UPC	1999 NEC	1997 UBC	1997 UFC							Guadalupe		
Litchfield Park	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2003 IFC	2006 IECC		2006 IFGC			Codes effective July 1, 2008	Litchfield Park		
Maricopa County	2009 IBC	2009 IMC	2009 IPC	2008 NEC	2009 IRC				2009 IFGC			WITH MAG/AZBO AMENDMENTS	Maricopa County	Adopted August 18, 2010	Effective date of 10-1-10, w/ grace period to 1-1-11.
Mesa	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2009 IECC (Effective 1/3/12)	2006 IEBC	2006 IFGC				Mesa		
Paradise Valley	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC		2006 IFGC				Paradise Valley		Will update to 2012 codes effective October 1, 2012
Peoria	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC			2006 IFGC			Adopted 2012 IPMC, 2012 IECC, effective 5/1/13, not IFC	Peoria	Adopted 5/1/2012	Adopted 2012 codes, effective 5/1/13
Phoenix	2006 IBC	2006 IMC	2006 UPC	2008 NEC	2006 IRC	2006 IFC w/ Amendments	2006 IECC	2006 IEBC	2006 IFGC	2006 ICCP for Buildings and Facilities	IGCC Public Version 2	Effective July 2, 2008	Phoenix		Discussing 2012 ICC, anticipated July 2013
Queen Creek	2006 IBC	2006 IMC	2006 UPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC	2006 IEBC				Effective Aug. 7, 2008	Queen Creek		No plans to adopt 2009 codes.
Salt River	2003 IBC	2003 IMC	2003 UPC	2002 NEC	2003 IRC	2003 IFC	None						Salt River		
Scottsdale	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC	2006 IECC				IGCC Public Version 2	Effective Sep. 1, 2007, except IPC June 30, 2008	Scottsdale	January/February 2010	July 2010

Survey of Code Adoption

Jurisdiction	Building	Mechanical	Plumbing	Electric	Residential	Fire	Energy	Existing Building Code	Fuel Gas	Performance	Green Construction	Notes	URL	Anticipated Adopted Date by Council	Anticipated Effective Date for 2009 or 2012 ICC Codes (Month and Year)
Surprise	2006 IBC	2006 IMC	2006 IPC	2006 IEC w/ 2005 NEC	2006 IRC	2006 IFC	2006 IECC	2006 IEBC	2006 IFGC			Adopted June 28, 2007	Surprise	January 2010	July 2010
Tempe	2009 IBC	2009 IMC	2009 IPC	2008 NEC	2009 IRC	2006 IFC	2009 IECC	2009 IEBC	2009 IFGC				Tempe		October 24, 2011
Tolleson	2006 IBC	2006 IMC	2006 IPC	2005 NEC w/ 2006 IEC	2006 IRC	2006 IFC	2006 IECC					2006 Fuel Gas Code, 2006 IPMC, 2006 NEAC. Adopted 2/20/07, effective 7/1/07.	Tolleson	January/February 2010	July 2010
Wickenburg	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2003 IFC	2006 IECC	2006 IEBC	2006 IFGC				Wickenburg		No plans to adopt 2009 codes.
Youngtown	2006 IBC	2006 IMC	2006 IPC	2005 NEC	2006 IRC	2006 IFC			2006 IFGC				Youngtown	November 2010	January 2011

This is intended to be used as a guide for the selected codes, as to what member agencies have adopted or intend to adopt.

Last updated September 24, 2012 by Scott Wilken, MAG
Source: MAG Building Codes Committee Members