THE CASBA JOURNAL

NEWSLETTER OF THE CALIFORNIA STRAW BUILDING ASSOCIATION

CASBA: A NON-PROFIT PROJECT OF THE TIDES CENTER - JULY 2011

Darcey Donovan, this year's Traveling Straw Dog, marking cracks during one of PAKSBAB's seismic research project wall tests at the University of Nevada Reno.

IN THIS ISSUE:

Darcey Donovan Receives the 2011 Traveling Straw Dog Award

The CASBA Traveling Straw Dog Award is given each year in recognition of "services above and beyond the call of duty in the furthering of straw building in California." Last year's recipient, Daniel Smith, chose Darcey Donovan to receive this year's award for her years of devoted work and service to the straw building community.

Darcey, a California licensed professional engineer, designs and engineers straw bale buildings through her private practice EcoEngineering in Truckee, CA. She served on the CASBA Advisory Board from 2005-2009, worked with the Detail Update Committee for three years, and has donated her structural engineering services to CASBA workshops.

Darcey has also been instrumental in bringing straw bale construction to earthquake-affected Pakistan. Darcey is a founder and the C.E.O. of Pakistan Straw Bale and Appropriate Building (PAKSBAB), whose mission is to apply straw bale and other appropriate building solutions to protect and improve the lives of the poor, especially in seismic and severe temperature regions of the developing world. To date, PAKSBAB has constructed 25 load-bearing straw bale houses in northern Pakistan.

In March of 2009, PAKSBAB performed the first shake table simulations of a straw bale house, which provided convincing evidence that straw bale construction is extremely earthquake resistant. The tests were conducted at the Network for Earthquake Engineering Simulation facility at the University of Nevada, Reno, with funding support from the Earthquake Engineering Research Institute. The full-scale 14' x 14' x 10' house was subjected to a series of eight simulated earthquakes of increasing intensity. It survived twice the ground motion of the Northridge Earthquake Canoga Park record and peak accelerations of 0.8g. More information and a video of the shake table tests are available on PAKSBAB's website at www.paksbab.org.

- NOTES FROM CASBA CENTRAL -

Well, summer has finally arrived with a bang: this is when we realize what a wonderful job our straw bale walls do insulating us from the heat and making our living spaces comfortable without expending lots of dollars on machines to keep us cool and happy. What a delight it is to walk in from 95 degrees or so into a 70ish degree space, so refreshing and recharging.

And that is what CASBA needs: a recharge. It seems as though the economy is slowly draining people of the energy and/or wherewithal to actively participate in promoting building with bales. We still have a wonderful core of strong, interesting people as members but maybe it's time for a jump-start. How do we continue to be the leading association in this country (and probably the leader in other countries) as well?

We are truly fortunate to have a dedicated group of members who have been working diligently on our revision and update of the Detail Book. Without the steadfast efforts of Jim Reiland and Joy Rogalla and the support of a group of architects and engineers, this project would probably have died on the vine a year or so ago. It is only because of the hard work of this dedicated group of volunteers that it didn't happen and we all owe them a huge debt of gratitude and thanks. And a special thanks to John Swearingen for opening up his office to the "revisionist" group.

While CASBA membership numbers have dropped from previous highs, we know that the spirit and heart that brought each member to CASBA is still out there. Like many organizations are realizing, this slow down could be the perfect time to reinvent, recommit, re-energize and revitalize the organization. But for that effort we **earnestly need your energy, support and help** to make certain that CASBA not only survives this slow period, but that it becomes an even stronger advocate for using renewable materials such as straw bales to create a better environment and raise awareness by teaching and talking to anyone who will listen.

Thank you for you help this year. Thank you for working to ensure that CASBA remains a strong, viable organization and that CASBA members always have a family of like-minded individuals on whom they can depend. **And now we are depending on you to engage in the process of recharging CASBA.**

Maybe we should have a Fall pow wow, not a conference, just a gathering of the clan to talk, eat, have a little fun and re-connect. The place and time is open. For the ease of attending, maybe we should shoot for somewhere in Central California? Let us have your thoughts (mbennjr@mac.com).

~ Maurice Bennett

Note: The Mother Earth News Fair that was to be held in San Rafael this summer was cancelled due to low ticket sales. CASBA had been working with the organizers and was planning on having a booth and display at the fair. We extend our thanks to Kathy Gregor for the time she spent pursuing this. If you know of other events that CASBA should be involved in, let Joy & Maurice know.

CALIFORNIA STRAW BUILDING ASSOCIATION
WORKSHOP EVENTS 2011

upcoming workshops:

Introduction to Straw Building Part 2 & 3

Part 2: Window & Door Details, Saturday, August 20, 2011. Learn about how to waterproof the edges of windows and doors to prepare them for the plaster application, which is a critical component of the strawbale building process.

Part 3: Earth Plaster Workshop, Friday evening, Saturday & Sunday, September 9, 10 & 11, 2011. Learn about making and applying the first layers of earth plaster, including discussion and demonstration of possible final finishes.

The building for these workshops is a 24' x 32' post and beam, strawbale infill barn with loft that will be used for small farm animals and food production. It is located outside of Nevada City in Nevada County, about 1 hour NE of Sacramento (directions will be sent after registration). The instructors for the workshops are Bill Donovan and CJ Cavet for the window and door details, and Tracy Thieriot (plastering contractor, www.tactileinc.com) for the earth plastering.

& a special workshop added this year:

Advanced Natural Plaster Techniques

Learn about advanced techniques in natural plaster from professional plasterer Tracy Thieriot. This 3 day workshop on Sept 30, Oct 1 & 2, (full day Friday and Saturday, 1/2 day on Sunday) will take place on an existing strawbale structure on a farm outside of Woodland, CA.

The focus will be on interior fine finishes in clay and lime including:

- how to design and create samples before committing to the wall
- making your own mixes of finish clay plaster and paints
- mixes and product for interior finish lime plasters and techniques
- using pigments and color in earth and lime
- special tools and cool things to use
- techniques for troweling, polishing, carving and relief work
- exterior earthen plaster repairs

Though the slow economy caused us to cancel the first part of the workshop in July due to lack of participants, the building is progressing and the rest of the workshops are planned as scheduled. If you are thinking about signing up but are holding off because you can not afford to pay right away, do let us know (email CJ at cjbwpv@sbcglobal.net) about your plans so we can include you in the count and help work out your payment. Meals are included in the cost of the workshops and camping space is available at each site. Hotels/motels are also less then 30 minutes away. For more information about cost and registration, go to the CASBA web site (www.strawbuilding.org). Early registration for the workshops helps us plan so please let us know as soon as possible if you plan to attend. Please feel free to print out this page and distribute it to anyone who might be interested.

An Investigation into Mesh Testing for Plaster Reinforcement in Strawbale Wall Assemblies

Test conducted and written up February 20, 2010
by Tim Rudolph PE, TimRudolph@cox.net

Test equipment shown tension testing a wire specimen

Test Summary: Having some free time and the right equipment, I obtained several brands of 2" x 4" wire mesh similar to what was used in the structural testing program that the Ecological Building network and CASBA did back in the 2000's. I wanted to replicate the attachment of the mesh to the sill plate and watch it fail when pull tested. I was unable to obtain the same brand as used in the test. I tested two different brands of 2" x 4" x 14 gage mesh and smooth wire made in China. The following is a write up of the test with photos and some conclusions at the end. Happy reading.

High accuracy gauge measures pressure of the cylinder

Test Goals: To verify the failure mode of fence wire mesh used as plaster reinforcement and verify a new anchorage detail for the bottom of a strawbale shear wall. Also to attempt to look towards an empirical component design method for strawbale shear walls.

Test Methods: Break stuff. Using a hydraulic cylinder and hand pump, various wires and meshes were tested to identify the breaking failure mode. The mesh wires were tested as individual wires and as a stapled mesh assembly.

Two different brands of 14 gage 2" x 4" welded wire fence mesh was tested: a brand made in the USA and a brand made in Mexico, both found at the local lumber yard. Part of the 3 foot wide roll was purchased for testing.

Tension testing stapled mesh connection

Test Configuration

Test Equipment: A 20 ton capacity hydraulic cylinder with 1-1/4" hole through 2 wire test fixtures and a 1.25" pipe welded to 3"x3"x1/4" angle to wrap the wire around and cause any wire breakaway from the anchorage.

Tension testing plastered mesh

7/16”x1-1/4” staple fails by pullout of fastener – about 475 lb peak load capacity

Testing staple breaking strength – about 530 lb

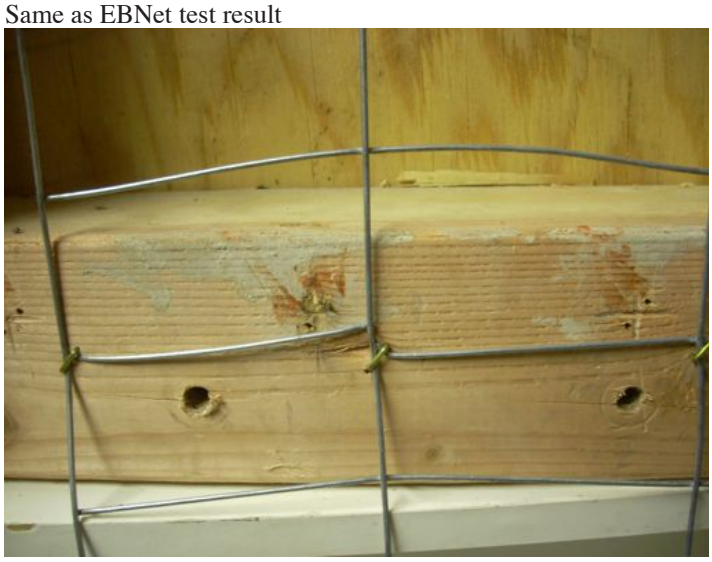
Test on single mesh strand – note tension failure away from weld location; same tension failure occurred on both brands of mesh away from the cross wire

Two staples holding the same wire – both staples broke at about 640 lbs

14 ga mesh stapled to 4”x4” with 7/16”x1.75” galvanized staples on a diagonal

14 ga mesh broke across weld location- test ended after break. Same as EBNet test result

Test of smooth wire non-contact lap splice 14 ga



Another close up of the broken 14 ga wire at the cross weld

Bottom condition of test – 3/8”dia lag bolt

Testing mesh with plaster – mesh has fold and 8” lap splice back up wall; failed by mesh breaking above plaster

Test pull of smooth wire lap splice – note cylinder and wire attachment at top

After test of non-contact lap splice –wire failed above plaster

Testing staple strength

Broken test staples – staple failed across top with a tension failure at about 530 lbs

16ga 5/16”x1-3/4” Hitachi galvanized staples -Wire wrap around Hot Dipped Galvanized Box nails –furthest nail 8d box 625 lb to pull out- closer nail HDG 16d sinker- loaded to 690 lbs then test ended

Discussion of Test Data and Test Observations:

Wire test breakage - The mesh tested was 14 ga 2”x4” fence wire. Wire specimens were taken from both brands of wire along with two rolls of smooth wire that were purchased to verify the testing device end anchorage method. The wires were tension tested and failed in tension and at locations away from the cross wire weld locations.

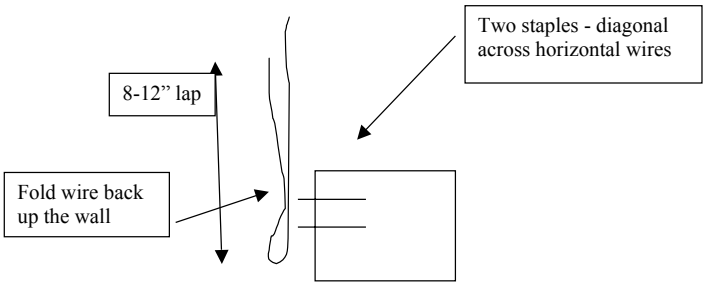
Mesh test breakage - The mesh was then stapled to the 4”x4” and subjected to a pull test. The wire was stapled to the 4”x4” with 7/16”x1-3/4” galvanized gun staples on a diagonal as in the original EBNet test. The break was the same as was originally found in their testing for both brands of mesh –made in the USA and Made in Mexico. After the testing, a third brand was located that is made in China but was not tested. Many have substituted the 2”x4” mesh for the 2”x2” mesh due the scarcity of the 2”x2” mesh. This mesh had the 2” wires horizontally with the 4” wires vertically thus reducing the number of vertical wires by 50%. This would likely reduce the capacity of the shear wall system.

Smooth Wire Splice - A test was done on smooth 14 gage wire to determine if a 8” non contact lap splice would work. The wire was wrapped 180 degrees around a 3/8” lag screw inserted in the 4”x4” sill plate. The 8” was based on the 6” lap splice determined by the EBNET testing. This would show that it could

be possible to fold the wire at the base of the wall to eliminate the anchorage reliance on the welded cross wires. The tension test managed to fail the wire in tension above the splice at about 575 lbs for the bare wire.

Anchorage Solution - The EBNET test rejected a 16 ga high tensile strength wire mesh due to problems with the cross wire weld locations breaking on the static pull test. The proposal of a model code for bale shear walls included a proposal for use of the 16 ga wire. This caused the investigator to determine how this could be made to work without depending on the welded cross wire reliability. The EBNET testing also pointed out that the wire meshes used have no material specifications for strength.

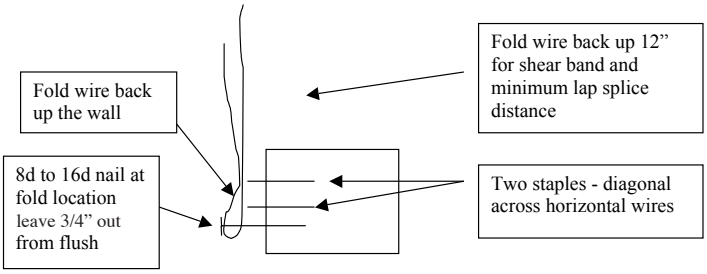
The solution to the anchorage of the mesh at the base of the wall without reliance on the cross wire weld is to fold the wire at the base of the wall. The mesh would be stapled to the sill plate (diagonal across the cross wire) then folded so that the cross wires do not align (1" offset of the cross wires) then lapped up the wall by 8-12". The folded wire would be stapled a second time on the lapped wire (across the cross wire) to the sill plate.



The additional mesh at the bottom of the wall was installed on the EBNET wall tests as a mesh band for shear but it was installed as a separate piece of mesh with its own staples. The EBNET full scale test failed the mesh (both layers) near the sill plate level in tension with the cross wires intact.

The wire mesh at the mesh panel vertical lap splices at sill level plate needs special detailing to prevent congestion and to maintain consistent strength of the assembly. Cutting and removal of portions of the mesh will need to be done to solve the congestion and strength issue. Cover requirements for the lap splices are unknown for plaster assemblies.

This assembly was tested and the wire broke above the plaster. Thus what appears to be a successful test. It did not simulate the full scale cyclic wall test. It is thought that by only pulling on a single wire the tension is dispersed via the plaster out into the cross wires and then the adjacent vertical wires. The full scale test exerts force on many adjacent wires simultaneously.



Possible improved sill plate anchorage at shear wall locations

The insertion of the 8d,10d or 16d nail in the fold loop has the purpose of anchoring the mesh with a large diameter fastener that can be hot dipped galvanized and anchoring the plaster to the sill plate where the mesh leaves the center of the plaster. The nail can help provide support to the plaster in compression and possibly support the plaster in compression when a weep screed is installed instead of landing the plaster on the foundation.

Calculation of sill plate uplift - The calculation of sill plate anchorage based on keeping the sill plate and the mesh anchorage from failing. Using the wire strength data from the EBNET test program the 14 gauge wire highest tested strength was 414 lbs. The sill plate size and anchorage was determined using force from the wire tensile strength. To reduce the lumber size of the sill plate and obtain a common size that is pressure treated with borates rather than ACQ or other corrosive treatments many jobs are using 3"x4" sill plates. To equate the 3"x4" with a 4"x4" check the deflection and then decrease the anchor bolt spacing to maintain the same calculated deflection. That makes the use of 3"x4" sill plates possible with 12" oc spacing of the anchor bolts rather than the 24"spacing on the 4"x4" plates. For comparison (and not recommended) is a 2"x4" plate which would need 9"oc anchor bolts and a bolt 3" from the end of the plate.

Calculation of reinforcement ratios - The reinforcement ratios are used in concrete structural design. Calculated here are the ratios of the meshes used to reinforcement in cement lime plasters. The ratio should

be calculated for the vertical and horizontal direction. The minimum percentage for concrete is different for grade 40 (0.002) and grade 60 (0.0018) steel. This would then be different for the higher yield stress used for wire mesh. This value needs to be proposed. The attached calculations are based on a temperature and shrinkage reinforcement ratio of 0.0018 used for grade 60 rebar. The 2”x2” mesh exceeds this requirement while the 2”x4” mesh falls short.

The vertical wire reinforcing needs to be designed based on the shear level the wall is designed for. Thus the 2”x2” mesh would be used for a higher shear value wall than a 2”x4” mesh wall. A model for stress distribution in primarily the vertical wires needs to be proposed to lead to the analytical design of the mesh.

CASBA Members Head North to Alaska

Just in time: rumors of California heat waves to come were rampant! Two members of CASBA and their wives headed out to Alaska for a working vacation and escape. The timing was perfect as South Central Alaska was just experiencing spring weather. The second week of April and Alaskans were out in T-shirts planning how to capture the suns energy.

Victor Guilott and his lovely wife Leslie were the lead presenters at a series of workshops sponsored by the Alaska Center for Appropriate Technology (ACAT) and funded by the Alaska Housing Authority. Victor’s and Leslie’s experience was well utilized as they own and operate Sol-Sierra, a highly productive business involved in design, installation and maintenance of photo voltaic systems. The additional team of presenters were Harvey Bowers of ACAT, George Menard and myself. George has been installing photo voltaic systems in South Central Alaska for over 30 years and he brought great wisdom to each workshop on what really works in Alaska’s harsh weather conditions.

The title of our workshop was “Pathways to Net Zero Housing.” Harvey and I each discussed the idea that conservation and the highly insulated thermal shell were a prerequisite to approaching the net zero concept. That discussion was followed by my PowerPoint presentation on how we have managed to approach the goal here by:

Building a straw structure
Choosing highly efficient appliances
Selecting good windows
House orientation
Building hybrid solar/wind energy systems

Victor then took over, taking the participants through a very interesting exercise of relocating our straw bale house from the Sierra Foothills to each of the three workshop sites (Wasilla, Soldotna and Anchorage). The next step was to walk the participants through a solar/wind design for this same house but in each of their locations. This, of course, lead to an extensive information exchange that was a great learning experience for participants and presenters alike.

The final segment of this workshop was lead by George Menard who examined Victor’s design in regards to how it might need to be adapted to Alaska’s weather conditions. Here the rubber met the road and participants and presenters entered into a productive discussion that did not end until the lights were turned out and the dinner hour drew our attention.

We are considering expanding on this type of workshop next year and now have a meeting scheduled the with the Mayor of Wrangell, Alaska on customizing a workshop for their community in the year to come.

~ Richard DeBusman

THE STRAW POLL

QUESTIONS TO SPARK DISCUSSION

Should it be

"straw bale building"
"strawbale building"
or
"straw-bale building"
?

Cast your vote by emailing rebecca@simpleconstruct.net

In the last Straw Poll, I asked "If you were involved in building a straw building that used clay plaster on the exterior, did you paper the wooden framing members? Why or why not?"

Here is the one answer received:

"I would like to see grade paper over any wood that is covered in earth plaster. This will protect any metal components used for the structure such as Simpson column caps, framing clips, bolts and nails, from excess moisture and potential corrosion.

If the structure was of mortise and tendon heavy timber construction like the historic structures then it would be ok to put the earth plaster directly on the wood."

~ Tim Rudolph

Project Profile of the Quarter

This is a new feature I am starting to encourage members to submit projects to be profiled here in the journal. All you need to do is send at least one photo (approximately 200 dpi at 3"x 4" JPEG format) and the at least the info below to rebecca@simpleconstruct.net (I hope I will be forgiven for using one of my own projects to get things started.)

~ Rebecca Tasker

Name & location: Humel Residence, Fallbrook, CA

Date completed: in progress

Type of building: post & beam with straw bale infill

Use of building: single family residence

Interior square footage: 2800 sq ft

Features: passive solar orientation, efficient windows and appliances, solatube daylighting, photo voltaics, solar thermal hydronic heating and cooling in the ceiling, exterior straw bale walls, interior light-straw-clay partition walls, clay plaster interior and exterior.

Architect: Lisa Swan, Design Forward, Pasadena, CA www.designforward.com

Builder: Alan Schmidt, Empowered Energy Solutions, San Diego, CA, www.empoweredenergysolutions.com

Straw & plaster: Simple Construct, San Diego, CA, www.simpleconstruct.net

The Humel residence: a low profile fits into the surrounding landscape

The main entry

Family straw stacking day

The guest bedroom stacked and chinked

Experiments with reed mat and clay plaster

Clay plastering a light-straw-clay partition wall

The California Straw Building Association

(209) 785-7077 www.strawbuilding.org

CASBA is a non-profit organization whose members are architects, engineers, builders, and people interested in straw building. Our mission is to "further the practice of straw bale building by exchanging current information and practical experience, promoting and conducting research and testing, and making that body of knowledge available to working professionals and the public at large."

A note from the editor: The journal is produced four times a year. It relies on receiving submissions from CASBA members. Please send your articles, letters, photos, questions, project profiles, musings, and ramblings to rebecca@simpleconstruct.net
The deadlines for 2011 are: Sept 23 and Dec 22.

Thank you! ~ Rebecca Tasker, editor

Upcoming Natural Building Events:

Aug 5-13: Natural Building Adventure: focused on cob, Groveland, CA, www.ederbickems.com

Aug 18-21: Mud Taste Test: focused on building a cob oven, Ederbickems Cob Hostel near Yosemite, CA, www.ederbickems.com

Aug 20: Introduction to Straw Bale Building Workshop Part 2: Window & Door Details: waterproofing the edges of windows & doors in a strawbale building, near Neveda City, CA, www.strawbuilding.org

Sep 13-17: Natural Building Intensive: focused on natural building materials, Lafayette, CA, www.verticalclay.com

Sept 9-11: Introduction to Straw Bale Building Workshop Part 3: Earth Plaster Workshop: making and applying the first layers of earth plaster, plus discussion of finishes, near Neveda City, CA, www.strawbuilding.org

Sept 3-4: How to Build Your Own Wood Fired Earth Oven, El Sobrante, CA, www.brownpapertickets.com/event/184696

Sept 30-Oct 2: Advandanced Natural Plaster Techniques: focused on advanced techniques in natural plaster, near Woodland, CA, www.strawbuilding.org

The California Straw Building Association
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