

3rd SMArT Meeting Madrid, 25-26 September 2003

News:

Future Conferences

ARCH 04 Conference - Pere Roca, Spain

17-19 November 2004, Barcelona, Spain

Website: <http://congress.cimne.upc.es/arch04>

Deadline for abstract submission: 15 September 2003

Topic areas: preferred to be general to include masonry, steel, concrete and also historical aspects should have more emphasis in ARCH 04.

Pere Roca has already received proposals for organising the next conference in 2007.

Suggested that an organising committee could be set up to decide where next conference should be. In future proposals should include details of:

- Proposed venue, accommodation, facilities
- How much time can they spend on organising the conference, ...

Structural Analysis Conference

10-13 November 2004, Padova, Italy

Website: www.historicalstructures.net

> Deadline postponed, more papers invited

11th European Conference on Composite Materials

31 May - 3 June 2004, Rhodes, Greece

Website: www.eccm11.eu.org

Deadline for abstract submission: extended to: October 24, 2003

Fourth SMArT Meeting

Jan 2004, UK, London (?)

Should include the new code of practise (BD .../03) for "Unreinforced Masonry Arch Bridges"

Past Conferences/Collaborations/Publications

Construction History Conference

20-24 January 2003, Madrid, Spain

Proceedings to buy (60 Euros for 3 Volumes) - Recommended

Masonry Arch Bridges Seminar: "Puentes de Bóvedas de Fábrica"

5 October 2000, Madrid, Spain

Proceedings (in Spanish)

Sixth Framework Project: Sustainable Bridges Project (EU)

Is starting Nov/Dec. 2003. To include analysis, repair, instrumentation of bridges.

Presentations

“Spanish railways I” - RENFE, Spain

Luis López Ruiz

About 50% of Spanish bridges are masonry.

More than 50% have span greater than 10m.

General procedure for bridge assessment at RENFE:

- 1) Visual inspections: Guide IAPF 75
- 2) Main inspections
 - No specific regulation
 - Damage classified I or II or III
 - Recommendations to repair
- 3) Damage evolution report
- 4) Full scale load tests

Existing RENFE Guides/documents:

- I. Structural characterization index
- II. Catalogue of damages (Dec 2002)
 - Document 1: description of materials and actions
Description of the process of deterioration of masonry arch bridges
 - Document 2: classification of damages: Class I or II (leaflets)
One leaflet for each main damage
- III. Guide of repair works
Under development

“Intermediate Level Analysis in Ancient Masonry Constructions”

José Luis Martínez Martínez, University of Madrid, Spain

Series of tests carried out on masonry units under shear/compression to investigate effect when tension and shear are not perpendicular to the bed-joint.

Software written.

Application for

- multispans arches
- domes

“Progressive damage detection to masonry from cyclic loading”

Tim Hughes – Cardiff, Brian Bell - Network Rail, UK

A series of cyclic tests was undertaken to model the opening of joints in multiring arches and ring separation under eccentric loading.

“Materials”

*José María García de Miguel,
International Council of Monuments and Sites (ICOMOS), Spain*

Deterioration of materials, evaporation, dehydration and porosity were discussed. Case studies were also introduced where the inside of the stone/brick was severely damaged and the strength of the stone/brick was significantly reduced without any visible sign of the masonry surface deteriorating.

It may be important to identify the types of stones, location, conditions, etc. for standard bridge inspection where such cases would appear.

Related references to the topic:

- GARCÍA DE MIGUEL J.M., SANCHEZ-CASTILLO L., ORTEGA-CALVO, J.A. GIL, SAIZ-JIMENEZ C. Deterioration of Building Materials from The Great Jaguar Pyramid at Tikal, Guatemala. "Building and Environment". 1994
- GARCIA DE MIGUEL J.M., SANCHEZ CASTILLO L., GONZALEZ AGUADO M.T., Characteristics of the Novelda Stone. III International Symposium On The Conservation Of Monuments In The Mediterranean Basin (Venecia). Junio. 1994
- GARCIA DE MIGUEL, J.M., SANCHEZ CASTIILLO, L., et al., Study of monumental stone from Madrid District, 7th International Congress on Deterioration and Conservation os Stone. Lisboa. 1992.
- GARCIA DE MIGUEL, J.M.: Colección de libros de texto del MRRP (Master de Restauración y Rehabilitación del Patrimonio) de la Universidad de Alcalá de Henares. Area de Piedra Natural. Tomo III. www.masterpatrimonio.edu, info@masterpatrimonio.edu.

“Spanish Railways II” – RENFE, Spain

Rafael Ozaeta García-Catalán, RENFE

Structural characterisation, structural analysis and damage catalogue in practise for the Spanish Railways were presented. This expists in a printed and electronic form but currently is not in the public domain.

“Spanish Ministry of Public Works”

*María del Carmen Picón Cabrera, Ministerio se Fomento, Spain
Javier León, University of Madrid, Spain*

Spanish bridge inspection procedures:

- 1) Routine inspection
- 2) Principal/detailed inspection
- 3) Special inspection

Catalogue of damages (available)
Condition parameter is calculated

Javier Leon Will report back at next SMArT meeting on the development regarding principal investigations.

“Effect of FRP reinforcement on multiring masonry arches under cyclic loading”
Adrienn Tomor and Clive Melbourne, University of Salford, UK

A series of tests have been undertaken on the 3m span two-ring masonry arches under static and cyclic loading. A change in the mode of failure was observed between static monotonically loaded unreinforced two-ring masonry arches (which failed by the formation of a four-hinge mechanism) and the cyclically loaded arches which failed by ring separation. Reinforced arches failed by ring separation under both static and cyclic loading. FRP reinforcement increased the endurance limit by about 20%.

Subgroups:

1. NDT

Publications:

- "Advice Notes on the NDT of Highways Structures"
Highways Agency publication.

- "Radar techniques – Hidden structures"

Will be published on the Highways Agency website: <http://www.highways.gov.uk> around December 2003

Prof. Mike Ford, consultant to Highways Agency, UK

A presentation should be arranged for January at next SMaRT meeting.

Actions

- "Advice Notes on the NDT of Highways Structures" document is coming out at the end of October 2003
- Padova University, Italy: testing. Filippo Cesarin, Padova University to send list of publications
- BAM (German Materials Testing Lab): list of NDT techniques

2. Parapets

Talk:

"Parapets"

Matthew Gilbert, University of Sheffield, UK

A series of tests have been carried out on parapets using different types of mortar and on the different types of reinforcement such as bed joint and diagonal reinforcement.

Discussion about the advantages and disadvantages of parapet reinforcement in relation to railway lines and their potential dangers.

What needs to be done:

- Further refinement of diagonal reinforcement techniques
- Validation of diagonal reinforcement techniques using car impact test
- Development of simple analytical tools
- In situ inspection techniques for unit-mortar bond properties
- Update codes of practice

Risk assessment

- Highways: Likelihood of vehicle impact
- Railways: Consequence of vehicle and/or masonry on railway line

Are individual bricks of full wall better when falling on the railway line and hit by a train? Network Rail has produced an estimation of likelihood of accidents/fatalities and the corresponding budget that should be spent to deal with the problem. Guidelines are on the web.

Actions: study into

- different types of materials: stone, brick and ashlar(!).

- shifting of spandrel walls
- influence of pilasters
- mortar and material is possible the weakest at the bottom of the wall.
- variation of properties within the height of the parapet – particularly at the base.

What needs to be done:

- 1) Brian to put problem in front of Bridge Owners Forum in Cambridge at the end of the month and apply for (government) funding. Use European 13/17 specification vehicles for full scale testing to be of general use.
- 2) Liaise with BSI standard B/50911
- 3) Find out measures issued by the Department for Transport (DFT) to prevent accidental impact to parapets (Brian).
DFT website: www.dft.gov.uk

3. Arch Fatigue

Talk:

- Identifying types of bridges vulnerable to fatigue
- Determining of the extent of potential impact
- Determining of the endurance limit
- Determining the environmental effect on fatigue life

Who has done work on it:

- Victoria Hogg, Nottingham University, UK
- Salford University, UK
- Minho University, Portugal (Paulo Lourenco)
- Cardiff University, UK

What needs to be done:

- Identifying parameters for:
 - different types of masonry
 - structural type – multi-span, skew, etc.

Work to be done in the next six months:

- Writing up, publishing Salford tests
- Finding out about Belfast tests on cyclic loading on masonry/stone.

4. Material Properties/Deterioration

Talk:

- Micro-modelling
Matthew Gilbert, Sheffield, UK; Portugal - Minho, Jinyan Wang - Salford
- National Research Centre, Italy (ENEA)
Seismic loading: Paolo Clemente (paolo.clemente@casaccia.enea.it)
- Literature review
Salford to coordinate, get results summary from Spain
- Soil - structure interaction: Sheffield

5. Analysis and Assessment

Talk:

Types of analysis:

- Advanced analysis
- Tim Hughes leading
- Tim to circulate report on this by email.
- RILEM report on modelling masonry would be relevant (Discussed at STRUIMAS VI Conference in Rome this week)
- Mechanics of Materials and Structures Laboratory (Istituto de Scienza a Tecnologie dell'Infomazione "A Faedo"), Italy.
Software development research into continuum mechanics for structural engineering; mathematical modelling of masonry materials.
Website: www.isti.cnr.it/ResearchUnits/Labs/mms-lab
- Limit analysis

Talk

"Overview of Assessment methods and results"

Network Rail publication

- MEXE - basic analysis
- ARCHIE - best for 1st level assessment
- RING - best for 2nd level assessment
- 2nd best for 1st level assessment
- ELFEN - high level analysis

Recommendations for future:

A program would be helpful that by putting in all parameters would come up with the answers from the main programs for comparison.

A list of all parameters would be useful that should be measured and to what extent they contribute to/influence the results.

Publications

- *Masonry and brick arch bridges: condition appraisal and remedial treatment*, CIRIA Project, Manual for arch bridges starting shortly

Collaboration

- *Bridge Research Forum, UK*

Include bridge owners and researchers

Roads liaison group/ Bridges board:

Issuing technical standards, research aims, etc.

What has been done :

- ARCHIEM (Equilibrium method)
- Cardiff spreadsheet (simple mechanism method)
- RING (Rigid block)
- Minho, Rome, Sheffield: particular emphasis on modelling friction

What needs to be done:

- Use of more efficient solution methods, permitting quick analysis of large problems (including 3D)

- Better modelling of soil-structure interaction
- Education: need better and simpler explanation of methods in textbooks
- RING: new version coming out shortly
Website: <http://www.shef.ac.uk/ring/>

What needs to be done in the next six months:

- Tim to circulate document
- Keep watch on new developments
- John Hodgson, Mouchel, UK – info on program for composite reinforcement
- Spain: Summary of assessment methods from Javier
- Create benchmark statements for calibrating bridges (Matthew)

6. New repair methods (to include: Speed of repair)

Four commercial companies in the UK.

What to be done:

- Produce checklist/questions for bridge owners to test new methods, retrofitting arches (Brian)
- Send us information if you know on related (non-UK) companies

7. New arch construction

New Highways Agency Code for “Unreinforced Masonry Arch Bridges” should be in final form by the next meeting, available for SMArT.