

Examples of practices: Non-destructive techniques

Non-destructive testing (NDT) uses different physical principles, methods and sensors for getting information about external and internal structure and material properties. Generally, NDT applications should be part of the global investigation of historic buildings. They do not replace other investigation techniques completely but in the case of historic monuments, NDT should be preferred instead of traditional tests on extracted samples when both types of techniques can solve the problem. In recent years, commercial systems or specifically developed systems like ground penetrating radar (GPR), impact-echo, sonics, microseismics, acoustic emission, geoelectric, active thermography and flat-jack have been applied successfully.

Depending on the particular situation and question NDT methods are useful to get a first survey of large areas at the beginning of building reconstruction or restoration projects namely on structures with defects or damage. It is then possible to investigate surfaces and parts of protected historic constructions or areas, which are difficult to access, with higher precision. These techniques can also be applied for long-running observations (monitoring) or be used as quality-assurance after repair interventions and during historical building researches.

With NDT methods, information is gained about irregularities within the historic structure, which itself is often inhomogeneous. Irregularities may derive from constructive mounting-parts (anchors, dowel, bars, nails), differences in material (brick, stone, mortar) or microstructure, from voids (chimney, unfilled joints) or delaminations, cracks, salt or moisture influence or differences of loading. Damage and deterioration of material might be related to complex environmental influences (pollution, sun, rain, freeze-thaw, ground water) and environmental hazards (fire, storm, flood, earthquake). In several cases the combination of different methods is required.



Left: Recording of radar data at the top of the cupola of the Altes Museum in Berlin. Middle: Application of active thermography at the Wartburg in Eisenach. Right: Test specimen made of historic brickwork at BAM.

RESEARCH PROJECTS, LITERATURE, GUIDELINES AND RECOMMENDATIONS

Research Projects:

www.onsiteformasonry.bam.de ; www.chef..bam.de ; www.iter.polimi.it ;
<http://minelab.mred.tuc.gr/dias/> ; www.niku.no/demotec ; www.samco.org

NDT Database and Journal:

www.ndt.net

Conferences :

<http://heberge.lcpc.fr/ndtce09/> ; <http://conference.bath.ac.uk/sahc08/> ;
<http://www.14ibmac.com.au/> ; <http://www.sacomatis.org/> ; www.structuralfaultsandrepair.com ;
<http://ecndt2010.ru/> ; <http://www.gpr2008.org.uk/> ; <http://www.thermo.p.lodz.pl/qirt/abstracts.php> ;
<http://www.cio.mx/AITA07/AITA07.htm>

Standards and Guidelines :

http://www.rilem.org/tc_sam.php ; www.iso.org ; www.cenorm.be ; www.astm.org ; www.din.de ;
www.dgzfp.de