

March 2013

SMARTBUILT

Newsletter#2

Leading Partner
welcome
message /
Project progress
and News /
Partners brief
presentation



LEADING PARTNER WELCOME MESSAGE

Structural Monitoring of ARTistic and historical BUILDing Testimonies (S.M.ART. BUIL.T.)

The S.M.ART. BUIL.T. project, between Historic heritage of Greece and Italy - between Corfu and Trani - two typical cultural symbols across the Adriatic Sea, successfully goes on and evolves itself by the actual development of its inceptive objectives.

The first project workshop, which took place on the 29th and 30th of November 2012 at the Politecnico di Bari, successfully marked the excellent cooperation among all the involved project partners. This effective cooperation framework brings nearer all expected outstanding results of preservation of relative cultural identities, represented, in particular, by the Structural monitoring of

Annunziata tower in Corfu and the Cathedral bell tower in Trani.

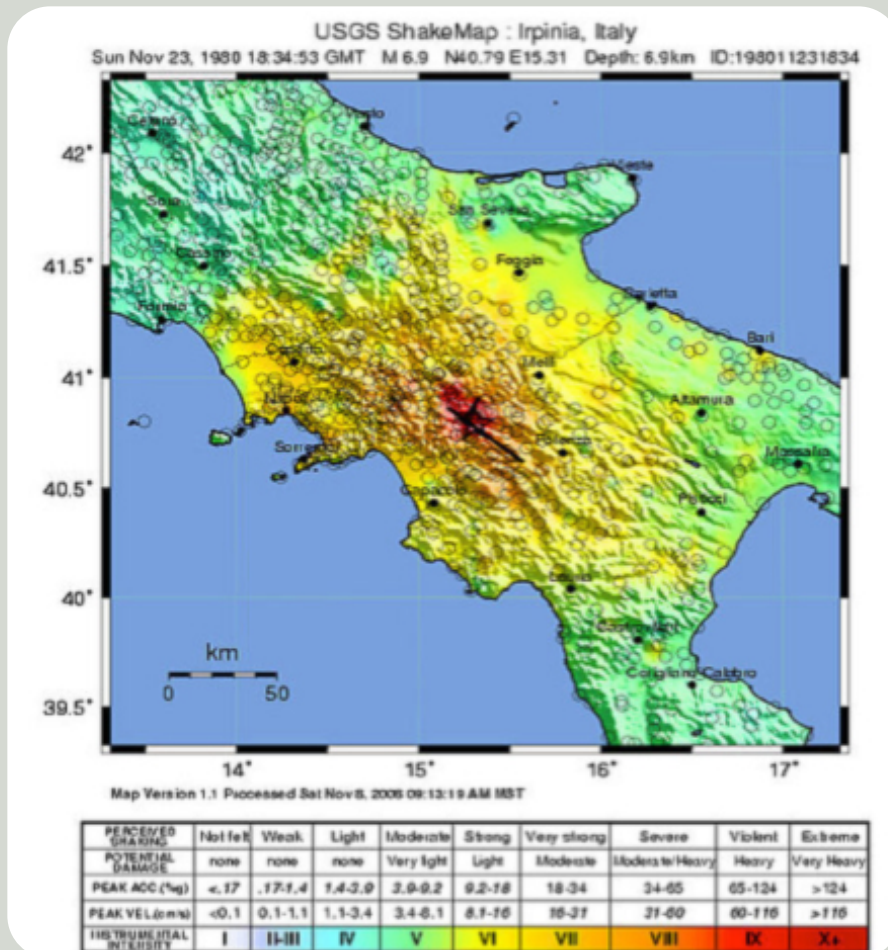
These structures represent the most important manifestation of both regional and national communities' identity. So all S.M.ART. BUIL.T. project activities, from workshops to real application of theories, gained extraordinary feedbacks from institutions and the community.

I would like to warmly thank all our partners for their constant diligence. We are all looking forward to organizing the next meeting so close to come.



Assoc. Prof. Dora Foti
Dept. of Civil Engineering
Technical University of Bari

E-mail: d.foti@poliba.it



MIBAC Activities

Regional Direction of Cultural Heritage and Landscape of Apulia region is involved in the project mostly on the general research and evolutionary stages of the historic center of Trani and its historical local seismicity.



Regional Direction of Cultural and Landscape heritage of Apulia Region

Regional Direction of Cultural Heritage and Landscape of Apulia region is involved in the project mostly on the general research and evolutionary stages of the historic center of Trani and its historical local seismicity (WP3). The historical and philological research in the archives of "Superintendency for Architectonical and Landscape Heritage" of Bari and other regional archives allowed to understand the born and then the evolution in the last twelve centuries of the historic center of the city, gradually enriched in its architectonical heritage. In the meanwhile it was investigated the seismic history of Trani in order to understand the vulnerability of the city and its heritage risks in case of earthquake. Trani, for the Italian legislation, is in a seismic zone "3", it means: "Area with low seismic hazard, which may be subject to moderate shaking ($0,05 \leq a_g < 0,15g$)". The delimitation of seismic zones in Italy allowed to set up regulations that take into account the stresses that any earthquake can have on the buildings. These rules, due to the temporal and quantitative unpredictability of the seismic event, are not intended to constitute an absolute defense against it, but to protect the building from harm in case of seismic movements of medium entity -the most likely- and in any case to equip it with the capacity for resisting to the first impact of the most violent stresses, allowing the saving of human lives. In particular, from the documents found and from Italian Geology and Volcanology Institute's data, results that since 217 b.C. until 2002 only six relevant event involved the city with a magnitude minor than 6 points on the Richter scale and, from the 2002 'till the 2012 all the earthquake in this area didn't overcome the 3 points on the same scale. We have no news

S.M.ART. BUIL.T. Project Report #1

about the damages of these earthquakes but we have sure notices about another earthquake that involved also Apulia region: The 1980 Irpinia earthquake took place in the Irpinia region in Southern Italy on Sunday, November 23, 1980. Measuring 6.89 on the Richter Scale, the quake, centered on the village of Conza, killed 2,914 people, injured more than 10,000 and left 300,000 homeless. It is clear that, even if not in a high risk area, Trani can be effected by intensive earthquakes of nearby areas of high intensity, as the "Irpinia earthquake" demonstrated. That's why it is important to monitor its historic building heritage. In particular, in our archives, we found news about the request of found after the Irpinia earthquake related to the Church of San Domenico.

In fact the studies of Regional Direction were focused also on the analysis of eight Monumental buildings in Trani on which PP3 should provide forms. These monuments are:

- Palazzo Vischi,
- Church of S. Anna,
- Tower of S. Lucia,
- Bell tower of St. Luigi,
- Palazzo Torres,
- Palazzo Filisio
- Clock tower of the Castle
- Bell tower of the Cathedral

Particularly, the last two of these monuments are the ones on which is being performed the operational Modal Analysis of the project, so the historical analysis on them was deepest involving also (cont'd)

restoration interventions regarding the Castel of Trani (so its clock tower) and the bell tower of the Cathedral (which in the Fifties was disassembled and rebuilt with the use of its same blocks - anastylosis). The clock tower of the Castle, in calcareous stone, was added to the entrance of the north side, in the XIX century, when the Castel became a prison. In 1979 the whole Castle was restored and quite all the superfetations of the prison period were demolished. Others restore works were done in 1997 for the public open of the castle, among these interventions:

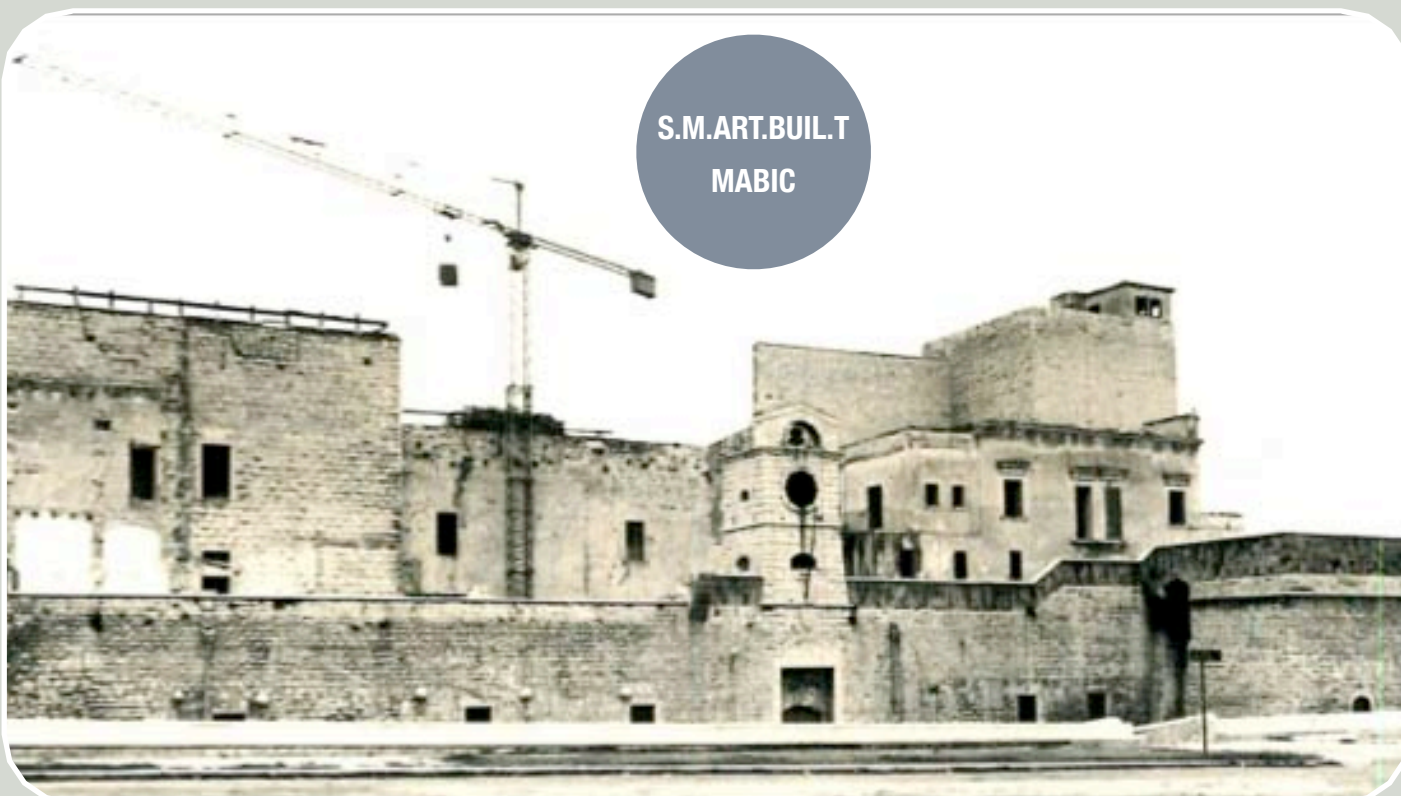
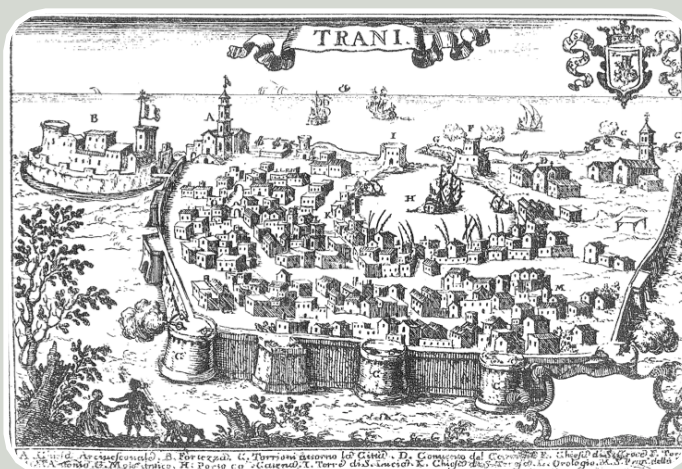
Consolidation of vaults extrados with hood in reinforced concrete

Consolidation of walls cores with armed injections

Reclamation from humidity of the walls of the north side and consolidation in order to improve seismic behavior as a result of the evaluation of the resistance of the masonry with jacks.

The Bell Tower of the Cathedral stands on an imposing ogival passage. Its surface is marked by windows progressively with more lights and culminates in an octagonal cusp and pyramid. Between 1950 and 1960 the Cathedral was involved in a series of radical measures aimed above all to recover the original architectural structure. Is obtained the splendid isolation of the monument with the demolition of the eighteenth-century Chapel of the Blessed Sacrament and the sacristy of the many chapels of the upper church, with the restoration of the interior, by removing the layer of plaster finish. The bell tower was disassembled and rebuilt it with the use of its same blocks. Both these monuments were investigated in its building history and moreover in the typology of interventions they've been effected in order to better understand their characteristics, materials and the state of the art in which the modal analysis can be performed. In fact, Italian legislation, with the above mentioned seismic zones, regulates also the work of the technician that wants to intervene now on historical buildings. Compliance with these standards is relatively easy in case of

new buildings but is considerably more complex in the restoration or just in the consolidation of old buildings, especially if the particular characteristics of that in terms of historical, artistic, architectural, require special caution in works. In restoration of historical buildings affected by earthquakes, it is necessary to intervene not only to reset the pre-existing static situation, but also to increase the safety coefficient of the building itself with restoration operations significantly complex that take into due account the conditions of future seismic activity. As a matter of fact, in order to intervene correctly on historical buildings, mostly if the intent is to preserve them from earthquakes, it is necessary to know not only their structure, materials and history of course, but moreover the constructive techniques with which they were built so that choose the most adequate earthquake resistant interventions to be realized. All these results of the research were showed in the workshop organized in Corfu and in the seminar of Bari during the proceeding of the project and are now collected in a deliverable, which contains all data retrieved.



S.M.A.R.T. BUIL.T. PROGRESS

A University of Salento Progress Report

Progress Overview

The activities of the University of Salento in the period July-December 2012 have been numerous and really important in the development of the project. The most important will be here introduced and described.

Experimental setup reparation and calibration

This activity was conducted in collaboration with the LP from July up to September 2012.

A system composed by several acquisition modules (photo Fig.1a) for acquiring the signals of several uniaxial seismic, high sensitivity, ceramic flexural ICP accelerometers PCB B393B31 (photo in Fig. 1b) was tested and opportunely calibrated. In this phase it was very important to develop a graphical interface for using the system 'on the field' and for easily setting some experiments parameters (starting time, sampling time, total time of acquisition, labeled name of the file where the data should be saved). Moreover some tests were conducted for realizing the

compatibility of the saved data format with the following analysis to be carried out with the specialized modal identification software. Finally an opportune block was designed and realized in such a way to guarantee the perfect orthogonality of each couple of accelerometers and to make easy the application of the sensors (jointed to the block with screws).

Measurements in Corfu and Trani

On October 2012, some initial measurements were conducted on the Annunziata tower in Corfu (12-13 October) and on Trani Cathedral bell tower (24-25 October).

This activity was conducted in collaboration with the LP and the local hosting partners (Ionian University and MIBAC).

The experimental measurements were carried out with similar common procedures; several consecutive acquisitions of 10 minutes each with a sampling time of 1024 Hz in environmental conditions, 8 accelerometers for plane, a couple for each corner.

Anyway, many difficulties were encountered especially for the measurements in the Annunziata tower.



Experimental Measurements

The experimental structural measurements on the selected buildings are now in full progress. Based on existing and innovative, state-of-the-art measurement approaches, the dynamic responses of the buildings under ambient and/or artificial loads will be obtained for delivering realistic scenarios on seismic vulnerability assessment via monitoring.



Progress
Report #2 -
University of
Salento

University of Salento Progress Report (cont'd)

The difficulties were mainly linked to the difficulty to access in the tower (the only access to the tower possible only with a temporary long metal stair). Also an external telescopic arm was used, but it could not help to achieve the cup of the tower. So using another metallic stair it was possible to achieve the second floor and to instrument also the double arches at that floor.

There is to underline the compromised state of the building fallen into decay.

With a system of ropes it was also possible to move the four bells placed under the vault for recording and evaluating their effects on the registered accelerations.

The tower was instrumented with 24 high sensitivity seismic accelerometers placed on 12 positions on 3 different levels; 8 accelerometers were placed on the four corners of the first floor, 8 placed on the four corners of the second floor, the last 8 placed on the basis of the four columns.

Several tests were carried out on 12th and 13th of October and the data analysis will be carried out in the next phases of the project.

The same procedure was applied to the tower of Cathedral of Trani on 24th and 25th of October, but it was easier because a recently restored internal stair permitted to achieve easily the four levels instrumented.

Eleven tests were conducted on the tower considering the effect of the sound bell and ambient vibrations for the tower of Trani Cathedral using 28 accelerometers.

CORFU SEMINAR

October 12-13, 2012

A thematic seminar on "Identification of optimal monitoring system for examining the vulnerability to dynamic loads of the historical buildings" was organized as a part of the "S.M.ART. BUIL.T. - Structural Monitoring of ARTistic and historical BUILDing Testimonies" project, implemented under the European Territorial Cooperation Program Greece – Italy, 2007 – 2013 and co-financed by the European Union (ERDF) and by National Funds of Greece and Italy.

The overall objective of the meeting was to enhance cooperation among the selected institutions of the two countries (Greece and Italy) towards facilitating the elaboration of historical buildings preservation methods and the implementation of policy guidelines.

The specific objective of the joint thematic seminar was to present at the broad public the so far project's results, especially for the developing monitoring system, and also to develop capacities with the Local Authorities to facilitate the implementation of historical buildings preservation methods, by increasing understating of the way that the available funding is distributing at local level.

The event was organized by the Corfu Municipality Sole Shareholder Co. S.A.. It was held at the offices of the Company, Pyli Agiou Nikolaou, Faliraki, 49100 Corfu.

Seminar agenda

At the beginning of the seminar, Mr George Mamalos (President of Boards of Directors of Corfu Municipality Sole Shareholder Co. S.A.) Prof. Vassilios Chrissicopoulos (Head of the Department of Informatics of Ionian University) provided a warm welcome to all seminar participants.

Next, a number of speakers belonging to the project research team presented the scope and aims of the project, as well as the current progress and estimated perspectives.

In Particular, Prof. Dora Foti, head of the project Leading Partner (Polytechnic of Bari) gave the seminar keynote speech entitled 'S.M.ART. BUIL.T. – Project overview'.

Next, Prof. Nicola Ivan Giannoccaro, Electronic Engineer, Professor at University of Salento presented his talk on 'S.M.ART. BUIL.T. Technical aspects of modal parameters dynamic identification for interested buildings'.

Mr Stelios Biribilis, Architect from National Technical University of Athens, talked about the Venetian Architecture of the Town of Corfu, followed by Mrs Tatiana Branca, Engineer from the Regional Direction for the Cultural and

Landscape Heritage of Puglia who presented the urban development and notes on the seismic history of Trani.

On behalf of Corfu Municipality, Mrs Mary Mitropia, Architecture, Head of Old City Office gave a presentation entitled 'Historical Buildings of Corfu', while Dr. Kostas Oikonomou, from Ionian University presented



the S.M.ART. BUIL.T. wireless sensor network targeted to analysis and implementation of the actual building structural monitoring.

The seminar concluded through a Questions and Answers session moderated by Prof. Dora Foti.

S.M.ART. BUIL.T. Project web site is now active

You may visit <http://www.smartbuilt.eu> for a full project description and up-to-date news

1st International Workshop

On November 30, 2012, the first Workshop of S.M.ART. BUIL.T. Project entitled "Structural Health Monitoring of Historical Towers: Sensor Network and FEM Modeling", was held in Bari. Its main aim was to present the initial project results to a technical audience like engineers and architects interested in structural monitoring and historical buildings restoration. Project Partners presented some important outcomes of the work carried out from the beginning of the project. In particular:

Dr. Spiros Vasiliadis, General Director of Corfu Municipality Sole Shareholder Company SA, made an intervention titled "Historical Public Buildings of Corfu", to show five Public buildings of the historical Center of Corfù, with important historical, cultural and architectural values, and to highlight the importance of the SMART BUILT implementation for the preservation and the restoration of these kinds of buildings.

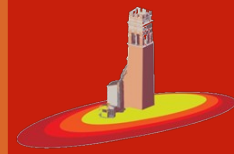
Dr. Tatiana Branca, expert of MIBAC, made an intervention titled: Seismic history and previous restorations of the two case studies of Trani, whose aim was to present the seismic history of Trani and to show the importance of restoration for earthquake resistant purpose, inter alia on the two case

studies of the SMART BUILT Project. Particularly restoration interventions regarding the Castel of Trani (so its clock tower) and the Bell tower of the Cathedral (which in the Fifties was disassembled and rebuilt with the use of its same blocks - anastylosis) were analyzed.

Prof. Konstantinos Oikonomou from Ionian University, presented a speech titled "Advanced structural monitoring through wireless sensor technologies" to make audience aware about the opportunities offered by wireless technologies in order to realize a non-destructive structural monitoring.

Prof. Andreas Floros, Ionian University, presented the "Deployment and assessment of the sensor-based monitoring infrastructure on historical buildings: the design process" which described in detail the design process to be followed for deploying the sensors' equipment on the historical buildings selected in the two historical centers of Corfu and Trani.

Dr. Maria Francesca Sabbà and Dr. Francesco Tucci, for the Technical University of Bari, presented, respectively, some preliminary results about the ambient vibrational monitoring of Annunziata tower in Corfu and the Cathedral bell tower in Trani".



**Structural Health
Monitoring of
historical towers:
sensor networks
and FEM
modelling**

INTERNATIONAL WORKSHOP ON STRUCTURAL MONITORING



**S.M.ART.
BUIL.T.**

**STRUCTURAL
MONITORING OF
ARTISTIC AND HISTORICAL
BUILDING
TESTIMONIES**

**THURSDAY 29TH NOVEMBER 2012
14.00—18.00**

**FRIDAY 30TH NOVEMBER 2012
10.00—11.30**

**SALA CONSIGLIO
2ND FLOOR DICAR
POLYTECHNIC OF BARI
ITALY**



**November 29 -
30, 2012**



Steering Committee Meeting

On December 1, 2012, just one day after the successful organization of the International Workshop on Structural Monitoring, the Project Steering Committee meeting was held aiming to define the next steps for project progress and future actions' organization.

The meeting was hosted by the project LP. The following members participated:

- Prof. D. Foti and Mrs A. Abrescia (Polytechnico of Bari)
- Prof. V. Chrissikopoulos, P. Vlamos and A. Floros (Ionian University)
- Dr. Nicola Ivan Giannoccaro (University of Salento)
- Mr. George Mamalos and Spyros Vassileiadis (Corfu Municipality)

UNIVERSITY OF SALENTO

A S.M.ART. BUIL.T. project partner

The University of Salento is actually composed by 750 academic staff, 28.000 students, 635 technical and administrative staff, 3 Campuses (Lecce, Arnesano e Brindisi) 10 Faculties (Cultural Heritage, Economics, Law, Engineering, Industrial Engineering, Literature and Philosophy, Foreign Languages and Literature, Science of Educational Training, MFN Science, Social, Political and Regional Sciences) 17 Departments, 22 Research Centers and Institutes, 4 Specialization Schools, 25 Libraries, 65 between 1° and 2° Level Degrees, 27 Post-Graduate courses and Masters, 56 Computer Laboratories, 162 Classrooms with a total 15372 seating capacity, 90 PhD Scholarships, 35 Foreign Internships (stage).

The University has grown remarkably in the last decades playing its leading role in the local cultural system. Its locations in Brindisi, Lecce and Arnesano (few kilometers from downtown), the University buildings and structures are a patrimony for the entire Salento, where tradition meets innovation, rootedness opens to contemporaneity.

Visiting the University of Salento is a pleasant journey among old buildings, cloisters and monasteries (like the Convento degli Olivetani, seat of the Rectorate), and very modern buildings (like the Engineering Department Building) which represent the icons of technology and research.

The University of Salento is a dynamic and versatile University, which is eager to progress and to increase its academic population in the perspective of scientific

development and sharing of human and cultural resources.

The University of Salento is a research university which aims to develop basic and applied research. The research activity ranges within a cooperation network among Italian and foreign universities, public and private research centers, and national and international enterprises.

In 2008 the University of Salento established the Research Observatory whose mission is to assess the scientific activity of the university, and to design useful guidelines to improve the quality and distribution of funding resources.

The University of Salento has a consistent tradition of working with foreign universities in the fields of research and educational programs with more than ninety institutions in twenty European countries. The information and promotion involved in exchange activity has notably enriched student interest in regards to educational opportunities offered by various programs. This has generated an on growing involvement with an academic component which is aware of the responsibility to quality connected to order on a programmatic, organizational and monitoring level.

Since the early years many important collaboration agreements have been stipulated with well-known European universities. Participation in the community (EU) Erasmus



UNIVERSITÀ
DEL SALENTO

visit:

www.unisalento.it

program and the Leonardo program has mobilized approximately 300 students every academic year. The considerable network of international agreements with U.S., Australian and Chinese universities, has brought to definition academic programs in common and Joint degrees.

The role of University of Salento (partner P2) in the S.M.A.R.T BUILT Project is to assist the LP in the actions 3.1, 3.2 ,3.3 and 5.2. The tasks of partner P2 in 3.1 is that of identifying dynamically the monitored historical buildings using novel techniques of dynamic identification and modern specialized software's using the experimental data opportunely obtained with a well-designed accelerometers configuration. The data obtained in 3.1 will be used for updating the finite element models (action 3.2) and, to detect the integrity of the building or eventual damages (action 3.3). Finally the P2 will be involved in action 5.2 using the new wire-less technology accelerometers for monitoring and controlling the building vulnerability to strong environmental events.

Visit University

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University of Salento in numbers

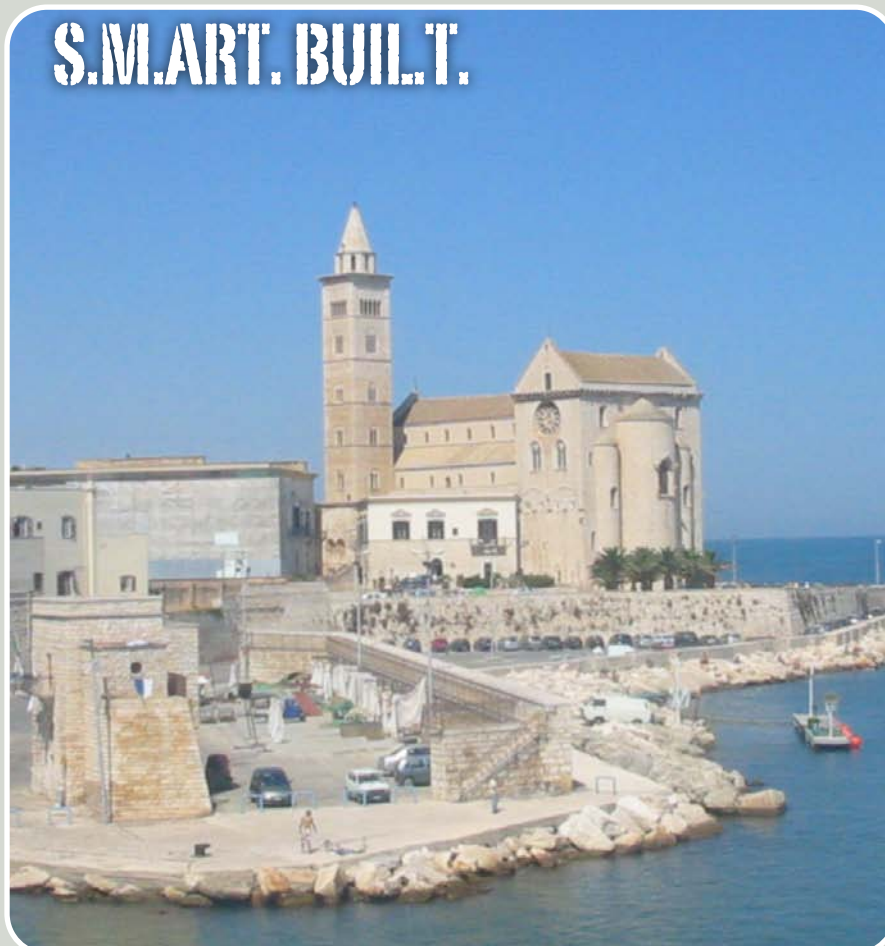
- 10 Faculties
- 17 Departments
- 22 Research Centers
- Located in 3 cities (Brindisi, Lecce and Arnesano)
- the University buildings and structures are a patrimony for the entire Salento, where tradition meets innovation.

CONTACT

Università del Salento

Piazza Tancredi, N7
73100 Lecce (LE)

tel +39 0832 29 11 11
C.F. 80008870752



Structural Monitoring of ARTistic and historical BUILDing Testimonies

About the newsletter

The S.M.ART.BUIL.T. NEWSLETTER is published every 4 months, containing information about the progress and the outcomes of the project.

It is electronically distributed in portable document format (pdf). Printed copies can be supplied on demand.

For any additional information regarding this publication, you may contact the publication coordinator via e-mail, using the address smartbuilt.bari@gmail.com