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PRESERVATION OF MONUMENTS & HISTORIC SITES
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ISSMGE Technical Committee TC301 Preservation of Monuments and Historic Sites



The preservation of monuments and historic sites is one of the most challenging problems facing modern civilization. It involves, in inextricable patterns, factors belonging to different fields (cultural, humanistic, social, technical, economical, administrative) and the requirements of safety and use appear (and often are) in conflict with the respect of the integrity of the monuments.

The complexity of the topic is such that a shared framework of reference is still lacking among art historians, archaeologists, architects, structural and geotechnical engineers.

The possibility of finding in practice an acceptable equilibrium is linked to the development of a shared culture.

For this reason, ISSMGE promoted over 30 years ago an ad hoc Committee (on Preservation of Monuments and Historic Sites), as suggested by Jean Kerisel and Arrigo Croce.

Hence, TC301 intended to provide a forum to share information, discuss and even propose possible solutions to geotechnical issues related to the preservation of monuments and historic sites, with the following two main aims:

- To promote and diffuse the culture of conservation within the geotechnical community;
- To establish a connection with experts from different cultural areas, and to highlight the role geotechnical engineering has in understanding and solving the possible pathologies of old structures and sites.

One of the pioneers in the field of the preservation of monuments from the geotechnical point of view was Jean Kérisel. Kerisel was a French geotechnical engineer and Egyptologist, president of the ISSMFE (1973–77). He became a pioneer in understanding and modeling the way soil interacts with man-built structures and he applied his engineering skills to examining monuments with a different perspective. In recognition of his pioneering work on the preservation of monuments, TC301 decided to dedicate to Jean Kerisel an honour lecture.

The first Kerisel Lecture was delivered at the International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE) in 2013 in Paris by Professor Giovanni Calabresi; the second one at the ICSMGE in Seoul in 2017 by Professor Carlo Viggiani, and the third one at the 3rd International Conference of the TC301, in Napoli in June 2022.

The TC301 International Symposium

The TC301 International Symposium is a premium quadrennial event held under the auspices of the International Society for Soil Mechanics and Geotechnical Engineering with the scientific supervision of the Technical Committee on the Preservation of Historic Sites (TC301). The Conference aspiration is to create a forum for interaction and exchange of ideas that will promote and diffuse the culture of conservation within the geotechnical community, and will facilitate inclusive discussions with architects, art historians, and engineers.

The Legacy

The first TC301 was held in Napoli in 1997 followed by two other conferences in 2017 and 2022 in the same city. Back then, the focus was to establish a common understanding on the many and longstanding challenges involved in the preservation of monuments and set the framework of collaboration among experts.

New Era, New Destination

Today, the challenge is still on and increasing. Climate change is affecting the structural stability and appearance of monuments and threatens them by extinction when located in the path of rising seas. On the other hand, new technologies and AI are building momentum in the engineering practice, advocating increasing capacities in solving complex problems from which the preservation science can benefit from.

The host of the 2026 Conference was the Hellenic Society for Soil Mechanics and Geotechnical Engineering.

The Athens Symposium broaden its scope to discuss the latest advancements in emerging topics, maintaining however the core focus of the previous conferences.

4th International Symposium
Preservation of Monuments and Historic Sites
IS TC301 Athens 2026

Message from the Chair



Dear Colleagues,

It was my absolute pleasure to welcome you to the 4th International Symposium on the Preservation of Monuments and Historic Sites (the 4th TC301 International Symposium) which was held in Athens, Greece from Wednesday 16 to Friday 18 September 2026, following the previous successful events at Napoli, Italy, in 1996, 2013 and 2022, respectively. This time, the Hellenic Society for Soil Mechanics and Geotechnical Engineering was hosting the Conference in Greece.

The legacy of the previous Symposia reminds us of the immense responsibility we bear in preserving the heritage and history encapsulated in the world's monuments. These structures are not merely physical entities; they are the custodians of our cultural identity and historical continuity.

Today, the challenge is still on and increasing. Climate change is affecting the structural stability and appearance of monuments and may even threaten them with extinction when these are in the path of rising seas. At the other end of the scale, new technologies and AI are building momentum in engineering practice, advocating increasing capacities in solving complex problems from which preservation science can benefit.

The Athens TC301 International Symposium broadened its scope to discuss the latest advancements in emerging topics, while maintaining the core focuses of the previous conferences.

The Symposium's themes underscore the critical intersection of engineering expertise and cultural stewardship. The Symposium provided a forum for exchange and discussion between engineers, architects, archaeologists, scientists and researchers in the field of protection of monuments. Among the objectives of the Symposium was that our discussions traverse the latest advancements in geotechnical engineering, focusing on sustainable and effective methods to protect and restore monuments threatened by natural and human-induced challenges.

As we delve into these critical topics, let us remember that our work transcends technical challenges. It is a testament to our commitment to preserving the legacy of human achievement and ensuring that these monuments continue to inspire and educate for centuries to come.

On behalf of the Organising Committee, I would like to express our sincere appreciation for your presence in the iconic city of Athens for the 4th TC301–IS Athens.

Warm regards,
Christos Tsatsanifos
Chairman, 4th TC301 – IS Athens

The Symposium was organized under the auspices of

SIMSG ISSMGE

HELLENIC SOCIETY FOR SOIL MECHANICS & GEOTECHNICAL ENGINEERING

HELLENIC REPUBLIC
Ministry of Culture

CITY OF ATHENS

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Conference Focus

Development of a shared culture for the preservation of monuments

Aligning requirements on the safe use of monuments with restoration ethics is a formidable task and a great challenge raising cultural, humanistic, social, technical, economic, and administrative considerations. The complexity of the topic is such that solutions can only flourish through the collaborative efforts of art historians, architects, and structural, and geotechnical engineers. The TC301 is intended to establish interactions among the different stakeholders and create a forum for discussing geotechnical issues related to the preservation of monuments and historic sites, with the following two main aims: (i) to promote and diffuse the culture of conservation within the geotechnical community; (ii) to highlight the role of geotechnical engineering in understanding and solving the possible pathologies of old structures and sites.

Effects of urban development on build heritage

Balancing urban development with heritage preservation is a collaborative task for geotechnical and structural engineers, architects and urban planners. The considerations are quite a few: how to analyze the effects of new constructions on existing monuments and buildings; how to design appropriate geotechnical or structural mitigation measures while preserving the character and identity of the monument; how to develop comprehensive monitoring schemes for real-time evaluation of the monument response during the construction sequence and afterwards, and so forth. The conference sessions will highlight this complex interplay, examining challenges, opportunities, and best practices to maintain the delicate balance between cultural heritage preservation and urban growth.

Learning from case histories

The importance of documenting and sharing key lessons from Case Histories was always a priority for TC301. Committed to this vision, the previous conferences hosted presentations on all latest research and developments in the six iconic historic sites that captivated the interest of our TC301 members in the past and continue to do so. These include: the underexcavation of Mexico City's Cathedral for correcting deformations caused by self-weight consolidation and regional subsidence, the restoration of the ancient walls surrounding the Acropolis of Athens, the unveiling of the ancient city of Angkor Wat with the assistance of remote sensing satellite imagery, the causal analysis of the differential settlements of the Modena Cathedral, the seismic vulnerability of the Giotto's Campanile in Florence, and the much-analyzed but always captivating geotechnical "mystery" of the lining tower of Pisa. We also welcome contributions on any other well-documented case history and real-life story offering insightful takeaways that could advance the geotechnical engineering research and practice.

Preserving monuments in a changing climate

Natural disasters bring about destruction, collapse and loss to monuments and historic sites. As the weather grows more extreme, the list of incidents is getting longer. The 2020 wildfires in Greece that threatened the Olympia site, the severe damage of Roman-era Gazeiantep Castle and the partial collapse of the 17th century Sirvani Mosque in Turkey during the 2023 Turkey-Syria earthquake, the flooding of Saint Mark's Basilica in Venice from sea-level rise are only a few of the latest reminders that nature cannot be harnessed, and urgent action is needed to safeguard our build heritage from destruction and extinction. The conference will offer several opportunities for rethinking our ideas for preserving monuments and exploring mitigation strategies that can be adaptive to changing climate conditions.

Leveraging digital technologies

Digitization and documentation of cultural heritage assets, automated laser-scanning, 3D modeling, and virtual reality are few of the many ways digital technologies and artificial intelligence can support the protection of monuments from ageing and natural and man-made hazards. The conference will steer the discussion to topics of such interest exploring the wealth of possibilities that digital technologies have opened.

Conference Themes and Topics

1. **Conservation Principles**
   - Authenticity
   - Ethics in the preservation of monuments and historic sites
   - Interdisciplinarity and synergies between science and practice
   - Intervention criteria and regulatory framework
2. **Historical Geotechnical Engineering**
   - Construction traditions and techniques
   - Materials of monuments and historic sites
   - Geotechnical characteristics of monuments and historic sites (earthworks, foundations, rock cuts and underground structures etc.)
3. **Diagnosis: Understanding and Investigating Monuments**
   - Documentation and engineering history
   - Investigation techniques
   - Monitoring and remote sensing
   - Pathology, diagnosis and performance assessment
4. **Analysis, Modeling, and Risk Assessment of Monuments and Heritage Sites**
   - Analytical and Numerical Modeling
   - Soil-Structure Interaction
   - Probabilistic Risk Assessment
5. **Geotechnical Aspects of Monumental Restoration / Preservation**
   - Ground Improvement Techniques
   - Slope stabilization and protection from rock falls
   - Foundation Repair/Enhancement
   - Geo-structural Reinforcement
   - Reburial of monuments
   - Movement of monuments
   - Geotechnical engineering and archaeological excavations
   - Geotechnical engineering, geoarchaeology and cultural landscape preservation
6. **Climate Change and Protection of Monuments from Natural Hazards**
   - Monument preservation in a changing climate: dealing with increasing temperatures and extreme weather
   - Climate adaptation measures for monuments and historic sites
   - Earthquakes, cloudbursts, and slope instability: Risk assessment, tactics, and preventative actions
   - Pro and post natural hazards structural maintainability
   - Preservation of diffuse heritage: soil instability, subsidence, environmental damages
   - Geotechnical challenges of coastal heritage preservation
7. **Urban Development Impact on Monuments**
   - Foundation engineering challenges
   - Soil erosion and settlement (due to changes in surface runoff patterns and soil disturbance during urban development)
   - Groundwater impacts
   - Subsurface infrastructure interference
   - Vibration and noise control
8. **Case Histories: Examples & Lessons Learned**
9. **Special Session on the Acropolis of Athens**

The Venues

Athens Conservatoire

The first two days of the IS TC301 Athens 2026 were hosted at the **Athens Conservatoire**, one of the most iconic cultural and architectural landmarks in Athens.

The Athens Conservatoire was design by the architect Ioannis Despotopoulos, a Bauhaus Pioneer in Greece.



Despotopoulos was born in Smyrna in 1903 and was educated at the Bauhaus School in Weimar. He was one of the leading figures of modern architecture in Greece and the only Greek architect to experience firsthand the intellectual and artistic environment of the Bauhaus. His international career later extended to Sweden, where he practiced architecture and taught at leading universities, further shaping his vision of architecture as a force for social and cultural progress.

The Athens Conservatoire is the most significant realization of that vision. Designed in 1959, it is the sole completed element of Despotopoulos' ambitious masterplan for the Athens Cultural Centre, reflecting his lifelong commitment to architecture as a catalyst for culture, education a civil life.

Drawing inspiration from both the ideals of European modernism and the civic traditions of ancient Athens, Despotopoulos conceived the Conservatoire as a contemporary agora a place where culture, education and public life converge.



Its monumental arcade, generous public spaces and clear geometric forms reflect a belief that arckitecture should do more than accommodate activities – it should foster community. For Despotopoulos, buildings were instruments for shaping civic identity and encouraging human interaction. The Conservatoire was therefore designed not merely as a music school, but as a cultural gahernig place where creativity, learning, and exchange could flourish.



More than six decades after its construction, the Athens Conservatoire continues to embidy the relevance and adaptability of Despotopoulos' vision. Recognized in 2017 as a protected Modern Monument by Greece's Central Council for Modern Heritage, the building stands as an important example of how twentieth-century architectural landmarks can be preserved ans adapted for contemporary use.

Acropolis Museum

The third day of the Symposium was held at the **Acropolis Museum**, a new architectural landmark of Athens, designed by Bernard Tschumi Architects, New York and Architect Michael Photiadis, Athens. Located in the historic area of Makryianni, the Museum stands about 300 meters southeast of the Parthenon. Its entrance is adjacent to the start of Dionysiou Areopagitou pedestrian walkway, which links it to the Acropolis and other key archeological sites in Athens. The top floor of the Museum, the Parthenon Gallery, offers a panoramic view of the Acropolis and modern Athens.



The overall scope and form of the Acropolis Museum were greatly determined by its own exhibits, in particular its vast collections of architectural sculptures, including large pediments from Archaic-era temples, and votive statuary, but especially the diverse sculptural decorations of the Parthenon. Exhibition of the latter called for a rectangular hall mirroring the forms and proportions of the ancient temple itself within a space of at least 3,200 square meters. The Museum's foundations, on the other hand, had to be successfully adapted to accommodate the archaeological remains of ancient buildings brought to light through the systematic excavation of the building site. An intensive collaboration between architects and archaeologists led to suitable solutions being found for the final location for the Museum's foundation columns, without damaging the surrounding antiquities. The ongoing ar-

chaeological excavations were conceived as an enormous exhibition to be integrated into the Museum, while a plan was also adopted for the most important artifacts unearthed to be displayed within the archaeological site.



The Museum's architecture boldly seeks to maintain, through its highly transparent glass facades, a direct visual connection between its exhibits, the Rock itself and the in-situ Acropolis monuments from which the Museum's exhibits originate. At the same time, it allows a panoramic view of the historic surrounding hills and mountains of Attica, as well as of the contemporary urban environment. Similarly, glass floors in the Museum's interior allow the view of the underlying excavated area to be incorporated into its galleries. In this way, the Museum precludes being cut off from its setting – instead becoming a continuation of it and affirming its integral relationship with the ancient Athenian landscape.





The Acropolis Museum Amphitheatre

Symposium Opening Ceremony

The first two days of the Symposium were hosted at the **Athens Conservatoire**.

The first day's programme began with opening remarks by Alessandro Flora, Chairman of TC301; Michalis Bardanis, President of HSSMGE; and Christos Tsatsanifos, Symposium Chair, followed by a short welcoming speech from the Deputy Mayor of Athens Mrs Olga Dourou.



Alessandro Flora, Christos Tsatsanifos, Michalis Bardanis



Michalis Bardanis addressing the Symposium



Alessandro Flora addressing the Symposium



Olga Dourou addressing the Symposium

Symposium Chair Address

Dear colleagues, ladies and gentlemen

It is a great honour and a genuine pleasure to welcome you to Athens and to the 4th International Symposium on Geotechnical Engineering for the Preservation of Monuments and Historic Sites.

Let me begin with a simple thought.

When we preserve a monument, we do not simply preserve a structure.

We preserve a memory, a story, and a part of our shared human heritage.

Our built cultural heritage is far more than a collection of structures. It embodies the creativity, the values and the identity of the societies that produced it.

And this is what brings us together today.

We come from different countries, different institutions and different scientific disciplines. We may employ different methodologies and technologies, and sometimes even different terminology. Yet

we share a common responsibility: to understand our cultural heritage, and to ensure that it survives for future generations.

It is the responsibility of each generation to pass this heritage to the next one

Preservation, therefore, is more than a technical undertaking. It is a social imperative.

And this responsibility extends beyond the physical survival of monuments. Our interventions should also contribute to environmental, economic and social sustainability, ensuring that the preservation of cultural heritage remains meaningful and viable for the communities that live alongside it.

For those of us in geotechnical engineering, this responsibility has a very particular dimension.

Why is geotechnical engineering so important for the preservation of monuments?

Every monument has an intrinsic relationship with the ground

on which it stands. The ground is not simply the foundation of a monument; it is part of its history.

Over the centuries, the ground beneath and around historic structures changes. Foundations and ground deform. Water conditions vary. Slopes evolve. Seismic events occur. Environmental conditions change. And, inevitably, the monument responds to all these processes.

At the same time, society often expects monuments and historic buildings to endure indefinitely. Yet all materials inevitably age and deteriorate over time.

This simple fact makes preservation a demanding scientific and technical challenge.

We therefore need rigorous scientific investigation and sound technical expertise to understand how historic structures have survived, how they are deteriorating, and how they may respond to future conditions.

Understanding this interaction between the monument and the ground is fundamental to its preservation. And this is precisely where our discipline has a particularly important role to play.

Through geotechnical engineering, we can investigate foundations, soil and rock behaviour, soil/rock-structure interaction, slope stability, seismic response, groundwater conditions, deformation and long-term performance.

However, technical knowledge alone is not enough.

We also need to understand the monument itself.



Effective preservation requires knowledge of historical construction techniques, of the materials and methods originally employed, and of the interventions that have taken place throughout the monument's history.

Previous repairs and modifications form part of the evidence we must consider. They can tell us how a structure has evolved, how it has responded to previous problems, and how it may respond to a new intervention.

Only by combining this historical understanding with modern scientific methods we can make responsible and well-informed decisions.

And we must always remember that our objective is not to make an old monument to behave like a modern structure.

Our objective is to understand the monument, to respect it, and to intervene only to the extent necessary to preserve it.

This requires sensitivity as much as it requires engineering knowledge.

Which brings me to another essential point.

No single discipline can preserve cultural heritage on its own.

A monument cannot be fully understood by an engineer alone, nor solely by an architect, an archaeologist, a historian or a conservation specialist. We need all these perspectives.

We need to understand the history of a structure, the materials from which it was constructed, the way in which it was built, the changes it has undergone over time, and the interaction between the structure and its environment.

This interdisciplinary cooperation is one of the great strengths of TC301.

Our Symposium, therefore, is not simply a forum in which we present papers. It is a place where different ways of thinking come together; where experience gained from one monument can help us understand another; and where young researchers can meet experienced colleagues and become part of an international scientific community.

We are also facing new challenges.

The monuments of the past were built to withstand the environmental conditions of their time. Today, however, those conditions are changing.

Climate change is bringing new and potentially more intense challenges: extreme rainfall, flooding, erosion, changes in groundwater conditions, rising temperatures, wildfires and other environmental hazards.

At the same time, earthquakes, landslides and other natural hazards continue to threaten historic structures in many parts of the world.

We therefore need to ask ourselves a fundamental question:

How can we preserve monuments not only for the conditions of today, but also for those of tomorrow?

This is one of the major challenges facing our generation.

Fortunately, we also have new tools at our disposal.

Digital technologies, advanced monitoring systems, remote sensing, three-dimensional documentation, numerical modelling and artificial intelligence are opening up new possibilities for diagnosis, assessment and long-term monitoring.

But technology is a tool - not the objective.

Artificial intelligence may help us to analyse information. Digital technologies may enable us to document a monument with extraordinary precision. Advanced numerical models may help us to understand better its behaviour.

Ultimately, however, the responsibility for deciding how we intervene remains ours.

Technology must therefore serve knowledge, and knowledge must serve preservation.

Dear Colleagues, Ladies and Gentlemen,

This Symposium continues a long and successful tradition of TC301.

Our previous Symposia, held in Naples in 1996, 2013 and 2022, provided important opportunities for scientists and engineers from around the world to exchange knowledge and experience concerning the preservation of monuments and historic sites.

Today, almost thirty years after the first Symposium, it is a great pleasure to bring this international community to Greece.

And there could hardly be a more appropriate place than Athens for this discussion.

Greece offers an extraordinary living laboratory of cultural heritage. Here, monuments from different periods coexist with a modern and continuously evolving city. The past is not simply remembered; it remains an integral part of everyday life.

The Acropolis, the ancient sites and the numerous monuments throughout the country provide us with an exceptional opportunity to study how historic structures have interacted with their environment over very long periods of time.

They remind us of the extraordinary achievements of the societies that preceded us in architecture, science and engineering. But they also remind us of something equally important: the responsibility of each generation to pass this heritage on to the next.

And, perhaps above all, they remind us that preservation is not about stopping time.

Preservation is about allowing history to continue.

During the third day of our Symposium, at the Acropolis Museum, we will have the opportunity to focus particularly on the protection of Greek monuments and historic sites from natural hazards and the impacts of climate change.

I believe this will provide a particularly meaningful conclusion to our scientific programme.

At this point, I would like to express my sincere appreciation to the International Society for Soil Mechanics and Geotechnical Engineering, ISSMGE, and to the Technical Committee TC301 for their continued support.

I would also like to extend my warmest thanks to the Hellenic Society for Soil Mechanics and Geotechnical Engineering, to the members of the Organising and Scientific Committees, and to all those who have worked over the past three years to make this Symposium possible.

And, of course, I would like to thank all of you for being here.

Dear Colleagues, Ladies and Gentlemen,

Over the next three days, we will listen to presentations, discuss research results, examine case histories and ex-change ideas.

But I hope that something more will also happen.

I hope that new questions will emerge. That new collaborations will begin. And that some of the conversations that start here in Athens will continue long after this Symposium has ended.

Because the preservation of cultural heritage is not the responsibility of one country, one institution or one generation.

It is a shared responsibility.

We are the temporary custodians of a heritage that belongs not only to us, but also to those who came before us and, most importantly, to those who will come after us.

Let us therefore use our knowledge, our experience and the remarkable advances in science and technology to fulfil that responsibility.

And let us remember that, many centuries from now, another generation may stand before the monuments that we are protecting today.

Our success will ultimately be measured by whether those monuments are still there for them to see.

With this thought, I would like to warmly welcome you all to Athens.

I wish you a scientifically rewarding, stimulating and enjoyable Symposium.

Thank you very much.

Lifetime Achievement Award for Cultural Heritage Protection

The Opening Addresses were followed by the Lifetime Achievement Award for Cultural Heritage Protection.



Symposium Chair started the session:



Following the establishment of the **Kérisel Lecture**, created to honour Jean Kérisel, a pioneer in the field of the Geotechnical preservation of monuments, the Organizing Committee of the **4th International Symposium on the Preservation of Monuments and Historic Sites** proposed that the **Hellenic Scientific Society for Soil Mechanics and Geotechnical Engineering** honour, during the Symposium, three distinguished figures for their outstanding and lasting contributions to the geotechnical preservation of monuments and historic sites, through the **Lifetime Achievement Cultural Heritage Protection Award**.

Moreover, the Organizing Committee proposes to **ISSMGE TC301** the establishment of this Award, thereby creating a lasting tradition of recognizing individuals whose work has significantly advanced our understanding and practice of monument preservation and has contributed, in a tangible and enduring way, to the safeguarding of our cultural heritage.

Michalis Bardanis, President of HSSMGE, presented the proposal for establishing the awards and announced the first recipients.

The first award was for **Honoring the Guardians of Pisa** and was presented to three legendary figures in geotechnical engineering for their instrumental role in the stabilization of the Leaning Tower of Pisa:

- The Late Professor Michele Jamiolkowski
- Emeritus Professor John Burland
- Emeritus Professor Carlo Viggiani

Their pioneering work stands as one of the most iconic achievements of geotechnical engineering, ensuring the Tower's survival for generations to come.



The Late Professor Michele Jamiolkowski

Universally remembered as the "savior of the Leaning Tower of Pisa," Professor Jamiolkowski chaired the historic international commission and personally led the bold soil extraction works that halted the Tower's progressive lean. His vision, courage, and persistence turned a global symbol of instability into a triumph of geotechnical ingenuity — a legacy that will stand for centuries.

Prof. Alessandro Flora introduced the Late Professor Michele Jamiolkowski and Professor Sebastiano Rampello, representing the Associazione Geotecnica Italiana, received the award.



Michalis Bardanis and Sebastiano Rampello



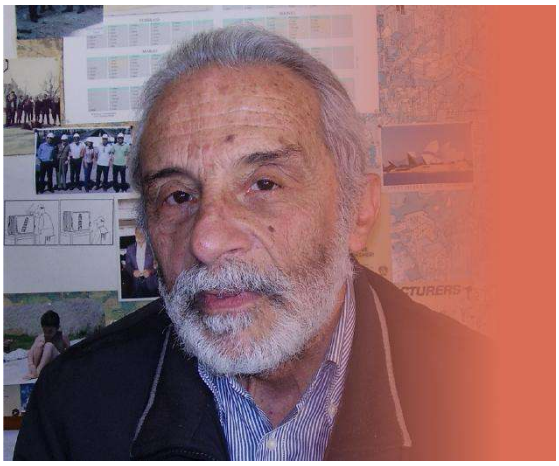
Emeritus Professor John Burland

A towering figure in geotechnical engineering, Professor Burland provided the scientific backbone and strategic direction for the Pisa project. Through his pioneering geotechnical

strategy and advanced numerical modeling, he unlocked the secrets of leaning instability — a breakthrough that guided the safe and elegant solution that preserved the monument.



Prof. Jamie Standing introduced Prof. Burland and he received the award on his behalf.



Emeritus Professor Carlo Viggiani

Professor Viggiani has been a steadfast guardian of the Tower for more than three decades. His unrivaled expertise in geotechnical monitoring and his tireless commitment to the International Committee have been instrumental in safeguarding the Tower's stability, ensuring its protection well beyond its rescue and into its monitored future.

Prof. Alessandro Flora introduced Prof. Viggiani.



At 90, the legendary Professor Carlo Viggiani took the stage to receive the award from the Hellenic Society for Soil Mechanics and Geotechnical Engineering, recognising his exceptional contribution to the preservation of the Leaning Tower of Pisa.

There was something very special in hearing him speak, even briefly, about his long relationship with this extraordinary monument, and about the 11 years of stimulating work that he described as the greatest adventure of his professional life.



In that moment, the story of Pisa felt less like a landmark engineering achievement and more like what it really was: a lifetime of knowledge, perseverance, curiosity and care invested in one of the world's most treasured monuments.

Thank you, Professor Viggiani, for being with us at TC301 Athens and for allowing us to begin the Symposium with such a meaningful reminder of the human side of engineering.

A beautiful and memorable way to open the conference.



Prof. Viggiani thanked HSSMGE for the award, which was presented to him by Michalis Bardanis.



Symposium Programme

The first two days, hosted at the **Athens Conservatoire**, covered the traditional themes of the Symposium. The programme consisted of a balanced combination of keynote lectures, including the Kerisel Lecture by E.O Shelley, and oral presentations of the accepted papers, providing a comprehensive overview of the latest developments in geotechnical engineering for the preservation of monuments and historic sites.

First Day 16.09.2026







Keynote Lecture - Gorun Arun
Session Chair: Elena Kapogianni (NTUA)



Substructure design of ancient master builders

In investigating heritage buildings, for proper interpretation of the causes of the failures and for decisions on proper intervention, it is important to consider the engineering knowledge and practice of their construction time. This study is made through reviewing archaeological and history of architecture publications, discussions with archaeologists and experiences met during diagnosis phase of restoration works.



Elena Kapogianni presents the commemorative diploma to Gorun Arun in recognition of her Keynote Lecture

Keynote Lecture - Alexander Puzrin
Session Chair: Jamie Standing (Imperial College)



The Leaning Tower of St Moritz: a structure on a creeping landslide

The 13th century Leaning Tower of St Moritz, is located in the historic center of the famous Swiss ski resort town in the compression zone of a 10 million m^3 Brattas landslide. Over the hundreds of years, this slowly creeping landslide, which is blocked by a rock outcrop below the tower, had damaged the adjacent St. Mauritius church to such an extent that it

had to be demolished already in 1893 due to dangerous differential settlements and cracks. In this lecture, Prof. Puzrin explored the history of the Leaning Tower of St. Moritz, described its stabilization attempts and paid tribute to some extraordinary minds behind them.

How do you keep a leaning tower standing when the ground beneath it refuses to stop moving?

A fascinating journey through more than a century of geotechnical engineering the keynote by Prof. Alexander Puzrin at TC301 Athens.

The story of the Leaning Tower of St. Moritz is, in many ways, a story of generations of engineers confronting the same extraordinary problem.

As early as 1899, Albert Heim recognised that the tower's movement was linked to a permanent landslide. What followed was a succession of remarkably inventive interventions by some of the great names of Swiss engineering — Robert Maillart, Robert Haefeli and Hans-Jürgen Lang — each helping to buy the tower precious decades.

And yet, the ground never really stopped moving.

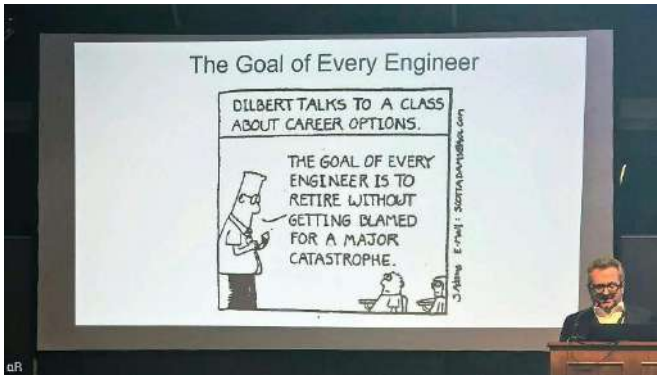
When Prof. Puzrin became involved, the puzzle had changed: why was the landslide accelerating again — and what did that mean for the tower's long-term stability?

Monitoring ruled out the obvious explanation of changing pore-water pressures. The answer instead lay in the mechanics of the landslide itself: creep was progressively loading the compression zone against the rock outcrop constraining the slope, eventually bringing the soil to failure and producing the observed acceleration.

What looked like a simple question — why is it moving faster? — became a beautiful example of how monitoring, mechanics and physical insight can come together to uncover what is happening deep inside a moving slope.

A memorable keynote, and a wonderful reminder that **preserving heritage is sometimes less about stopping movement altogether and more about understanding it well enough to stay one step ahead**.

Prof. Puzrin concluded his lecture by highlighting the ultimate goal of every engineer involved in design:



Session: Case Histories in Heritage Preservation
Session Chair: Prodromos Psarropoulos (NTUA)

Ilaria Bertolini, Michela Marchi, Guido Gottardi
ID. 33 Archaeological Heritage and subsidence-induced flood risk: the emblematic case of Santa Croce in Ravenna (Italy)



Michael Bardanis, George Dounias
ID. 10 Investigation, analysis and rehabilitation of the failures of St Dimitrios Bastion in the old city of Chania, Crete



Yoshinori Iwasaki (was not presented)
ID. 61 The Sandy Mound which has been supporting Bayon Tower in Angkor under Squall in the past 700 years but still needs countermeasures in the coming global warming climate

Peng Hong Lim, Jin Jie Loo, **Chin Yoong Lim**
ID. 64 Case Study- Excavation Around Heritage Buildings in an Urban Environment



George Dounias, Evryviadis Lyberis, Vasilis Gikas
ID. 83 The behavior of support measures applied to the Efpalineio tunnel, 10 years later



Keynote Lecture - Ikuo Towhata
Session Chair: Ioannis Anastasopoulos (ETH Zurich)



Different kinds of restoration philosophy for cultural heritages after damage by disasters

Everything deteriorates with time, and cultural heritage is no exception. Natural hazards and human-induced events can cause severe damage, raising difficult questions about how monuments should be restored and preserved.

The lecture reviewed different conservation approaches, from strict authenticity to rapid reconstruction, and examines their suitability in different contexts. The discussion ultimately questions the absolute importance of authenticity, suggesting that the enduring value of heritage may depend more fundamentally on the respect it conveys for history.

How far should we go to preserve authenticity - if preserving a monument exactly as it is may also mean allowing it to deteriorate?

This was the difficult question at the heart of Prof. Ikuo Towhata's keynote at TC301 Athens.

Through examples from around the world, he explored the difficult choices that arise when heritage preservation meets geotechnical risk:

How precisely should we reproduce the original?

Should foundations be treated with the same concern for authenticity as the visible structure, even when deterioration or corrosion makes intervention unavoidable?

How do we strengthen a monument against future earthquakes without compromising what makes it authentic? And when traditional techniques are no longer sufficient, can a modern intervention still remain faithful to the original concept?

From Iran and Bukhara to post-earthquake restoration in Kumamoto, the examples all pointed to the same underlying idea:

Authenticity is not simply about preserving age or original materials. It is about preserving memory – and a living culture.

A thoughtful reminder that conservation does not always mean avoiding intervention.

Sometimes, carefully chosen intervention is what allows heritage to endure.



Ioannis Anastasopoulos presents the commemorative diploma to Ikuo Towhata in recognition of his Keynote Lecture

Session: Materials, Monitoring and Geotechnical Investigation Methods
Session Chair: Emmanouel Vassilakis (NKUA)

Ilaria Bertolini, Michela Marchi, Alessio Mentani, **Guido Gottardi**
ID. 40 Geotechnical modelling for the structural assessment of the Two Towers in Bologna (Italy)



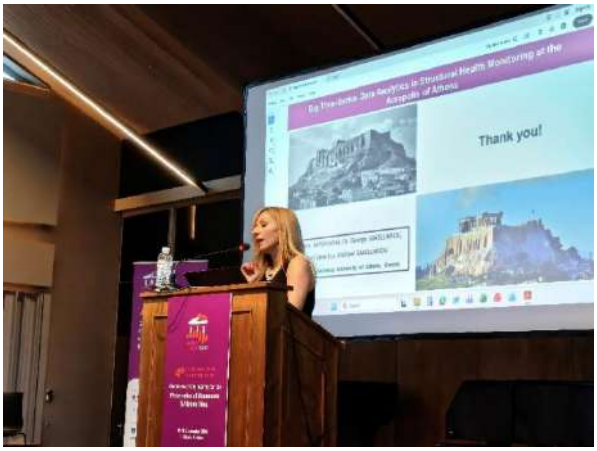
Michael Bardanis
ID. 76 Effect of partial saturation of soil pastes between masonry stones in the tensile strength of the masonry walls



Shaohan Wang, Shuaikang Su**,** Ji-peng Wang**,** Jing-yi Shen, Ling Wang, Shangqi Ge
ID. 108 Experimental Investigation of Multi-Material Reinforcement for Han Dynasty Bricks from the Dingtao Tomb



Elena Kapogianni, Georgios Sakellariou, Michael Sakellariou
ID. 37 Big Time-Series Data Analytics in Structural Health Monitoring at the Acropolis of Athens Utilising Optical Fibre Sensors



María Aragón-López, Ignacio Ruiz-Moreno, Cristina Soriano-Cuesta, Francisco M. Hidalgo-Sanchez, Rocío Romero-Hernandez, Antonio Jaramillo, Emilio Mascort-Albea
ID. 95 Geotechnical characterisation for dating rammed earth architecture. The medieval wall of Seville (Spain)



Rafail Panagiotou, Ioannis Ioannou
ID. 85 The importance of soil characteristics on the resistance of Compressed Earth Blocks against water-mediated weathering



Michael Bardanis, Dimitrios Kokoviadis
ID. 101 The light dynamic penetrometer and its use in geotechnical investigation for monuments and historic sites

Tomoyoshi Nishimura
ID. 87 The influence of the suction distribution on deformation property

Yutaro Hara
ID. 88 High-resolution SH wave exploration to assess damage to the Sakuradani Kofun Tumulus No.2 caused by the Noto earthquake



Gianfranco Totani, Ferdinando Totani, Claudia Durante
ID. 25 Investigations by use SDMT seismic modulus to restore two historical buildings damaged by the April 6, 2009 L'Aquila earthquake

Prodromos Psarropoulos
ID. 31 A New Theory for the verification of the location of the ancient city of Helike in Achaia, Greece



V.N. Georgiannou, Ch. Papazoglou, E.M. Pavlopoulou
ID. 112 Drying in Clays: Insights from Within Using X-ray CT

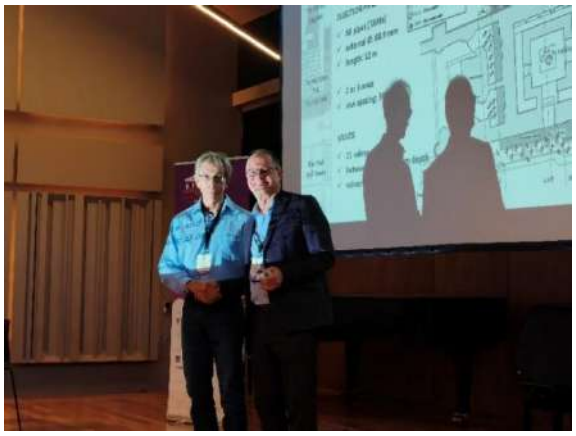


Keynote Lecture - Guido Gottardi
Session Chair: Dimitris Egglezos (NTUA)



Foundations in Venice: Characteristics and Preservation Challenges in a Unique Environment

The unique, delicate and inherently unstable environment in which Venice was established has, paradoxically, contributed to the city's remarkable resilience and prosperity over the course of more than a millennium. The Venetian experience thus offers valuable insights that remain highly relevant today.



Dimitris Egglezos presents the commemorative diploma to Guido Gottardi in recognition of his Keynote Lecture

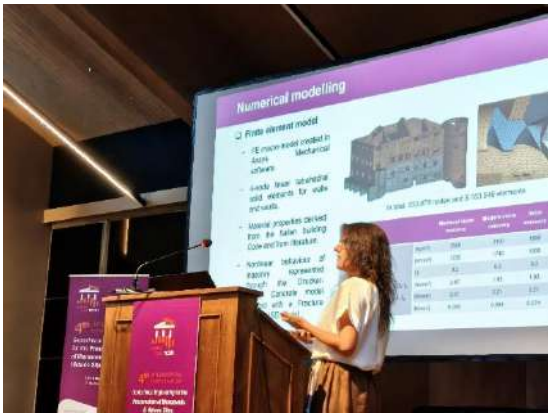
Session: Geohazards and Multi-Hazard Risk Assessment for Cultural Heritage
Session Chair: Nikolaos Klimis (DUTH)

Francesco Castelli, Salvatore Grasso, Valentina Lentini, Maria Stella Vanessa Sammito (was not presented)
ID. 3 Site effects and risk assessment for the preservation of cultural heritage in the city of Augusta (Italy)

Keith Parfitt, Eddie Bromhead Presenter: **Jamie Standing**
ID. 14 The Folkestone Warren landslides and the East Cliff Roman Villa



Chiara Ferrero, Giulio Lucio Sergio Sacco, Chiara Calderini
ID. 39 Numerical damage assessment of a medieval masonry castle under differential settlements



Julio César Hernández Ch., Elvira Leon (was not presented)
ID. 98 Geometric correction and subsurface hardening for heritage sites in Mexico City. Lessons learned

Dimitrios Boutakidis, Spiridoula Bareka, Georgios Efraimidis, Polyxeni Kallioglou
ID. 21 Landslides Under Flash Floods: Failure Mechanisms and Risk Mitigation Measures



Christos Tsatsanifos (was not presented)
ID. 80 Monuments affected by the construction of dams

Janet Botha, C. W. MacMinn, H. J. Burd, S. Acikgoz
ID. 110 Long term prediction of ground movement in expansive clays due to soil-atmosphere-vegetation interaction



National Archaeological Museum
Guided Tour - Conference Reception

The first day concluded with an exclusive Conference Reception at the National Archaeological Museum of Athens. Delegates enjoyed a private after-hours visit to selected collections, guided by the Museum's Director General, before gathering in the Museum's Atrium to celebrate the opening of the Symposium.

Some experience stay with you long after they are over

One of the most special moments of TC301 Athens 2026 was our private visit to the **National Archaeological Museum of Athens** — a unique experience made possible through the vision and thoughtfulness of **Ioanna Dretta**, **Chair of the Museum's Board**, and brought to life with exceptional care and precision by **Dr. Konstantinos Nikolentzos, Deputy Director General of the Museum**.

We cannot thank enough the National Archaeological Museum team. Staying with us after hours and preparing such a beautifully guided experience required generosity, dedication and extraordinary professionalism.

What followed was a journey through history, art, science and human creativity — spanning centuries of Greek civilization, from the Neolithic and Mycenaean worlds to the Archaic and Classical periods, across mainland Greece, the islands of the Aegean and the wider ancient Greek world.

Perhaps most fascinating was seeing how the representation of the human form evolved alongside society itself: from the almost abstract early figurines, to the monumental kouroi, larger than human scale and governed by strict geometric forms, and finally to the extraordinary naturalism and understanding of the human body achieved in the Classical period.

And then, some objects simply stopped us in our tracks: the monumental bronze Zeus or Poseidon of Artemision, whose identity remains one of the enduring mysteries of ancient Greek sculpture; the extraordinary Antikythera Mechanism, which continues to inspire admiration for the scientific knowledge embodied in such a complex ancient instrument; and the gold treasures from the royal graves of Mycenae, including the famous funerary mask traditionally known as the "Mask of Agamemnon."









A truly memorable evening — and one of the moments of TC301 Athens 2026 that will stay with us for a long time.







Second Day 17.09.2026

Keynote Lecture - Koenraad Van Balen
Session Chair: George Dounias (EDAFOS)



Dealing with evolving conservation principles to include interdisciplinary collaboration for cultural heritage preservation

A holistic approach for the preservation of cultural heritage often requires the input and collaboration of various disciplines. It therefore requires the various involved actors to understand and agree on the principles that contribute to the preservation of the identified heritage values. Based on my experience with teaching interdisciplinary groups of students to develop a conservation and valorisation project in the Master of science in Conservation of Monuments and Sites at KU Leuven, a methodology and lessons learned can be shared that stimulate and improve interdisciplinary collaboration in the field.



The discussion on authenticity of the first day opened important questions about what exactly we seek to preserve. Today, Prof. Koenraad (Koen) Van Balen took that conversation a step further — asking how conservation itself must evolve.

His keynote traced the changing principles of heritage conservation: from a strong emphasis on material preservation toward a broader understanding of cultural significance, local development and multiple values.

One message stood out: **interdisciplinarity is no longer optional**.

Different disciplines, stakeholders and communities inevitably bring different perspectives. The challenge is therefore not simply to collaborate, but to make that collaboration operational. Prof. Van Balen illustrated this through his cyclic approach — **Anamnesis, Diagnosis, Therapy and Control** — together with practical tools for structured diagnosis, risk assessment and preventive conservation.

Perhaps the broader lesson was that heritage conservation cannot remain static while the world around it changes. It must continuously negotiate between established systems, emerging innovations and the wider social, cultural and political landscape.

And the discussion continues throughout the day, with a strong focus on restoration practice. We look forward to seeing of interdisciplinary collaboration in action.

Session: Seismic Behaviour of Heritage Monuments: Observa-tion, Modelling and Mitigation
Session Chair: Anargyros Alexandris (Archidoron)

Fausto Somma, Benedetta Cortellesi, Alessandro Pagliaroli, Paolo Tommasi, Giuseppe Lanzo
ID. 20 Numerical analysis of the cliff failure occurred at St. Eutizio Abbey during the 2016 Central Italy seismic sequence



Filomena de Silva, **Alessandro Flora**, Mariano Nuzzo, Francesco Silvestri
ID. 50 Influence of uncertainties on the stability of rock cavities under gravity and seismic loads



Dimitrios Egglezos, Christos Giannelos
ID. 59 A Multidisciplinary Approach to the Restoration of the Pyli Arch Bridge: Integrating Seismic, Geotechnical, and Hydraulic Analyses



Cihan Taylan Akdag, Frank Rackwitz, Daniel Musall, Thekla Schulz-Brize, Altug Hasözbek
ID. 15 Geotechnical Study on the Hellenistic stone retaining wall of the Upper Agora in Ephesus under static and seismic loading



Elena Kapogianni, **Prodromos Psarropoulos**, Georgios Sakellariou, Michael Sakellariou
ID. 36 Dynamic Response Assessment of the Acropolis Circuit Wall Using Structural-Health Monitoring, Big-Data Analytics, and Numerical Modelling



Evangelia Pelli, Ioannis Dourakopoulos, Paraskevi Yiouta-Mitra, Anastasios Sextos
ID. 55 Monuments of Greece classified according to seismic behavior and case study for seismic vulnerability index



Session: Restoration Engineering and Structural Interventions
Session Chair: Thomas Grammenos (Elliniko Metro)

Kari Avellan, Kirsi Vaali, Erika Belopotocanova
ID. 29 Geotechnical and Structural Engineering for Old Historical Buildings

Giuseppe Tropeano, Giovanna Concu, Donatella Rita Fiorino, Daniel Meloni
ID. 34 Development of methodologies and protocols for the analysis of the geotechnical and structural safety of archaeological monuments from the pre-Nuragic age in Sardinia



Eleni-Eva Toumbakari, Dimitrios Egglezos
ID. 43 Anastylosis of the northeastern tower of the ancient fortress of Aegosthena in Attica: construction analysis, collapse mechanism and interventions for the improvement of the foundation conditions



Anargyros Alexandris, Konstandinos Papandonopoulos
ID. 47 Anastylosis of the Western Stoa of the Gymnasium of Ancient Messene: Engineering Insights into an Archaeological Monument



Andrea Dominijanni**,** Matteo Gabassi, Fritz Kopf, Daniel Metz, Alberto Minardi, **Alberto Pasquetto**, Juergen Polansky
ID. 23 Restoring the foundation of a historic Viennese building using injections of expanding polyurethane resins



Vasiliki Palieraki, **Eleni Tavouktsi**, Eleni Karakike, Constantinos Arvanitis
ID. 63 Vertical connectors between successive drums in ancient columns: literature and in-situ investigation



Valter Maria Santoro, Maria Rita Acetoso, Stefano De Vito
ID. 19 The Reconstruction of the Al Hadba Minaret in the Al Nuri Mosque in Mosul, symbol and outstanding historic heritage of the city



War remains, unfortunately, one of the greatest threats to cultural heritage in many parts of the world.

This presentation on the reconstruction of the Al-Hadba Minaret in Mosul — destroyed during the conflict in 2017 and painstakingly rebuilt — was a powerful reminder of an issue that goes far beyond this particular project.

No matter how accurately we reconstruct a destroyed monument, **can we ever truly replace what was lost?**

Reconstruction can return a landmark to a city. It can restore a place of worship, memory and community. But it cannot restore the authentic material, the centuries embedded within it, or its uninterrupted connection with history.

Perhaps that is the strongest reminder of all: **protecting heritage before it is lost remains irreplaceable**.

Aris Chatzidakis
ID. 89 Study for the restoration of the walls of the Castle of Kalamata



Paolo Simonini, Francesca Ceccato, Ahmet Sevren
ID. 105 Optimization of Flood Protection Interventions in St. Mark's Square in Venice and evaluation of effectiveness through Geotechnical Investigations and Monitoring



Dimitrios Egglezos, Christos Tsatsanifos, **Emmanouil Tzannidakis**
ID. 107 Revisiting Ancient Dam Engineering: Stability Assessment of the Alyzia Dam Using Modern Geotechnical Methods

Kerisel Lecture - Efrain Ovando Shelley
Session Chair: Alessandro Flora (TC301 Chair)



The Session Chair presented the 4th Kerisel Lecturer.



Geotechnics for the preservation of the architectural heritage of a sinking city

Mexico City, with more than 20 million inhabitants, is sinking due to extensive water exploitation. It also lies, mostly, over extremely soft and compressible clays that have induced differential settlements in the whole of its urban infrastructure, including heritage buildings. This presentation describes some of the solutions and techniques with which Geotechnical Engineers have coped with the challenge of preserving these culturally relevant structures.

A very special and powerful moment at TC301 Athens: the **4th Kerisel Lecture**, delivered by Prof. **Efraín Ovando-Shelley**.

His lecture took us beneath Mexico City, where the exceptionally soft clays of the former lakebed continue to consolidate, causing the city — and its monuments — to sink, tilt and, in some cases, seemingly re-emerge.

What was particularly striking was the systematic use of decades of measurements and experiments to show that the ground itself evolves with time — changing not only in volume, but also in stiffness and seismic response.

The lecture culminated in the remarkable case of the **Metropolitan Cathedral of Mexico City**, where controlled underexcavation was used to induce corrective settlements and reduce the effects of severe differential movement.

A memorable reminder that preserving heritage does not always mean keeping a monument perfectly still. Sometimes, it means understanding how the ground beneath it moves — and learning how to move with it.



Alessandro Flora presents the commemorative diploma to Efrain Ovando-Shelley in recognition of his Kerisel Lecture

Session: Underground Monuments and Rock Engineering
Session Chair: Haris Saroglou (NTUA)

Nicolas Carpentier
ID. 42 Underground Church of Saint-Emilion: Geotechnical challenges in light of heritage issues



Emilio Bilotta, Gianluca Fasano, Alessandro Flora
ID. 22 The Crypta Neapolitana: a Roman tunnel deserving new life



Dimitrios Egglezos, **Emmanouil Tzannidakis**, Charalambos Gouvas, Antonis Galanakis
ID. 94 Geotechnical Challenges and Stabilization Interventions in Three Greek Show Caves of Monumental Value



Arash Barjasteh
ID. 2 Hydraulic behavior of rock masses around historical underground structures (Boleiti tunnel and Daryun canal) of Shushtar City, Iran

Nikolaos Antoniadis, Wout Broere, Guillaume Rongier, Dominique Ngan-Tillard
ID. 5 Predicting Creep Behaviour in the Historical Valkenburg Calcarenite Mines Using LSTM Neural Networks



Dimitrios Egglezos, **Lysandros Pantelidis**
ID. 58 A Simplified 2D Methodology for Assessing the Stability of Carved Mycenaean Tombs Under Asymmetrical Geological Conditions



Orazio Casablanca, Margherita Zimbardo, Anna Scotto di Santolo
ID. 99 Stability Analysis of Excavation Fronts at the Herculaneum Archaeological Site

Haris Saroglou
ID. 109 Mitigation of rock slope instabilities affecting Cultural Heritage sites. Examples from Greece



Edoardo Lusini, Daniela Boldini, Daniele Spizzichino, Claudio Margottini
ID. 32 Assessment of Stability Conditions for a Large Block Overhanging a Nabataean Archaeological Well at the UNESCO Site of HEGRA – KSA



Panagiotis Sarellas Presenter: Giannis Giannopoulos
ID. 111 Preserving the old fortress of Corfu: Geotechnical stabilization of historic masonry and rock slopes using industrial rope access techniques



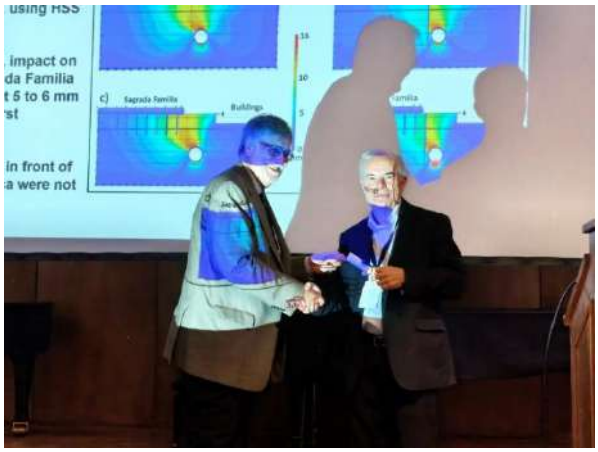
Keynote Lecture - Alberto Ledesma
Session Chairs: Marina Pantazidou (NTUA) Christos Tsatsanifos





Examples of preserving historic buildings from the impact of tunnelling

The lecture presented 3 cases of very different buildings and the corresponding Geotechnical Engineering solutions adopted: an old farm house from 13th century, where an underpinning system was designed; the Sagrada Familia Basilica, where a barrier of stiff piles was built to protect the world heritage monument from the tunnel, and the building La Farinera, from early 20th century, where a compensation grouting was carried out.



Christos Tsatsanifos presents the commemorative diploma to Alberto Ledesma in recognition of his Keynote Lecture

Session: Heritage Sites and Urban Development
Session Chair: Christos Tsatsanifos

Debra Laefer
ID. 49 New York City's Lost Cemeteries



Dimitrios Tsoutsas, Basil Kasimis, Michael Bardanis, Marina Dede
ID. 78 Finite element analyses of prehistoric walls under the loads of modern day shelters



Marialuigia Sangirardi, Fabio Rollo, Giacomo Di Santo, S. Barsoum, **Angelo Amorosi**
ID. 103 Damage induced by groundwater drawdown-related settlements on a Roman Aqueduct



Emmanuel Vassilakis, Georgios Gavalas, Aliki Konsolaki, Maria Kazantzaki, Evangelos Tsakalos, George Oikonomidis
ID. 73 Digital Twin Technology in Archaeology: Laser Scanning the Underground Mine Galleries at Agios Sostis, Sifnos



Federico Capata, **Matteo Iacorossi**, Francesca De Santis
ID. 4 Preserving Historical Structures in Urban Tunneling: Diaphragm Walls Embedded in Bedrock



Luca Masini, Gaetano La Grotta, Francesco Lavagnini, Sebastiano Rampello
ID. 27 3D FEM coupled simulation of TBM tunnelling and station excavation



Taryn DiLorenzo
ID. 16 Winter Road Maintenance as a Threat to Our Built Heritage



Third Day 18.09.2026

The third day of the Symposium was held at the **Acropolis Museum** and was dedicated to the protection and preservation of Greece's monuments and cultural heritage against natural and climate-related hazards—an enduring legacy of the host country. The programme featured keynote lectures by Professor Manolis Korres, presenting the Acropolis restoration programme and the new era of the monument; Professor Christos Zerefos, discussing the emerging threats of climate change to cultural heritage; and Professor Nicos Makris, revealing the inherent structural ingenuity of ancient Greek engineering and architecture. These keynote lectures were complemented by invited lectures from members of the Acropolis Restoration Service (YSMA) and selected technical presentations on Greek cultural heritage, followed by a technical visit to the Acropolis.

Keynote Lecture - Manolis Korres
Session Chair: Androniki Miltiadou (NTUA)



Acropolis of Athens

The lecture offered a comprehensive reading of the Acropolis of Athens, beginning with the geomorphology of the Sacred Rock and tracing the successive historical phases that shaped its present form. Architecture and construction technology were examined as expressions of the knowledge, ingenuity and evolving needs of each period. Beyond the physical development of the monument, the lecture addressed the theoretical values that underpin its understanding, preservation and restoration, revealing the Acropolis as a continuously evolving cultural landscape.

Welcoming Prof. Manolis Korres to TC301 Athens was a very special moment for the Symposium.

Before the Parthenon, there was the rock — and before the monuments, a landscape shaped by geology, water and time.

He took us back to the very beginning of the Acropolis story: to the Athenian schist, tectonic breccia and Acropolis limestone, and even to traces of ancient marine erosion preserved high on the rock — evidence of a landscape dramatically different from the one we know today.

From there, he guided us through the successive phases of occupation and construction: from the **Mycenaean fortifications and early buildings**, to the use of marble and the extraordinary transformation of the Acropolis during the Classical period.

What emerged was not simply a history of monuments, but a history of the continuous interaction between rock, construction, engineering and human ambition.

For a Symposium centred on geotechnical engineering and heritage, the message was especially resonant: the history of a monument is inseparable from the history of the ground beneath it.

We are deeply grateful to Prof. Korres for sharing with us his extraordinary knowledge, perspective and lifelong connection with the Acropolis and the Parthenon.



Androniki Miltiadou presents the commemorative diploma to Manolis Korres in recognition of his Keynote Lecture

Invited Lectures
Session Chair: Eleni-Eva Toumbakari (Ephorate of Antiquities of W. Attica)

Invited Lecture - Vasileia Manidaki



Ancient Methods, Modern Science: Restoring the Parthenon's West Pediment

The Acropolis Restoration Service systematically repaired centuries of damage to the Parthenon's West Pediment through advanced structural modelling and geometric restoration. Culminating in March 2026 with the placement of the 7th orthostate as the closure stone, the project revived the brilliant ancient construction assembly and restored the complete silhouette of the tympanum for the first time since 1802

Invited Lecture - Antigoni Vrouva



The seismic response of the north wall of the Parthenon cella: Parametric numerical investigation of structural details and restoration scenarios

The numerical simulation methodology for assessing the seismic response of ancient dry-joint monuments was presented, as developed by the academic community and systematically employed by YSMA in restoration studies. Its implementation was demonstrated through two representative case studies from the Parthenon: (a) the restoration of the northern cella wall, and (b) the design of the special connectors for the western pediment.



Eleni-Eva Toumbakari presents the commemorative diploma to Antigoni Vrouva in recognition of her Invited Lecture

Invited Lecture - Eleni Aggelakopoulou

Research and Conservation of the Acropolis Monuments and Circuit Walls

What is the "right" material to restore the Parthenon? And what colour was the Parthenon really?

These were just some of the fascinating questions addressed by Dr. Lena Aggelakopoulou of YSMA in her excellent presentation at TC301 Athens.

From the search for a compatible replacement for the original porous sedimentary **Piraeus Stone** — with **travertine from Kilkis** emerging as the answer — to the careful selection of materials for mortar, sealing, strengthening fragments and connecting original stone with new additions, the lecture offered a remarkable look into the science behind conservation.

And then came another layer of discovery: colour and decorations.



Using a combination of techniques, including spectrometry and specialised imaging, traces invisible to the naked eye can still reveal evidence of colour and decorative patterns that time has almost completely erased.

A powerful reminder that conservation is not only about preserving what remains visible. It is also about using science to recover information that has survived, quietly, within the material itself.



Eleni-Eva Toumbakari presents the commemorative diploma to Eleni Aggelakopoudalou in recognition of her Invited Lecture

Session: Greek Monuments & Environment
Session Chair: Stella Karafagka

Dimitrios Egglezos, Dorina Moullou, Vasso Evgenikou
ID. 57, 60 Seismic Risk Mitigation of the Acropolis Circuit Wall: Lessons from Historical Damage



Michael Bardanis, Nikos Ninis, Dionisia Michalopoulou
ID. 77 Laboratory and field investigation of the backfill behind the ancient walls of the Acropolis, Athens



Keynote Lecture - Christos Zerefos
Session Chair: George Belokas (UniWA)

Climate Change Impacts on UNESCO Cultural and Natural Heritage Sites in the Mediterranean

The Mediterranean region, home to numerous UNESCO World Heritage Sites of exceptional cultural and natural value, is increasingly vulnerable to the adverse effects of climate change. This lecture will present key scientific findings re--garding the impacts of extreme weather events, sea-level rise, desertification, and other environmental stressors on both cultural monuments and natural landscapes. A multidisciplinary approach will be discussed, bridging climate science, heritage conservation, and policy frameworks.

Professor Zerefos, a member of the Academy of Athens, alarmed us about the threat of climate change on cultural heritage!



The threat is not a projection. It is already here.

This was one of the strongest messages from Prof. Christos Zerefos' Keynote Lecture at TC301 Athens.

Over the past 30 years, our monuments have already been exposed to increasing aridity, changing precipitation patterns, coastal hazards and atmospheric pressures. They remain silent — but they record these changes, and they suffer from them.

Monuments may be silent. Our science should not be.

If we are to protect our cultural heritage, we first need to understand and accept the threats it is already facing. And that understanding cannot come from one discipline alone.



George Belokas presents the commemorative diploma to Christos Zerefos in recognition of his Keynote Lecture

Prof. Zerefos took us on a journey across environmental science, archaeology and engineering, showing why collaboration between them is essential.

Through the Heritage Hazard Index, applied to around 260 UNESCO World Heritage sites, he showed how climate-related pressures may intensify under future scenarios — particularly those associated with aridity and precipitation — while coastal hazards remain a persistent concern.

Understanding comes first. Only then can we act effectively.

Keynote Lecture - Nicos Makris
Session Chair: George Doulis (EDAFOMICHANIKI)



From Hooke's "Hanging Chain" and Milankovitch's "Druckkurve" to a Variational Formulation: The Adventure of the Thrust Line of Masonry Arches

In this lecture, Prof. Makris explained the subtle difference between the thrust line and the funicular polygon; and then he proceeded by showing that Milankovitch's result, t/R= 0.1075 is not unique and that it depends on the stereotomy exercised. The lecture concluded that the catenary (the hanging chain), which has been used widely since the period of the enlightenment to assess the stability of masonry arches, is not a physically admissible thrust line.

The symposium just "rocked" and how more fitting than having a "rock star" of a structural engineer delivering his invited lecture! Professor Nikos Makris!

How thin can a masonry arch be and still remain stable?

This apparently simple question was at the heart of Prof. Nicos Makris' Keynote Lecture at TC301 Athens— and took us on a fascinating journey through some of the brilliant minds of the 18th and 19th centuries.

Masonry arches have an extraordinary ability to carry increasing loads through compression, adapting their internal force path without collapsing.

But there is a limit.

Prof. Makris retraced the progressive understanding of this problem, culminating in the solution developed by Milankovitch for the minimum thickness required for stability.

Along the way, he challenged an assumption deeply embedded in traditional equilibrium analysis: the direction of the thrust force is not necessary tangent to the thrust line— unlike the familiar hanging-chain analogy that has influenced our understanding for so long.

And then came the magic number:

t/R = 0.10748

A beautiful example of how revisiting the foundations of mechanics can still reveal new insights into structures that have stood for centuries.



George Doulis presents the commemorative diploma to Nicos Makris in recognition of his Keynote Lecture

Invited Lecture - Denis Istrati
Session Chair: George Doulis (EDAFOMICHANIKI)

Simulating and Mitigating Dynamic Water Hazards on Coastal Heritage via Multiphysics Modeling and AI



Session: Greek Monuments & Environment
Session Chair: Lysandros Pantelidis (Cyprus University of Technology)

Dimitrios Egglezos
ID. 93 Integrated Risk Assessment for Monumental Structures under Climate Change and Seismic Hazards



Stella Karafagka, Kyriazis Pitilakis
ID. 65 Effect of local soil conditions on the seismic response of free-standing multi-drum ancient Greek columns

George Gazetas, Ioannis Anastasopoulos, Vasilis Drosos
Seismic Performance of Ancient Multi -drum Columns



INTERNATIONAL SYMPOSIUM
PRESERVATION OF MONUMENTS & HISTORIC SITES
ATHENS 2026 TC301

The Keynote and Invited Lectures of the 3rd day of the Symposium were recorded by BLOD (BODOSAKI LECTURES ON DEMAND) and can be viewed via the following link: https://www.blod.gr/events/4o-diethnes-symposio-gia-ti-diatirisi-mnimeion-kai-istorikon-horon/

The proceedings of the Symposium can be found via the following link: https://tc301-athens.com/proceedings/

Furthermore, the proceedings are now available in open access through the ISSMGE Online Library https://lnkd.in/dw3eiQMq

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Closing Ceremony



Alessandro Flora, Michalis Bardanis and Christos Tsatsanifos



Chairman's Closure

Dear colleagues, ladies and gentlemen,

As we reach the end of IS TC301 ATHENS 2026, I would like to take a moment to reflect on the significance of what we have shared during these three days.

We have gathered here in Athens, a city where history and contemporary life exist side by side, to discuss the preservation of monuments and historic sites — places that are not simply remnants of the past, but an essential part of our collective identity and cultural memory.

At the same time, our discussions have reminded us that **preservation is not about keeping history frozen in time. It is about ensuring that monuments and historic sites can continue to live, to be understood and appreciated, and to remain meaningful to future generations**.

This is why meetings such as this Symposium are so important. By bringing together researchers, engineers, architects, conservators and heritage professionals from different countries and disciplines, we create opportunities not only to exchange knowledge, but also to develop new ideas and build lasting collaborations.

As I said at the beginning of the conference

The preservation of our heritage is a responsibility that we share across generations and across borders. It requires scientific knowledge, technical expertise, careful judgement and, above all, respect for the authenticity and cultural significance of the monuments entrusted to us.

And **no single discipline can preserve cultural heritage on its own. A monument cannot be fully understood by an engineer alone, nor solely by an architect, an archaeologist, a historian or a conservation specialist. We need all these perspectives.**

I would like to express my sincere appreciation to all the authors and speakers for sharing their work and experience, to the session chairs for their valuable contribution, and to the members of the Technical and Organizing Committees for their dedication and hard work. Special thanks to the Organizing Team Rallis Kourkoulis, Fani Gelagoti and Leda Chaorianopoulou.

I would also like to thank all of you who travelled to Athens and made this Symposium truly international.

I hope that you leave Athens not only with new knowledge and perspectives, but also with new professional connections, new collaborations, and perhaps a renewed sense of the importance of the work we all do for the protection of our cultural heritage.

It has been a great honour and a great pleasure to welcome you to Athens.

I would like to close with a simple thought:

We preserve the monuments of the past not only because they tell us where we come from, but because they help us decide what we want to pass on to the future.

And with a very recent photograph from an excellent example of the preservation and enhancement of archaeological remains of the early Byzantine era unearthed during the construction of the Thessaloniki Metro, in which geotechnical engineers played a major role.



This is from the Agia Sofia Station.

Thank you very much for being part of IS TC301 ATHENS 2026.

I wish you all a safe journey home, and I sincerely hope that we will meet again in 2030 in China, probably in September, certainly around the same shared commitment to preserving our cultural heritage.

Thank you.

Technical Visit to the Acropolis
led by Architect Vasileia Manidaki and Dr. Eleni Aggelakopoulou (YSMA)

A Rare Privilege. An Unforgettable Finale for TC301 Athens.

After three intense days of TC301 Athens, there could hardly have been a more perfect closing than an extraordinary technical visit to the Acropolis and the Parthenon.

This was far more than a visit to one of the world's greatest monuments. It was a rare opportunity to look behind the monument we all know and into the extraordinary science, engineering and craftsmanship involved in preserving it.

Guided by Architect Vasileia Manidaki and Dr. Lena Aggelakopoulou of YSMA, we followed the evolution of the Acropolis restoration—from the pioneering interventions at the Erechtheion to the meticulous work continuing today on the Parthenon. Their knowledge was exceptional, but it was their enthousiam, openness and passion that made the experience truly special, allowing us to dive into the thinking and extraordinary precision behind every intervention.



And, through their explanations, we gained an even greater appreciation for the mastery of the ancient builders themselves: the subtle curvatures, the extraordinary precision of the column drums, and the optical refinements that create the harmony we still admire today.



You begin by admiring the monument. Then you understand a little more of how it was conceived and built. And you admire it all over again.

And then came the moment none of us will easily forget: entering the interior of the Parthenon itself.



Standing inside, surrounded by the ancient fabric and its contemporary restoration, was a unique moment of connection, between old and new, engineering and art, the monument and the human.

Our deepest gratitude to the Hellenic Ministry of Culture for granting TC301 delegates this exceptional access; to YSMA – Acropolis Restoration Service for organizing this remarkable visit; and to the Hellenic Society for Soil Mechanics and Geotechnical Engineering for generously funding it.

And, above all, heartfelt thanks to Vasileia Manidaki and Lena Aggelakopoulou. Your knowledge, generosity and genuine passion transformed an exceptional visit into an unforgettable experience.

A moment of awe that will stay with us for a very long time.





ISCARSAH at International Conferences!

International conferences are always a valuable opportunity to exchange ideas, learn about the latest developments in the field, and reconnect with colleagues and friends.

Last week, a group of **ISCARSAH** members met in Athens, Greece, at the 4th International Symposium on Geotechnical Engineering for the Preservation of Monuments and Historic Sites (**TC301 - Athens 2026**).

The programme included two keynote lectures delivered by ISCARSAH members:

- Prof. Gorun Arun– Substructure design of ancient master builders
- Prof. Koenraad Van Balen– Dealing with evolving conservation principles to include interdisciplinary collaboration for cultural heritage preservation.

The conference also offered participants a unique technical visit to the Acropolis of Athens, including access to the Parthenon and the opportunity to observe the ongoing restoration works from very close. Many thanks to **TC301 - Athens 2026** for making this special visit possible!



Koenraad Van Balen, Kari Avellan, Chiara Ferrero, Gorun Arun, Androniki Miltiadou, Christos Tsatsanifos (Symposium Chair)

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Editor	:	Christos TSATSANIFOS, Dr. Civil Engineer, PANGAEA CONSULTING ENGINEERS P.C.C. editor@hssmge.gr, ctsatsanifos@pangaea.gr

HSSMGE

Geotechnical Section
School Of Civil Engineering
National Technical University of Athens
Zografou Polytechnioupoli
GR-15780 ZOGRAFOU, ATHENS

Tel. 210.7723434
Fax. 210.7723428
Email secretariat@hssmge.gr ,
geotech@central.ntua.gr
Web page www.hssmge.org (under construction)

«THE NEWS PF HSSMGE» Editor: Christos Tsatsanifos, tel. 210.6929484, fax. 210.6928137, Email. ctsatsanifos@pangaea.gr, editor@hssmge.gr, info@pangaea.gr

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