December 2013

SMARTBUILT

Newsletter#4

Dept. of Informatics welcome / Project progress and News / Internatinal Conference announcement

S.M.ART. BUIL.T WELCOME MESSAGE

from Partner 6, Dept. of Informatics, Ionian University

It was more than a year ago when I had the chance to welcome you all at the first issue of the S.M.ART. BUIL.T project newsletter. That particular issue was targeted to present the most significant and, more importantly, very promising activities that were planned and defined within the project technical framework. Now, after a number of productive months, the SMART BUILT project activities are coming to their end and the corresponding outcomes are more valuable and significant than expected.

The project particular aim was to develop fundamental building structural monitoring procedures, particularly emphasizing on structures of special architectural character and significant historic importance. Typical structures of this kind were selected among historical building existing at the cities of Corfu - Greece and Trani - Italy. The above monitoring procedure has obvious advantages towards risk prevention management against earthquakes, environmental pollution, noise and traffic conditions and has its origins from the recent realization of the fundamental role that historic buildings have as national and regional cultural resources. Hence, any monitoring task is not exclusively limited to optimize these buildings' protection plans, but also directly affects local communities in multiple level, including the local economic growth.

After a period of time of hard and concerted work and collaboration between the project partners, the project aims are completely fulfilled. I deeply believe that S.M.ART. BUIL.T represents a strong scientific basis for future optimization, deployment and assessment of historical building structural monitoring approaches.

Last, but not least, I would like to welcome the new project partner, the Municipality of Corfu, whose particular expertise on historical building prevention was significant towards the succesful completion of the project work packages.

On behalf of Ionian University / Dept. of Informatics, I would like to thank all project partners for the effective collaboration within the innovative project scope. We are all looking forward to participating into the final project activity, the International Conference on Historical Centres among Culture, Art, and Techniques: A new paradigm for Risks Prevention Through Structural Monitoring. I believe that this Conference will be the capstone of the work and the valuable project outcomes, as well as the chance to disseminate them worldwide among the interested members of the scientific community.

Prof. Vassilios Chrissikopoulos
Dept. of Informatics, Ionian University
Scientist in charge / Scientific responsible for Ionian University
E-mail: vchris@ionio.gr

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

S.M.ART. BUIL.T. PROGRESS

A Progress Report from Partner P4 - Regional Direction for the Cultural and Landscape Heritage of Puglia

THE HISTORICAL VALUATIONS ON BELL TOWER OF TRANI'S CATHEDRAL

The bell tower was built in two phases. Base, first and second floors have been built in the first half of the thirteenth century and the first half of the fourteenth century.
The other floors and the spire were erected in the second half of the fourteenth century. The inscription in stone indicates the name of the first architect “Nicolaus sacerdos et protomagister me fecit”.

The holy visit of june 19, 1633 verifies for the first time the tower’s structural problems. We know that in 1786 the niches of the base were closed.

In 1884, it was proposed, without success, to demolish the top three floors of the tower and spire to improve tower's stability of bell tower of Trani’s cathedral.

In these images we can see the consolidation project made by the civil engineering boureau in 1886 (genio civile): the structure of the struts is wood. Then other minor restoration works were made in 1891 and 1893, while in 1892 a bell fell down.

In the bell tower’s measurements realized by Sarlo in 1893 we can see that the bell tower was inclinated because of important structural problem at the base's arch.

In 1902 the bell tower was completely restored by engineer Francesco Sarlo, in particular he substituted all deteriorated elements like stone ashlars where was old cracks, but also columns, capitals and plinths. The most important reinforced was at the arch of base of the bell tower. In a picture of 1933 we can see the reinforced arch realized by Sarlo under the original one. In this way Sarlo intended to increase the resistent base and to improve the stability of tower. The foundation, the masonry’s core at the base and at the first floor was realized in reinforced concrete.

Progress Report #

In the first time the reconstruction project intended rebuilt the bell tower skeleton in reenforced concrete. Finally the project was modified and the skeleton was limited to the base up to first order.

The phase of demolition was realized with this method: every stone was signed with a number to identify the position into the wall for facility the reconstruction.

In July, 1953 the demolition of spire is completed. The elements of spire were ordinated in the square under the tower.

In the priced bill of quantities we can read that only the 60% of original stones was use to rebuilt.

In the other images of rebuilding we can see the skeleton in reenforced concrete with the round rods on the top and the stone masonry. But attention: in this way the wall had lost the original load bearing function and now it is only a cladding.

Today we can see the same situation that in the 1959. We can observe two different treatment of stone surface: gradine and bush-hammered surface.

S.M.ART. BUIL.T. INTERNATIONAL CONFERENCE

Final Official Announcement

SMART BUILT

HISTORICAL CENTRES AMONG CULTURE, ART AND TECHNIQUES: A NEW PARADIGMA FOR RISKS PREVENTION

BACKGROUND

S.M.ART. BUIL.T. "Structural Monitoring of ARTistic and historical BUILding Testimonies" is a project funded by the European Territorial Cooperation Programme Greece-Italy 2007/2013, and leaded by the Polytechnic of Bari. The core idea of "S.M.ART. BUIL.T." is risks prevention, which concerns not only the prevention of loss of lives and properties, but also the preservation of artistic and historical buildings from natural hazards.

Architectural heritage is an important part of the history and identity of Italy and Greece, contributing to their economy and well being. On the other side, ancient buildings suffer a high vulnerability to dynamic loads, which may induce an unpredictable partial or total collapse. Recent past experience after L'Aquila earthquake strongly evidence this problem.

The main objectives are the implementation of procedures for the structural monitoring, the seismic vulnerability assessment, the development of guidelines for strengthening and repair of the historical buildings (in Trani and Corfu). The two historic centers are made up of many ancient and brittle masonry buildings, mostly built with local stone, representative of a widespread typology in the Mediterranean area.

T

o circulate and diffuse the information produced in the project as much as possible, there were been organized seminars and workshops both in Italy and in Corfu, completely dedicated to dissemination and external communication, in order to enhance the diffusion of knowledge and information, as well as the results achieved step by step by the project team, to an audience of experts such as professional architects and engineers, building officials, educators, researchers, students, masonry construction professionals, and everyone else interested in the art and science of masonry historical buildings.

MOTIVATION

The international project "S.M.ART.BUIL.T." aims at providing to technical officials of the territorial authorities of Puglia and Ionian Islands Regions some indispensable training tools for the development and/or validation of structural restoration projects and seismic rehabilitation of historical buildings. Most of buildings of artistic value are invariably built of masonry, a material as old as the civilization and with a 10,000 years record of success and lasting qualities.

The International Conference titled "HISTORICAL CENTRES AMONG CULTURE, ART AND TECHNIQUES: A NEW PARADIGMA FOR RISKS PREVENTION THROUGH STRUCTURAL MONITORING" is the most important action of diffusion activities of the S.M.ART.BUIL.T. project and it is open to all experts in the following topics: seismic and structural monitoring, historical and artistic heritage in order to exchange experience of correlated research areas. The purpose is to make the conference a forum for dissemination of the latest scientific and technical developments and for exchange of new ideas in emerging topics of the project.

The international conference is planned to be held in Bari (Italy) at the beginning of April 2014

Invited lectures on specific topics strictly related with the major research issues will alternate with presentations on several topics of general interest, coming from this call for abstracts. Depending on the number of abstracts, a poster session might be organised.
A book of abstracts will be distributed during the conference; powerpoint presentations will be made available on the S.M.ART. BUIL.T. website (www.smartbuilt.eu) after the event. Extended versions of selected papers will be considered for publication in peer-reviewed journals in the field of the conference.

Project Part-Financed by the European Union
European Regional Development Fund

European Territorial Cooperation Programme
Greece - Italy
2007-2013
INVESTING IN OUR FUTURE
Co-funded by the European Union (ERDF) and by National Funds of Greece & Italy

TOPICS

The main topics are divided into *three areas*:

I. HISTORICAL AND ARTISTIC AREA

a. **Typological and morphological characters of historical centres**
b. **Historical aspects and general methodology of historical centres**
c. **Conservation and restoration of historical buildings**

II. COMPUTATIONAL AND TECHNOLOGICAL AREA

a. **Sensor-based monitoring infrastructures on historical buildings**
b. **Ambient vibration testing for structural monitoring**
c. **Mathematical modeling for early vulnerability assessment**

III. STRUCTURAL AREA

a. **Dynamic identification and structural monitoring of historical buildings**
b. **Analytical and numerical approaches**
c. **Seismic analysis and vulnerability assessment**
d. **Case studies**

KEY-DEADLINES

- ***Dicember 16, 2013*: deadline for draft papers;**
- ***January 31, 2013*: acceptance of the papers and elaboration of a draft program by the organizing committee;**
- ***February 28, 2014*: deadline for revised papers;**
- ***March 27/29, 2014*: International Conference;**
- ***End April, 2014*: conference proceedings published on an ISBN book.**

VENUE

"Castello Svevo", Bari, Italy.

REGISTRATION

No registration fee is charged.

LANGUAGE

The official language of the conference is English.

CONFERENCE CHAIR

Prof. FOTI D., *Polytechnic of Bari*

CONFERENCE CO-CHAIRS

Prof. CHRISSIKOPOULOS V., *Ionian University*
Prof. GIANNOCCARO N. I., *University of Salento*

INTERNATIONAL SCIENTIFIC COMMITTEE

Prof. AIELLO M. A. (Italy, *University of Salento*)
Dr. ANGELINI G. (Italy, MiBac)
Prof. BERNAL D. P. (USA, *Northeastern University*)
Arch. BUONOMO S. (Italy, *MiBac-SBAP Bari Foggia*)
Prof. DE ROECK G. (Belgium, *University of Leuven*)
Prof. DE STEFANO M. (Italy, *University of Florence*)
Prof. DIAFERIO M. (Italy, *Polytechnic of Bari*)
Prof. DOULIGERIS C. (Greece, *Piraeus University*)
Prof. FABBROCINO G. (Italy, *University of Molise*)
Prof. FARAVELLI L. (Italy, *University of Pavia*)
Prof. FLOROS A. (Greece, *Ionian University*)
Prof. GATTULLI V. (Italy, *University of L'Aquila*)
Prof. GENTILE C. (Italy, *Polytechnic of Milan*)
Prof. IVORRA S. (Spain, *University of Alicante*)
Prof. KARIDIS P. (Greece, *Technical University of Athens*)
Prof. LAGOMARSINO S. (Italy, *University of Genova*)
Prof. LOURENÇO P. B. (Portugal, *University of Minho*)
Prof. MAGKOS M. (Greece, *Ionian University*)
Prof. MICELLI F. (Italy, *University of Salento*)
Dr. MILELLA M. (Italy, *MiBac – Bari)*
Prof. OIKONOMOU K. (Greece, *Ionian University*)
Prof. ROCA P. (Spain, *Polytechnic of Catalunya*)
Prof. SAVOIA M. (Italy, *University of Bologna*)
Prof. SERINO G. (Italy, *University of Naples Federico II*)
Prof. SIOUTAS S. (Greece, *Ionian University*)
Prof. SPENCER B. (USA, *University of Illinois*)
Prof. VLAMOS P. (Greece, *Ionian University*)

ORGANIZING COMMITTEE

Dr. ABRESCIA A.
Lect. AVLONITIS M. (Greece, *Ionian University*)
Dr. GIANNOCCARO R.
Arch. LONGOBARDI F. (Italy, *MiBac - Bari*)
Arch. PRETE F. (Italy, *Polytechnic of Bari*)

PAPER SUBMISSION

Authors can submit draft papers on the conference website (www.smartbuilt.eu soon available) filling a special form, before Dicember 16th 2013.

All submissions should include a title, author names and affiliations and indicative key-words, specifying the scientific area which they belong to.

The papers should not be longer than 6 pages.

Camera-ready guidelines with paper template in letter-sized PDF will be sent afterwards for final submission.

Only presented papers will be accepted for publication in a special session of the International Journal of Advanced Structural Engineering (IJASE).

Contact: smartbuilt.comunicazione@gmail.com

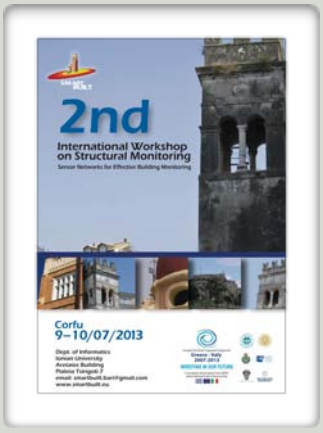
S.M.ART. BUIL.T. Project International Conference

Topics - Dates & Deadlines - Venue - Committees - Information for Paper Submission

A S.M.ART. BUIL.T. Workshop

The Workshop was held in Corfu, Greece, on July 9-10, 2013. The main objective of the workshop was to provide a summary of the best practices derived through the current progress S.M.ART BUIL.T project related to the employment of modern types of sensor networks as effective means for monitoring old buildings. These practices typically include novel approaches on the design and deployment of the overall sensor network infrastructure, taking into account the particularities of the buildings under monitoring imposed by their age and monument nature.

The workshop was targeted to local authorities and municipal technical agencies, as well as teachers, professionals and students who are interested in extending their knowledge on the state-of-the-art topic of historical building seismic prevention and rehabilitation building through sensor networks.



Workshop Agenda

Tuesday, July 9th 2013

16:00 – 16:30 **Welcome reception and registration**

16:30- 16:40 **Welcome messages**
Prof. Vassilios Chrissikopoulos, Dept. of Informatics, Ionian University Associate Prof. Dora Foti, Project Scientific Respon sible, Polytechnic of Bari

Session 1 Coordinator: M. Magkos, Ionian University

16:40 – 17:00 Non-destructive Characterization and Dynamic Identifica tion of the Annunziata Tower of Corfu
Assist. Prof. Nicola Ivan Giannoccaro, University of Salento

17:00 – 17:20 Stochastic Modeling and Structural Identification Analysis of Experimental Tests
Lecturer Markos Avlonitis, Dept. of Informatics, Ionian University

17:20 – 17:40 The Bell Tower of Trani Cathedral Experimental Tests , Structural Identification and FEM Model Updating
Dr. Maria Francesca Sabbà, Politechnic of Bari

Coffee Break

Session 2 Coordinator: A. Floros, Ionian University

18:00 – 18:20 Accuracy of prediction models of time- and space-depen dent vulnerability of historical buildings
Associate Prof. Panayiotis Vlamos, Dept. of Informatics, Ionian University

18:20 – 18:40 Historical valuations about the bell tower of the Trani's cathedral
Donatella Campanile, Regional Direction for the Cultural and Landscape Heritage of Puglia

18:40 – 19:00 The S.M.A.RT. BUIL.T Wireless Network: going through a novel architecture
Assist. Prof. Konstantinos Oikonomou, Dept. of Informatics, Ionian University

19:00 – 19:30 Round Table: "From Monitoring to Modeling – Towards an Integrated and Effective Structural Identification and Preservation"
Coordinator:Panayiotis Vlamos, Dept. of Informatics, Ionian University

19:30 Workshop Closing

Wednesday, July 10th 2013

11:00 – 13:00 Project steering committee meeting (Faliraki)

UPCOMING PROJECT EVENTS	STEERING COMMITTEE MEETING	INTERNATIONAL CONFERENCE
	S.M.ART. BUIL.T. Steering Committee Regular Meeting **Bari, December 2013**	"Dynamic Identification and Model Updating of Historical Buildings", **Bari, April 2014**

S.M.ART. BUIL.T. PROGRESS

Partner P2 - University of Salento

UNIVERSITÀ DEL SALENTO

Progress Report #2 - Univ. of Salento

The activities of the University of Salento in the period July-November 2013 have been important in the development of the project. The most important will be here introduced and described.

July: San Giacomo Theatre measurements, Corfu

This activity was conducted in collaboration with LP.

The experimental measurements were carried out with several difficulties, both for the particularity of the building bot for logistical problems. The building monitored is actually the place where is located the office of the Major of Corfu and the working place of many Municipality employers. The technical difficulties were related to the characteristics this masonry historical construction built in the XIX century. It´s built in a rectangular plant of 25x14 m with tree different levels of wooden floors, the third was built some year after the initial building. This configuration presents a particularity in this structure for a dynamic identification because its shape is extremely stocky. The monitoring system consists of several elements properly connected: in total eighteen accurate accelerometers have been positioned at different levels and in different rooms, according to the orthogonal directions.

In Figure 1a) and 1b) the frontal and lateral view of the building, in Fig. 2a) and 2b) some details of the internal part of the building; in Fig. 2a the main stair between the first floor and the super elevation of the second floor, in Fig. 2b) the long corridor at 1st floor (in wood), and in Fig. 2c) the corridor at 2nd floor (in wood).

Figure 2a: Stair

Figure 1a: building frontal view

Figure 2b: 1st floor corridor

Figure 1b: building lateral view

Figure 2c: 2nd floor corridor

S.M.ART. BUIL.T. Project is on-line!

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

University of Salento Progress Report (cont'd)

The vaults are very high, but by using long stair, 18 accelerometers have been positioned at the superior corners at different levels (in Fig. 3a two accelerometer at a corner the second floor, in Fig. 3b two accelerometers at the corners of the corridor, in figure 3c two couples of accelerometers on the basis and on the high corner at the end of the first flight of the main stair).

The installation procedure and the following measurements have been performed in a period really difficult from the social point of view; a huge strike has been carried out by all the employers of the Municipality and the Major was obliged to close the structure.

Before the closing it was possible just in time to fix 18 accelerometers and to perform two carrots for having information on the materials characteristics (the carrots extraction is depicted in Figs 4a and 4b).

A stratagem has been performed in order to realize the foreseen acquisition of 10 minutes; a window was left opened before leaving the building and a wire connected to the central acquisition unit remote control was passed through the window (Fig.5a). This wire was suspended and passed to the other side of the street (Fig. 5b) and finally connected to a driving pc placed on a table of the bar placed in front of the building (the bar entrance is indicated in Fig. 5c). In this way it was possible to complete the experimental measurement campaign also if the building was officially closed for the strike.

Finally, the working group depicted together with the Major and some architects employed in the Municipality who helped in the operation of experimental monitoring (Figs. 6a and 6b).

July: Workshop in Corfu

The University of Salento participated to the Workshop in Corfù and its scientific responsible makes a presentation titled 'Non-destructive characterization and dynamic identification of the Annunziata Tower of Corfù'. The workshop was held at the Department of Informatics of the Ionian University.

Fig. 3a

Fig. 3b

Fig. 3c

Fig. 4a and 4b

University of Salento Progress Report (cont'd)

September: analysis of the experimental data and comparison with a Finite Element (FE) model

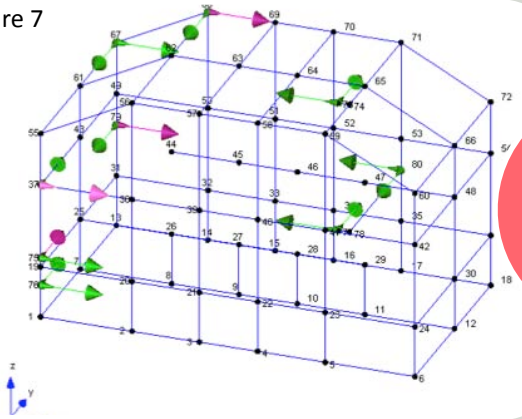
The analysis of the experimental data has performed by the University of Salento together with a comparison with a detailed FE model realized by the LP. For the particularity of the structure that is extremely stocky and that has wooden floors, there is not the safety of a global localization of the identified frequencies.

For this reason, we retain that a preliminary analysis becomes necessary before applying the usual methodologies of model updating; this preliminary analysis, actually in progress, tries to analyze the phase shift of different acquisition points for the identified frequencies by means of digital band pass filter opportunely designed. This preliminary analysis will be useful to analyze the global characteristic of the frequencies identified with the OMA (Operational Modal Analysis) methods, EFDD (Enhanced Frequency Domain Decomposition) that operates in the frequency domain, and the SSI (Stochastic Subspace Identification) technique that operates in the time domain.

The scheme of the points where the accelerometers have been placed (indicated as arrows) is shown in the Artemis model of the building reported in Fig. 7 where it is also introduced the Oxyz reference system used.

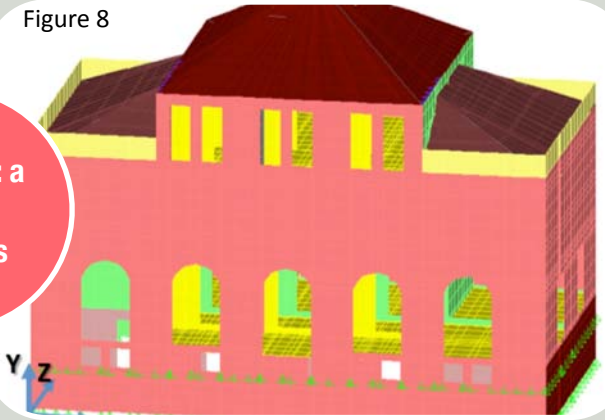
The FE model realized in SAP with shell elements is shown in Figure 8; the possibility of updating the model in such a way that it could have the same dynamic behavior of the experimental data is the next challenge of the project for the working group.

Figure 7



FE model: a work in progress

Figure 8



Project progress in pictures

POLYTECHNIC OF BARI

UNIVERSITY OF SALENTO

IONIAN UNIVERSITY
DEPARTMENT OF INFORMATICS

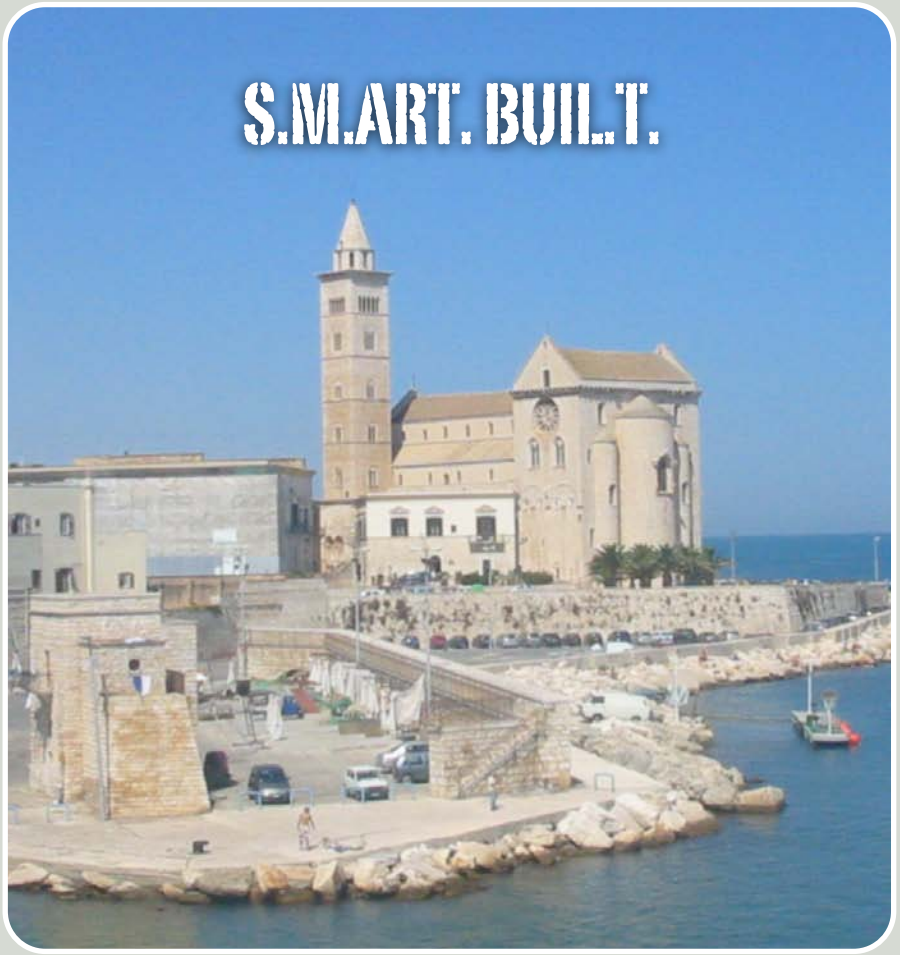
Project Partners

MUNICIPALITY OF TRA

MINISTERO PER I BENI E LE ATTIVITÀ CULTURALI
REGIONAL DIRECTION FOR THE CULTURAL AND LANDSCAPE HERITA OF PUGLIA

MUNICIPALITY of CORFU

European Territorial Cooperation Programme
Greece - Italy
2007-2013
INVESTING IN OUR FUTURE
Co-funded by the European Union (ERDF) and by National Funds of Greece & Italy



Structural Monitoring of ARTistic and historical BUILding Testimonies

About the newsletter

The S.M.ART.BUIL.T. NEWSLETTER is published every 4 months, conatining 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