COST Action TU1208
"Civil Engineering Applications of Ground Penetrating Radar"

2014 Working Group Progress Meeting

Scientific Programme and Practical Information Guide

Dates:

24 and 25 February 2014

Venue:

Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux (IFSTTAR)
Route de Bouaye , Bouguenais Cedex - Nantes, France

Organisers:

Dr. Xavier Derobert (Ifsttar, Nantes, France)
Dr. Lara Pajewski ("Roma Tre" University, Rome, Italy)

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Introduction

Dear Participant,

It is our great pleasure to welcome you in Nantes for the 2014 Working Group Progress Meeting of the COST Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar".

Over 30 delegates from both academia and industry will actively participate to the meeting, being engaged in a series of presentations, discussions and brainstorming sessions, concerning the Ground Penetrating Radar (GPR) use in civil engineering tasks.

The main focus of the meeting will be on the following topics: (i) inspection procedures for effective GPR surveying of critical transport infrastructures and buildings; (ii) inspection procedures for effective GPR sensing and mapping of underground utilities and voids in urban areas; (iii) inspection procedures for effective GPR monitoring of construction materials; (iv) determination, through the use of a GPR system, of water content in structures, foundations and soil; (v) advanced techniques for the solution of forward and inverse electromagnetic near-field scattering problems by complex scenarios; (vi) shape-reconstruction and quantitative estimation of electromagnetic and physical properties from GPR data; (vii) processing of GPR data collected during civil engineering surveys.

We will be honoured to have Prof. Antonis Giannopoulos (The University of Edinburgh, United Kingdom) and Dr. Craig Warren (Edinburgh Napier University, United Kingdom) holding a special workshop on "Computational Electromagnetics with the Finite-Difference Time-Domain technique." The programme of this workshop is to resume the Finite-Difference Time-Domain method and the potentialities of the well-known versatile and accurate GPRMAX software, as well as to talk about some advanced topics like the modelling of complex structures and of inhomogeneous media with stochastically distributed parameters, for realistic electromagnetic representations of GPR antennas, construction materials and soils.

We are delighted to announce that two keynote lectures are foreseen, by Prof. Andreas Tzanis (University of Athens, Greece) and Dr. Janne Poikajarvi (Lapland University of Applied Sciences, Finland). Prof. Andreas Tzanis will present the well-known MATGPR software that he developed, providing a broad and functional range of tools for the analysis of zero and single-offset GPR data; he will also give an overview on GPR data processing, suggesting open issues and possible future developments in this area. Dr. Janne Poikajarvi will present the Mara Nord Project, recently carried out in Finland, Sweden and Norway; the project objectives were to demonstrate the potential of GPR in road-condition measurement and rehabilitation planning, to create and harmonise Scandinavian recommendations, and to organise a GPR training programme.

A very interesting visit to the IFSTTAR geophysical test site, Accelerated Pavement Testing (APT) facility and geotechnical centrifuge has been organised. The geophysical test site is an open-air laboratory including a large and deep area, filled with various materials arranged in horisontal compacted slices, separated by vertical interfaces and water-tighted in surface; several objects as pipes, polystyrene hollows, boulders and masonry are embedded in the field. The APT facility is an outdoor circular carousel dedicated to full-scale pavement experiments, consisting of a central tower and four long arms equipped with wheels, running on a circular test track. The IFSTTAR test sites represent a perfect location for the comparison of different GPR equipment and surveying procedures.

We are deeply grateful to COST, for funding the COST Action TU1208, and to the Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux, for hosting this event.

We wish you a successful meeting!

With best regards,

Xavier Derobert and Lara Pajewski

About COST

COST - European Cooperation in Science and Technology is an intergovernmental framework aimed at facilitating the collaboration and networking of scientists and researchers at European level. It was established in 1971 by 19 member countries and currently includes 35 member countries across Europe, and Israel as a cooperating state.

COST funds pan-European, bottom-up networks of scientists and researchers across all science and technology fields. These networks, called 'COST Actions', promote international coordination of nationally-funded research. By fostering the networking of researchers at an international level, COST enables break-through scientific developments leading to new concepts and products, thereby contributing to strengthening Europe's research and innovation capacities.

COST's mission focuses in particular on:

- building capacity by connecting high quality scientific communities throughout Europe and worldwide;
- providing networking opportunities for early career investigators;
- increasing the impact of research on policy makers, regulatory bodies and national decision makers as well as the private sector.

Through its inclusiveness, COST supports the integration of research communities, leverages national research investments and addresses issues of global relevance. Every year, thousands of European scientists benefit from being involved in COST Actions, allowing the pooling of national research funding to achieve common goals.

As a precursor of advanced multidisciplinary research, COST anticipates and complements the activities of EU Framework Programmes, constituting a "bridge" towards the scientific communities of emerging countries. In particular, COST Actions are also open to participation by non-European scientists coming from neighbour countries (for example Albania, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Lebanon, Libya, Moldova, Montenegro, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine) and from a number of international partner countries.

COST's nine key domains are: (i) Biomedicine and Molecular Biosciences; (ii) Food and Agriculture; (iii) Forests, their Products and Services; (iv) Materials, Physics and Nanosciences; (v) Chemistry and Molecular Sciences and Technologies; (vi) Earth System Science and Environmental Management; (vii) Information and Communication Technologies; (viii) Transport and Urban Development; (ix) Individuals, Societies, Cultures and Health. In addition, Trans-Domain Actions allow for broad, multidisciplinary networks to strike across the nine scientific domains.

COST invites researchers throughout Europe to submit proposals for COST Actions through a continuous Open Call. The two collection dates a year are announced in the Official Journal of the European Union and on the COST website. Following a thorough evaluation and selection process, the decision for funding a proposal is taken by the COST Committee of Senior Officials (CSO), within eight months from the collection date. Successful proposals are approved to become COST Actions.

COST's budget for networking activities has traditionally been provided by successive EU RTD Framework Programmes. COST is currently executed by the European Science Foundation (ESF) through the COST Office on a mandate by the European Commission, and the framework is governed by a Committee of Senior Officials (CSO) representing all its 35 member countries.

More information about COST is available at www.cost.eu.

About COST Transport and Urban Development (TUD) Domain

The COST Transport and Urban Development (TUD) Domain fosters research coordination in the fields of transport and the built environment, which play a strategic role in the modern society and economy. The Domain is by definition cross-sectoral and multidisciplinary, encompassing a wide range of scientific expertise within the transport and land use planning, design, and management activities with a special emphasis on the strong interrelationships among the relevant policy fields as well on all aspects related to sustainable development.

The TUD Domain activities are innovative and complementary to other European programmes in the relevant fields. The aim is to cover both basic and applied research activities including technical and technological developments and their changeovers that are relevant to policy and decision making processes. A significant concern is devoted to activities exploring new research needs and developments.

The Chair of the TUD Domain is Prof. Cristina Pronello (Politecnico di Torino, Italy). The Science Officer of the TUD Domain is Dr. Mickael Pero (COST Office, Belgium).

The 25 running COST Actions within the TUD Domain are:

- TD1106 "UAE - Urban Agriculture Europe"
- TU0902 "Integrated Assessment Technologies to Support the Sustainable Development of Urban Areas"
- TU0904 "IFER – Integrated Fire Engineering and Response"
- TU0905 "STRUCTURAL GLASS – Novel Design Methods and Next Generation Products"
- TU1001 "P3T3 – Public Private Partnerships in Transport: Trends and Theory"
- TU1002 "Accessibility Instruments For Planning Practice In Europe"
- TU1003 "MEGAPROJECT: The Effective Design and Delivery of Megaprojects in the European Union"
- TU1004 "Modelling public transport passenger flows in the era of intelligent transport systems"
- TU1101 "Towards safer bicycling through optimization of bicycle helmets and usage"
- TU1102 "Towards Autonomic Road Transport Support Systems"
- TU1103 "Operation and safety of tramways in interaction with public space"
- TU1104 "Smart Energy Regions"
- TU1105 "NVH analysis techniques for design and optimization of hybrid and electric vehicles"
- TU1201 "Urban Allotment Gardens in European Cities - Future, Challenges and Lessons Learned"
- TU1202 "Impact of climate change on engineered slopes for infrastructure"
- TU1203 "Crime Prevention through Urban Design and Planning"
- TU1204 "People Friendly Cities in a Data Rich World"
- TU1205 "Building Integration of Solar Thermal Systems"
- TU1206 "SUB-URBAN – A European network to improve understanding and use of the ground beneath our cities"
- TU1207 "Next Generation Design Guidelines for Composites in Construction"
- TU1208 "Civil Engineering Applications of Ground Penetrating Radar"
- TU1209 "TEA – Transport Equity Analysis: assessment and integration of equity criteria in transportation planning"
- TU1301 "NORM for building materials"
- TU1302 "SaPPART – Satellite Positioning Performance Assessment for Road Transport"
- TU1303 "Novel Structural Skins: Improving Sustainability And Efficiency Through New Structural Textile Materials And Designs"

More information about COST TUD is available at www.cost.eu/tud.

About COST Action TU1208
"Civil Engineering Applications of Ground Penetrating Radar"

The COST Action TU1208 focuses on the exchange of scientific-technical knowledge and experience of Ground Penetrating Radar (GPR) techniques in civil engineering, aiming as well at promoting a wider and more effective use of this inspection method throughout the Europe. The scientific activities of the Acton are being developed within the frame of a unique approach based on the integrated contribution of University researchers, software developers, geophysics experts, Non-Destructive Testing equipment designers and producers, end users from private companies and public agencies.

In this interdisciplinary Action, advantages and limitations of GPR will highlighted, leading to the identification of gaps in knowledge and technology. Protocols and guidelines for EU Standards will be developed, for an effective application of GPR in civil engineering. A novel GPR equipment will be designed and realised. Advanced electromagnetic-scattering and data-processing techniques will be developed. The understanding of relationships between geophysical parameters and civil engineering needs will be improved. Freeware software will be released, useful for inspection and monitoring of structures and infrastructures, buried-object localization, shape reconstruction and estimation of electromagnetic parameters. A high level training program will be organised. Mobility of early career researchers will be encouraged. The project has already received the interest of key end users and excellent EU Institutions.

Four Working Groups (WGs) carry out the research activities:

- WG1 focuses on the design of innovative GPR equipment, on the building of prototypes, as well as on the testing and optimization of new systems;
- WG2 focuses on the GPR surveying of pavement, bridges, tunnels and buildings, as well as on the sensing of underground utilities and voids;
- WG3 deals with the development of electromagnetic forward and inverse scattering methods and of advanced data processing algorithms; and
- WG4 explores the use of GPR in fields different from civil engineering and the integration of GPR with other non-destructive testing techniques.

The Chair of the COST Action TU1208 is Dr. Lara Pajewski ("Roma Tre" University, Italy) and the Vice-Chair is Prof. Andreas Loizos (National Technical University of Athens, Greece). The Domain Committee Rapporteur is Prof. Goran Mladenovic (University of Belgrade, Serbia), the Science Officer is Dr. Mickael Pero (COST Office, Belgium) and the Administrative Officer is Ms. Carmencita Malimban (COST Office, Belgium). The Chair of WG1 is Dr. Guido Manacorda (IDS Ingegneria dei Sistemi, Italy), the Chair of WG2 is Dr. Christina Plati (National Technical University of Athens, Greece), the Chair of WG3 is Dr. Antonis Giannopoulos (The University of Edinburgh, United Kingdom) and the Chair of WG4 is Dr. Immo Trinks (Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology, Austria). The Editorial Coordinator is Prof. Andrea Benedetto ("Roma Tre" University, Italy), the Training School Manager is Prof. Giuseppe Schettini ("Roma Tre" University, Italy) and the Short-Term Scientific Missions Manager is Prof. Marian Marciniak (National Institute of Telecommunications, Poland).

About 100 Institutions from 25 COST Countries (Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Malta, Macedonia, The Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, Turkey, United Kingdom) have already joined the Action. Institutions from Armenia and Ukraine, U.S.A., Rwanda and Australia have joined the Action, too. Further applications from Egypt and Hong Kong are under examination. The COST Action TU1208 is still open to the participation of new parties! For more information, please visit www.cost.eu/domains_actions/tud/Actions/TU1208 and www.GPRadar.eu.

About IFSTTAR

IFSTTAR is a major player in the European research on the city and the territories, transportation and civil engineering. The French Institute of Science and Technology for Transport, Development and Networks, born on January 1st 2011, from the merger of INRETS and LCPC, is a Public Institution of a Scientific and Technical Nature, under the joint supervision of the ministry of ecology, sustainable development and energy and the ministry of higher education and research.

IFSTTAR's role is to carry out and commission, direct, lead and appraise research, development and innovation in the areas of urban engineering, civil engineering, and construction materials, natural hazards, the transportation of persons and goods, systems and means of transport and their safety, infrastructure, and investigate their uses and impacts from the technical, economic, social, health, energy, environmental and human points of view.

The Institute's principal aims are: (i) to carry out fundamental and applied research, perform methodological studies and develop tests and prototypes; (ii) to conduct all types of expert appraisals and advisory work in the fields mentioned in the above paragraph; (iii) to implement a scientific and technical information policy and disseminate the knowledge gained, in particular through publications, technical regulations and standards; (iv) to pursue a policy to exploit the results of its scientific and technological research, in particular by means of technical support, technology transfer and certification tests; (v) to play a role in training by and for research and both vocational and in-service training; (vi) to help to export its expertise and the techniques it develops and gain better international exposure for them.

More than ever, the harmonious development of human societies depends on our capacity to live together and share public space and time, quite as much as resources. Society is becoming not only increasingly mobile, urbanized, globalised and digital, but also more and more participative, environmentally responsible, aware of the limited nature of its resources and safety conscious. In addition – at least in developed countries – populations are ageing rapidly. Each of these factors is a challenge for the 21st century. IFSTTAR has made a non-exhaustive list of the areas where it could make a valuable contributi: (i) mitigating climate change, adapting to it and limiting energy demand; (ii) protecting our built heritage and making it versatile, increasing the resilience of systems; (iii) preserving biodiversity and natural resources; (iv) enhancing living environments and reducing sociospatial inequalities at various scales; (v) responding to demographic changes, improving public health and human safety; (vi) adapting to and implementing technological and socioeconomic changes to improve the design of public space and transport.

The Institute has a key role to play in the debate on the accessibility, equitable distribution and safe use of public space in a context of increasing urbanization, limited resources of raw materials and with regard to sustainable development. It has thus been given the important political and social role of improving the living conditions of all members of society, while helping to protect fundamental rights such as transport, safety and access to an environmentally-friendly living space that takes account of the individual. It relies on its existing expertise, particularly in the areas of civil engineering, transport and road safety, but also intends to meet new challenges, especially in relation to climate change, sustainable development and ageing populations. IFSTTAR's ability to pursue targeted research and adopt a systems approach, which is necessarily multidisciplinary, is reflected in the structure of its research programmes, based based on the following four major scientific challenges: 1 - Inventing sustainable transport and mobility; 2 : Adapting infrastructure; 3 : Controlling natural hazards and our environmental impacts; 4 : Thinking and planning the cities and regions of the future . While IFSTTAR's first goals and performance contract considers these challenges on a medium-term time scale, those that follow it will enable the Institute to update its scientific strategy as societal and scientific concerns evolve.

Programme of the 2014 Working Group Progress Meeting at a glance

Monday 24 February 2014

At 09:15 the IFSTTAR bus will bring participants from Nantes city centre to IFSTTAR (meeting point: close to the Railway Station, south access, in front of the Mercure Nantes Centre Gare Hotel); at the end of the meeting, the bus will bring participants back to Nantes city centre.

10:00 – 10:40	Opening Session
10:40 – 11:30	Keynote Lecture 1
11:30 – 11:45	Coffee break
11:45 – 12:55	Presentations on WG3 topics
12:55 – 13:10	Introduction to the visit of IFSTTAR test sites
13:10 – 14:15	Lunch
14:15 – 15:15	Visit of IFSTTAR test sites
15:15 – 15:30	Coffee break
15:30 – 17:45	Workshop on Computational Electromagnetics with FDTD
20:00	Common Dinner in Nantes

Tuesday 25 February 2014

At 08:15 a private bus will bring participants from Nantes city centre to IFSTTAR (meeting point: again, in front of the Mercure Nantes Centre Gare Hotel); at the end of the meeting, the IFSTTAR bus will bring participants to the airport and subsequently to Nantes city centre.

09:00 – 09:45	Keynote Lecture 2	
09:45 – 11:05	Presentations on WG2 topics	
11:05 – 11:20	Coffee break	
11:20 – 12:55	Presentations on WG2 topics	
12:55 – 13:05	On COST STSMs and Conference Grants	
13:05 – 14:10	Lunch	
14:10 – 15:00	Open discussion on next Action's events, dissemination activities, and Horizon 2020 proposals	
15:00 – 16:00	WG2 Brainstorming session	WG3 Brainstorming session
16:00 – 16:30	Closing Session	

Monday 24 February 2014

10:00 – 10:40	**Opening Session** – Chairs: Dr. Xavier Derobert, FR and Dr. Lara Pajewski, IT • *Welcome* - Dr. Xavier Derobert, FR • *Introduction of participants* • *Progress report on COST Action TU1208* - Dr. Lara Pajewski, IT
10:40 – 11:30	**Keynote Lecture 1** – Chair: Dr. Xavier Derobert, FR • *On MATGPR and GPR data processing* – Prof. Andreas Tzanis, EL • *Discussion*
11:30 – 11:45	Coffee break
11:45 – 12:55	**Presentations on WG3 topics** – Chair: Prof. Antonis Giannopoulos, UK 1. *Development of advanced methods for the solution of forward electromagnetic scattering problems by buried structures* – Progress Report by Dr. Cristina Ponti, IT (Project 3.1) (15 min, including discussion) 2. *Rigorous and asymptotic modelling of coherent scattering from random rough layers: application to roadways* – Dr. Nicolas Pinel, FR (Project 3.1) (15 min, including discussion) 3. *Development of intrinsic models for describing near-field antenna effects, including antenna-medium coupling, for improved radar data processing using full-wave inversion.* – Progress Report by Dr. Albéric De Coster, BE (Project 3.3) (10 min, including discussion) 4. *Near-subsurface imaging in an absorbing embedding medium with a multistatic/single frequency scanner* – Dr. Christelle Eyraud, FR (Projects 3.2 and 3.4) (15 min, including discussion) 5. *GPR full-waveform inversion – state of the art and open issues* – Prof. Jan Van der Kruk, DE (Projects 3.2 and 3.4) (15 min, including discussion)
12:55 – 13:10	**Introduction to the visit of IFSTTAR test sites** • *The IFSTTAR geophysical test site and the road carousel* – Dr. Xavier Derobert, FR
13:10 – 14:15	Lunch
14:15 – 15:15	**Visit of IFSTTAR test sites**
15:15 – 15:30	Coffee break
15:30 – 17:45	**Workshop on Computational Electromagnetics with FDTD** Prof. Antonis Giannopoulos, UK, and Dr. Craig Warren, UK
20:00	Common Dinner in Nantes

Tuesday 25 February 2014

09:00 – 09:45	**Keynote Lecture 2 (WG2)** – Chair: Prof. Andreas Loizos, EL • *On the Mara Nord Project* – Dr. Janne Poikajarvi, FI • *Discussion*	
09:45 – 11:05	**Presentations on WG2 topics** – Chair: Dr. Christina Plati, EL 1. *Innovative inspection procedures for effective GPR surveying of critical transport infrastructures (pavements, bridges and tunnels)* – Progress Report by Dr. Josef Stryk, CZ (Project 2.1) (15 min, including discussion) 2. *Innovative inspection procedures for effective GPR surveying of buildings* – State of the Art Report by Prof. Gracia Vega-Perez, ES (Project 2.2) (15 min, including discussion) 3. *Innovative inspection procedures for effective GPR sensing and mapping of underground utilities and voids, with a focus to urban areas* – Progress Report by Dr. Xavier Derobert, FR (Project 2.3) (15 min, including discussion) 4. *The main areas of interest and current efforts in Project 2.4: Innovative procedures for effective GPR inspection of construction materials and structures* – Progress Report by Dr. Lech Krysinski, PL (Project 2.4) (15 min, including discussion) 5. *Evaluation of moisture content using GPR* – Dr. Zoubi Mehdi Sbartai, FR (Project 2.5) (20 min, including discussion)	
11:05 – 11:20	Coffee break	
11:20 – 12:55	**Presentations on WG2 topics** – Chair: Dr. Christina Plati 6. *Snow and frost GPR-monitoring in suburban areas* – Dr. Pekka Hanninen, FI (20 min, including discussion) 7. *GPR experience at the National Laboratory for Civil Engineering, in Portugal* – Prof. Simona Fontul, PT (20 min, including discussion) 8. *GPR activities at the Federal Institute for Materials Research and Testing (BAM), in Germany* – Dr. Christiane Trela, DE (20 min, including discussion) 9. *GPR activities for road applications at the BRRC, in Belgium* – Dr. Colette Gregoire, BE (20 min, including discussion) 10. *An efficient system for GPR surveying of pavement, bridges and tunnels* – Dr. Roger Wisen, DK (15 min, including discussion)	
12:55 – 13:05	**On COST STSMs and Conference Grants** – Dr. Lara Pajewski, IT	
13:05 – 14:10	Lunch	
14:10 – 15:00	**Open discussion** • Next Action's events • Dissemination • Horizon 2020 proposals	
15:00 – 16:00	**WG2 Brainstorming session** Chair: Dr. Christina Plati, EL Co-Chair: Prof. Andreas Loizos, EL	**WG3 Brainstorming session** Chair: Dr. Antonis Giannopoulos, UK Co-Chair: Dr. Lara Pajewski, IT
16:00 – 16:30	**Closing Session** – Chair: Dr. Xavier Derobert, FR • *Reports from WG Chairs, resuming the meeting* - Dr. Christina Plati, EL, and Prof. Antonis Giannopoulos, UK • *Discussion* • *Closure of the 2014 Working Group Progress Meeting* - Dr. Xavier Derobert, FR, Prof. A. Loizos, EL, and Dr. L. Pajewski, IT	

Venue / How to reach the Event

Nantes is France 6th largest town, located on the Loire estuary, 50 km from the Atlantic coast, and is considered to be a « Ville d'Art et d'Histoire ». The city is located conveniently 2 hours from Paris by TGV train, and close to other tourist destinations such as the Atlantic coast, Brittany, the river Loire castles and Vendée.

On the Office du tourisme de Nantes website (en.nantes-tourisme.com/) you can find useful informations. You can download, as a pdf file, the touristic guide of the city of Nantes (en.nantes-tourisme.com/brochures/touristic-guide-2691.html). You can find all the necessary information on how to arrive in Nantes (en.nantes-tourisme.com/arriving-nantes-3123.html). You can search and book an accommodation (en.nantes-tourisme.com/accommodation-3135.html).

The picture below, shows how to reach the IFSTTAR in Bouguenais Cedex, at about 10 km from the Nantes city centre. A bus will bring participants from Nantes city centre to IFSTTAR (meeting point: in front of the Mercure Nantes Centre Gare Hotel, at 9:15 on Monday and at 8:15 on Tuesday); at the end of the meeting, the IFSTTAR bus will bring participants back (to Nantes city centre on Monday, to the airport and subsequently to Nantes city centre on Tuesday).

Wi-fi Internet Connection

IFSTTAR is pleased to provide a free wi-fi internet connection to all the participants attending the meeting.

Connection details will be written here.