

Straw Bale Vault Test

Designed by David Marr, structural engineer and Skillfull Means Architecture and Construction. Conducted by Bill Rothacher and Doug Stark of Consolidated Engineering Laboratories (CEL), 1998, Berkeley California.

http://www.skillful-means.com/strawbale/papers/vault_report.htm

<http://www.strawbuilding.org/tech/archtest.htm>

- Compressive and Lateral Loading of Straw-Bale Walls

By Ghailene Bou-Ali, 1993, University of Arizona.

- Thermal and Mechanical Properties of Straw Bales as They Relate to a Straw House

Conducted by the Canadian Society of Agricultural Engineering, 1993, Halifax, Nova Scotia, Canada.

- Straw-Bale Construction Moisture Research

by Joanna Karl, Lis Perlman and Bill Kownacki, 1995, Portland, Community College

- E-119 Small Scale Fire Test

by SHB AGRA, 1993 New Mexico.

- Thermal Performance of Straw Bale Walls

by Nehemiah Stone and Tav Cummins, 1999, California Energy Commission.

(2a) EBNet Conference CD-ROM

A commander: www.ecobuildnetwork.org

- Straw-Bale Shear Wall Lateral Load Test

Jason Nichols and Stan Raap, 2000, California Polytechnic State University, San Luis Obispo, Architectural Engineering Dept.

- For the land of Camels: A Straw Bale Test Wall for Seventeen Foot High Ceiling Structures in the Kingdom of Saudi Arabia

By Chris Stafford, Christopher Stafford Architects, Inc., Port Townsend, Washington.

- A pilot Study Examining the Strength, Compressibility and Serviceability of Rendered Straw Bale Walls fro Two Storey Load Bearing Construction

by Micheal Faine and Dr. John Zhang, 2000, University of Western Sydney, Australia.

mikefaine@bigpond.com

- Preliminary Report on the Out-of-plane Testing of an 8x8ft Straw Bale/PISE Wall Panel

by David Arkin and Kevin Donahue, 2001 Mill Valey, California

- Straw Bale Construction: A Review of Testing & Lessons Learned to Date

by Bruce King, 2001

- A Status Report on the Greening of Building Codes and Standards

by David Eisenberg, 2001

- Alternative Building Materials and Systems – Understanding Technical Risk and Uncertainty

by John Straube, 2001

(2b) EBN et Tests to download:

Support

You are welcome to download any and all of the test reports and research summaries listed below, and we hope you find them useful. Please be aware, however, that these reports--despite having been supported by grant funding--were generated only with an enormous outpouring of unpaid effort by EBNet and the project

participants. We intend to improve and expand upon the June tests, but can only do so with continued support. **We ask that you make a donation to EBNet in proportion to the value you receive from this work, and suggest at least \$2 per page received.** Checks can be made out and sent to:

**The Tides Center / Ecological Building Network
209 Caledonia St.
Sausalito, CA 94965 USA**

STRUCTURAL TESTS

- Load-Bearing Straw Bale Construction ([download](#))

A summary of worldwide testing and experience

Bruce King, PE

- Properties of Earth, Lime, and Lime-cement Plasters ([download](#))

Compressive strength, Modulus of Rupture, shrinkage, erosion, and Modulus of Elasticity.

- Bearing on bales plastered 2 sides -- COMING SOON

Measure the bearing capacity of single bale "miniwalls" with different types of mesh & plaster, flat & on edge.

- Mesh bond development -- COMING SOON

Find out how much different meshes need to overlap in different plasters so as to transfer load.

- Mesh tension and shear at wood plates -- COMING SOON

Determine the strength of various meshes with various fastenings pulled parallel and perpendicular to plate.

- Load-bearing and Creep ([download](#))

Long-term deflection on walls with different combinations of plaster and load.

- Out of plane load on wall ([download](#))

Capacity of walls with different combinations of plaster and mesh to resist load perpendicular to the face.

- In-Plane Cyclic Tests of Plastered Straw Bale Wall Assemblies ([download](#))

Capacity of walls with different combinations of plaster and mesh to resist load parallel to the face.

MOISTURE TESTS

- Monitoring Ridge Winery ([download](#))

The Ridge Winery building near Healdsburg, California is probably the largest straw bale structure in the world. It has rice bale walls up to 23 feet high, coatings of many different types of earthen and lime plasters, and many different moisture loading conditions (such as barrel rooms maintained at a high humidity and cool temperature next to hot, dry outside air). We installed temperature & moisture sensors in 60 wall locations which are wired to a microprocessor accessible by Dr. John Straube via modem. Dr. Straube is monitoring conditions in the wall, and will issue an interim report and analysis in June.

- Moisture and Thermal Conditions for Degradation of Rice Straw ([download](#))

12/10/2003

Matt Summers at the University of California Davis School of Agricultural Engineering is

completing a Ph.D thesis on straw degradation. This work consists of isolating identical samples of rice and wheat straw under controlled conditions of temperature and humidity, then monitoring decay as evidenced by carbon dioxide production. This gives us baseline information about conditions under which straw will "go off", in the parlance of straw bale building. Wheat straw data will be available in early 2004 for comparison against performance of rice straw and hay.

Future work at UC Davis will identify the specific biological organisms (e.g. mold spores) whose activity constitutes what we call decay. EBNet will also report that work as it is published.

- Moisture properties of straw and plaster/straw assemblies ([download](#))

Tests individual bales of straw, or plastered samples of straw, for *capillarity* (tendency to wick water up or sideways), *permeability* (tendency to allow migration of water), and *sorption isotherms* (ability to hold quantities of water like a sponge).

OTHER REPORTS

- Fire ([download](#))

No new testing was done, but results of an ASTM one hour fire test conducted a few years back, and as yet unpublished, are assembled and reported. Previous fire and flame spread tests, as well as field experience with fire problems, are also referenced and discussed.

- Thermal Performance of Straw Bale Wall Systems ([download](#))

No new testing was done; results of previous thermal tests, particularly the most referenced one from Oak Ridge National Labs, are reviewed, analyzed, and discussed in a summary report.

Building Codes

The recently revised version of SB 332, aka the California Straw Bale Building Code, is now viewable on the California Senate website (<http://www.sen.ca.gov>). Based on the information we have gained in the testing program, as well as field experience to date, we will develop a model building code useful for both seismic and non-seismic areas, and will publish it as an appendix in the textbook next year.

EBNet testing is continuing. www.ecobuildnetwork.org

(3) Canada Mortgage and Housing Corporation (CMHC)

<http://www.cmhc-schl.gc.ca/>

CMHC

Suite 1000

700 Montreal Road

Ottawa ON K1A 0P7

Canada

tel (613)1-800-668-2642

- Moisture Properties of Plaster and Stucco for Strawbale Buildings

by John Straube, 1999, University of Waterloo

http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/00-132_e.pdf

Propriétés de résistance à l'humidité du plâtre et du stucco pour les bâtiments aux murs en ballots de paille

by John Straube, 1999, University of Waterloo

Dept of Civil Engineering and School of Architecture, University of Waterloo

Waterloo, Ontario N2L 3G1 CANADA

http://www.cmhc-schl.gc.ca/publications/fr/rh-pr/tech/00-132_f.pdf
www.BuildingSolutions.ca

- Straw Bale House Moisture Research

by Rob Jolly, 2000

http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/00-103_e.pdf

<http://www.baubiologie.at/asbn/literatur.html>

Étude sur la teneur en eau des murs des maisons en ballots de paille

by Rob Jolly, 2000

<http://www.cmhc-schl.gc.ca/publications/fr/rh-pr/tech/00-103-F.htm>

- Bibliography on straw bale housing (En/ Fr)

<http://www.cmhc-schl.gc.ca/en/Library/whpu/loader.cfm?url=/commons/pot/security/getfile.cfm&PageID=14297>

- Pilot Study of Moisture Control in Stuccoed Straw Bale Walls – CMHC

by Bob Platts, 1997

http://www.cmhc-schl.gc.ca/en/imquaf/hehosu/stbawa/stbawa_001.cfm

Étude pilote de contrôle de l'humidité des maisons en ballots de paille

http://www.cmhc-schl.gc.ca/fr/amquablo/masadedu/masa/mabapa/mabapa_001.cfm

- Energy Use In Straw Bale Houses

<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/tech02-115-e.html>

La consommation d'énergie dans les maisons en ballots de paille

<http://www.cmhc-schl.gc.ca/publications/fr/rh-pr/tech/tech02-115-f.html>

- Wood Usage in Straw Bale House Construction

<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/tech02-116-e.html>

L'utilisation de bois dans la construction de maisons en ballots de paille

<http://www.cmhc-schl.gc.ca/publications/fr/rh-pr/tech/tech02-116-f.html>

- Alternative Wall Systems for Low-Rise Housing

<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/02-132-e.html>

Systèmes muraux non traditionnels pour les petits immeubles

<http://www.cmhc-schl.gc.ca/publications/fr/rh-pr/tech/02-132-f.html>

More tests are available <http://www.cmhc-schl.gc.ca/>

(4) University of Manitoba

3 papers are available from:

Department of Biosystems Engineering

University of Manitoba

Winnipeg, Manitoba, R3T 5V6

Canada

http://www.umanitoba.ca/faculties/afs/biosystems_engineering/overview.html

- Design Dead Load of a Straw Bale Wall

by E. Arbour, 2000

- Design Approach for Load Bearing Strawbale Walls

by K.J. Dick and M.G. Britton, 2002

- Resistance to Shear in Stuccoed Straw Bale Walls

by Lisa Stepnuk, 2002

(5) Other test documents (probably for sale)

- House of Straw: Straw Building Comes of Age, 1995

Only available online:

<http://www.djc.com/news/en/11144314.html>

www.eren.doe.gov/EE/strawhouse

- Straw Bale Exterior Pinning Report

by Sustainability International, 1998

Contact: Bob Bolles to purchase copies bob@strawbalehouse.com

- Moisture Control in Strawbale Homes: Report to Ontario Building Code Commission

by John Straube, 1999

Contact: Engineering Group, Civil Engineering Department, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.

Tel. 519 888-4567, ext 2378

- Community-Built Housing Solution: A Model Strawbale Home Design

by D. Riley, G. MacRae and J.C Ramirez, 1998

Contact: Prof. David Riley, Dept of Architectural Engineering, Penn State, 104 Engineering Unit A, University Park, PA 16802, USA.

Tel. 814-863-2079 driley@engr.psu.edu

- Moisture in Straw Bale Housing – Nova Scotia

by S.H.E. Consultants, 1998

Contact: S.H.E. ConsultantsRR#3, Comp 308, Wolfville, Nova Scotia, Canada.

Tel. 902-542-3518

- Investigation of Environmental Impacts: Straw Bale Construction

by Ann V. Edminster

Contact: Ann Edminster, 115 Angelita Ave, Pacifica, CA 94044

avedminster@earthlink.net

- Evaluation of a Straw Bale Composite Wall

by Edwin R. Schmeckpepper and Joe Allen, 1999.

Contact: Joe Allen, PE Allen Engineering, 917-10th Street, Clarkson, WA 99403

-Thermal Performance Test - Rotatable Guarded Hot Box (ASTM C 0236)

by Oak Ridge National Laboratory (ORNL)

<http://www.ornl.gov/~roofs/StrawBale/strawphotos.html>

<http://www.ornl.gov/~roofs/StrawBale/strawtest.html>

- Straw-bale construction outstanding in CSIRO bushfire test

<http://www.users.bigpond.com/brookman/bushfireTest.htm>

[sur disc](#)

- Refining Straw Bale R-values

<http://hem.dis.anl.gov/eehem/99/990306.html>

- Insulative Values for Straw Bale Construction

<http://www.uvm.edu/~gflomenh/CDAE170/Green%20materials/straw%20bale%20slide%20s>

[how.ppt](#)

- Acoustical Characterization of Straw Bales as Structural Elements

by Carl J. Mas and E. Carr Everbach

Dept. of Engineering

Swarthmore College

500 College Ave.

Swarthmore, PA 19081

Acoustical Society of America <http://www.acoustics.org/press/130th/lay03.html>

- The Thermal Insulating Value of Straw Bales for Construction

1993, by Joseph McCabe. energyi@mccabe.net

A collection of mostly Canadian links to additional straw bale information:

<http://www.harvesthomes.ca/links.htm>

Tests available: www.dcat.net

German: At the Austrian StrawBale Network (ASBN) www.baubiologie.at :

- Wandsystem aus Nachwachsenden Rohstoffen – die Strohballenwand

Projektbericht: Haus der Zukunft <http://www.baubiologie.at/asbn/hausderzukunft.html>

(Download)

-Projektergebnissen zu Brandwiderstand, Brennbarkeit, Wärmedämmleitwert, bauphysikalischen Berechnungen und einer Beschreibung des mobilen Prüflabors

Projekt der GrAT/TU Wien gem. mit ASBN und IBO (Österr. Institut für Baubiologie und - ökologie); . PDF-Dokument für Acrobat Reader (Windows und Mac), deutsch.

With short English text (Download)

- Die Zertifikate extra (JPG oder PDF):

B2-Zertifikat (normal brennbar) der MA39/Wien, F90-Zertifikat eines Bauteils (Aussenwand) der MA39/Wien. Wärmedämmleitwert-Überprüfung: Zertifikat der MA39/Wien (Download)

- Strohballen-Belastungstest von Arch. Werner Schmidt, CH

(Download) *****

Belastungstests mit 3 u. 6 Tonnen ergaben im Schnitt 7 cm Kompression bei einem 74 cm (Groß-)Ballen. siehe [Grafik](#) bzw. eine weitere Beschreibung zum [Strohballenhaus in Dissentis](#)

Danish:

Fire resistance, Humidity and Thermal performance of a Straw Bale wall & performance of a mussel shell foundation (Download)

Paper:

- Moisture Barriers in Straw-bale Construction

<http://www.skillful-means.com/strawbale/papers/moisture.htm>

Timber Frame:

- Full-scale fire tests a six story timber and frame building

Report and video-presentation of Dr. Vahik Enjily from the Centre for Timber Technology and Construction, Building Research Establishment, UK (BRE: www.bre.co.uk)

(6)Video

by Black Range Films, 1996. www.strawbalecentral.com

- **Straw Bale Code Testing**

- **Arizona Compression and Lateral Loading Test**

- **Nova Scotia Moisture Reading, 1993**

- **New Mexico Lateral Load and E-119 Fire Tests**

(http://www.dcat.net/resources/ASTM_E119.pdf)