



International Course on Stone Conservation SC13

SESSION: Mechanical properties of masonry construction and structural mechanisms of decay (part II)

INSTRUCTOR: Giorgio Croci

TIME: Tuesday, 10th May/ 14:40 – 16:00 (1.5 hours)

SESSION OUTLINE

ABSTRACT

This lecture is a follow up to *Mechanical Properties of Masonry Construction and Structural Mechanisms of Decay* (part I). This session will present various case studies of world monuments that illustrate the principles of masonry construction behavior, identification and analysis of the mechanisms and patterns of deterioration, and the design of remedial repairs. In addition, the cases present the application of a conservation methodology from an engineering perspective and display how a methodological approach informs the conservation decision making process.

The studies presented are divided in the following categories:

- **Arches, vaults, and domes:** the Domus Aurea, the Roman Pantheon, Hagia Sophia, Brunelleschi's dome, and Saint Peter's Basilica by Michelangelo
- **Seismic problems:** the Basilica of St. Francis of Assisi, Hagia Sophia and Hagia Irene in Istanbul, the Basilica of Collemaggio in L'Aquila, and the Prambanan Temple in Indonesia
- **Soil settlement problems:** the Tower of Pisa (this project will be presented in consideration of the site visit during the study tour), the Ducal Palace of Modena, the Ducal Palace of Genova, and the Towers of Angkor.

The cases present actual scenarios where structural principles, theory and conservation methodology were applied. They reveal the limitations of theory and the realities of the field.

OBJECTIVES

To display how specific theoretical principles and general criteria are applied to the reality of construction.

CONTENT OUTLINE

Structural behavior of monuments and historic buildings

- **Vertical structures:** pillars, columns, towers, bell towers, minarets, and obelisks Example: the Obelisk of Axum
- **Horizontal structures:** arches, vaults, domes, and lintels. Examples: Pantheon, Hagia Sophia, Brunelleschi's dome, and Saint Peter's Basilica by Michelangelo
- Damage and decay of masonry structures
- **Seismic behavior of structures:** the Basilica of St. Francis, the Colosseum in Rome, Trajan's Market in the Roman Forum Case Study: The Tower of Pisa

SESSION OUTLINE CONT'D

READINGS

 = Essential reading material

 = Available online

- Croci, Giorgio. 2000. General Methodology for the Structural Restoration of Historic Buildings: The Cases of the Tower of Pisa and the Basilica of Assisi. *Journal of Cultural Heritage* 1 (1): 7-18.
- . 2006. Seismic Behaviour of Masonry Domes and Vaults: The Examples of Hagia Sophia in Istanbul and St. Francis in Assisi. In *First European Conference on Earthquake Engineering and Seismology 3-8 September, 2006, Geneva, Switzerland: Proceedings*. edited by 13th European Conference on Earthquake Engineering & 30th General Assembly of the European Seismological Commission. Geneva: s.n.
- Croci, Giorgio, and A. Viskovic. 1993. Causes of the Failures of Coliseum over the Centuries and Evaluation of the Safety Levels. In *Public Assembly Structures: From Antiquity to the Present: Proceedings of the IASS-MSU International Symposium, May 24-28, 1993, Istanbul, Türkiye*. Istanbul: Mimar Sinan Universitesi
- Croci, Giorgio, A. Viskovic, A. Herzalla, M. Erdik, M. Akdoğan, G. de Canio, and L. Antonelli. 2010. Seismic Assessment by Numerical Analyses and Shaking Table Tests for Complex Masonry Structures: The Hagia Irene Case Study. In *7th International Conference on Structural Analysis of Historic Constructions: Strengthening and Retrofitting*. edited by Xianglin Gu and Xiaobin Song. 777-82. Advanced Materials Research Vol. 133-134. Stafa-Zuerich and Enfield, N.H.: Trans Tech
- Croci, Giorgio, A. Viskovic, A. Bozzetti, L. Ungaro, and M. Vitti. 2008. The Trajan Markets and Their Great Hall: The Conservation Problems and the Structural Intervention for the Improvement of the Seismic Safety. In *Structural Analysis of Historical Constructions: Proceedings of the VI International Conference on Structural Analysis of Historical Constructions, Sahc08, 2-4 July 2008, Bath, United Kingdom*. edited by Dina D'Ayala and Enrico Fodde. 1445-53. London: Taylor & Francis
- Croci, Giorgio. Forthcoming. The re-erection of the Stele of Axum. In [Axum Rediscovered: The Reinstallation of the Obelisk](#). Paris: UNESCO World Heritage Centre.

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