



International Course on Stone Conservation SC13

SESSION: Non-destructive techniques of investigation

INSTRUCTOR: John Fidler

TIME: Thursday, 9th May/ 9:30-11:00 (1.5 hours) & 16:30-13:00 (1.5 hours)

SESSION OUTLINE

ABSTRACT

The session will introduce the range and scope of direct and indirect nondestructive evaluation tools and techniques for the assessment of stone and masonry building and sculpture. Explanations will be given about the degree of overlap and limitations of the methods described. Ethical, technical and economic issues will be explored.

OBJECTIVES

- to be aware of the range and scope of nondestructive diagnostic techniques available to help determine the state and condition of masonry buildings, sculpture and stonework;
- to gain an awareness of the physics behind the remote sensing and nondestructive equipment;
- to understand the ethical, technical, logistical and economic ramifications of using nondestructive diagnostics techniques and
- to understand the overlapping complementary nature of direct and indirect techniques, and the limitations of the technology.

CONTENT OUTLINE

Direct tools

- endoscopy
- RILEM tube water absorption
- Crack tell-tales

Indirect tools

- ultra sound
- pulse radar
- impact echo
- magnetometry
- pachometry
- radiography (LINAC and radio-isotope)
- resistance, capacitance and dielectric constant moisture meters
- Acetylene gas/carbide reaction "Speedy" moisture meter
- Linear Variable Differential Transducers and other monitoring devices
- Infrared camera
- Thermography



SESSION OUTLINE CONT'D

READINGS

 = Essential reading material

 = Available online

BIBLIOGRAPHY: Introduction and Scope


Crosby, Anthony. "A Preservation Monitoring System at Tumacacori National Monument" in *Bulletin of the Association for Preservation Technology*, Vol. 10, No. 2, U.S. National Park Service Issue (1978), pp 47-76.

Hart, David M. "X-Ray Investigation of Buildings" in *Bulletin of the Association for Preservation Technology*, Vol. 5, No. 1 (1973), pp 9-21.

Hum-Hartley, Susan. "Nondestructive Testing for Heritage Structures" in *Bulletin of the Association for Preservation Technology*, Vol 10, No. 3, Department of Indian and Northern Affairs, Canada (1978), pp 4-20.

Fidler, John. "Non-destructive Surveying Techniques for the Analysis of Historic Buildings" in *Transactions of the Association for Studies in the Conservation of Historic Buildings*, Vol. 5, (1980) pp. 3-10.


Friedman, Donald. "Ambiguity in Building Investigation: A Study of Sampling and Decision-Making with Field Data" in *APT Bulletin*, Vol. 31, No. 2/3 (2000), pp 39-44.


 Harvey Jr., Donald W., and Michael P. Schuller. 2010. Nondestructive Evaluation: Structural Performance of Masonry. *APT Bulletin* 41 (2/3): 51-61.


<http://www.apti.org/clientuploads/publications/PracticePoints/PracticePoints9.pdf>

OTHER RESOURCES

 American Society for Nondestructive Testing (www.asnt.org)

 European Commission Research Directorate *Environment* and other programs on Cultural Heritage <http://ec.europa.eu/culture>

 ICOM-CC (International Council on Museums-Conservation Committee) www.icom-cc.org Scientific Research Working Group on NDE.

 RILEM (International Union of Laboratories and Experts in Construction Materials, Systems and Structures) www.rilem.net - International symposia 15-18 May 2011 Istanbul.

Hollis, Malcom. *Surveying Buildings*. Surveyors Publications, London (1983) 5th edition (2005).

BIBLIOGRAPHY: Moisture Measurement

Brown Morton III, W. "Field Procedures for Examining Humidity in Masonry Buildings" *Bulletin of the Association for Preservation Technology*, Vol. 8, No. 2 (1976), pp 2-19.

Massari, Giovanni and Ippolito. *Damp Buildings Old and New*. ICCROM/Italian Committee of UNESCO, Rome (1992).



RESOURCES FOR MOISTURE MEASUREMENT

ASTM D 2216-10 Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass Balance, ASTM, West Conshocken, PA (2010).

ASTM D 4442-07 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-based Materials, ASTM, West Conshocken, PA (2007).

ASTM D 4944 Standard Test Method for Field Determination of Water (Moisture) Content by the Calcium Carbide Gas Pressure Tester. ASTM, West Conshocken, PA (2004).

AASHTO T217 Determination of Moisture by Means of Calcium Carbide Gas Pressure Moisture Tester (Speedy).

BS 6576 Code of Practice for Diagnosis of Rising Damp in Buildings, BSI, London (2005).

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