

## Conference reports

### Engineering challenges in Rehabilitation of Damaged Historical Monuments in Mosul, Iraq

The Iraqi Scientific Society of Soil Mechanics and Foundation Engineering (ISSMFE) in cooperation with the Civil Engineering Department at the University of Mosul was arranged a two-day symposium entitled “**Engineering Challenges in Rehabilitation of Damaged Historical Monuments in Mosul/Iraq**”. The symposium was allocated to address the engineering challenges in the rehabilitation of the damaged historical monuments in Mosul City, Mosul is considered as one of the historical and cultural significant cities of the Arab World. A city is with a long-life history extending back from hundreds to thousands of years, from the Assyrian Empire 1000 BC to the Ottoman era, passing through many historical eras. Accordingly, it is one of the cities that possess an enormous wealth of heritage buildings that have historical value. Among the most important Archaeological monuments which have been entirely demolished by ISIS are: Al-Nuri Mosque and its Al-Hadba Minaret, Prophet Younis Mosque, Al-Nabi Sheet Mosque, Al-Nabi Gerges Mosque, Al-Khidr Mosque, Al-Tahira Church, Al-Imam Hassan Mosque, Al-Imam Al-Bahir Mosque, Al-Musfi Mosque, Nineveh Wall, and the ancient houses of Mosul city. There are other heritage buildings which have been partially demolished such as: the Church of the Hour, the Monastery of Markorkis, and many other famous old mosques in the city. The invasion of Mosul by ISIS, the second-largest city in Iraq, turned the city into large rubble, which never happened in Mosul city and not witnessed throughout its history. Devastation was pervaded all parts of the city, as neither stone nor humans were spared from the disaster.



Figure 1. Al-Tahira Church during rehabilitation by UNESCO



Figure 2. Pope Francis visited Al-Tahira church in 2021



Figure 3. Al-Hadba Minaret inclined with 142 cm from the centerline



Figure 4. Current view of Al-Hadba Minaret after been destroyed by ISIS

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Figure 5. Dome of the Al-Nuri Mosque under rehabilitation

Today, after the liberation of Mosul from ISIS, the reconstruction processes have begun. Based on the importance and complexity of Mosul historical sites, their reconstruction requires some unusual engineering solutions, which necessitates the involvement of the geotechnical engineering due to the complexity in nature of this region and its geotechnical aspects. This symposium was devoted to the most practical challenges, which belong to various geotechnical features that dealing with the reconstruction processes; it explores approaches in addition to suitable methodologies to overcome these challenges. The program of the 1st day includes two sessions. The first session started with the speech of Prof. Mahdi O. Karkush, the President of the Iraqi Scientific Society of Soil Mechanics and Foundation Engineering. Then, it was followed by speech to clarify the reality of the historical filiation and inheritance in the city of Mosul. The city damages and its causes were presented by archaeological expert Mr. Mosab Jasim. Finally, the resident engineer, Omar Yasir, presented a presentation concerning the soil nature and geotechnical problems existing in the archaeological of Al-Hadba Minaret of Al-Noori Mosque in the old city of Mosul.



Figure 6. Opening ceremony of the symposium

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The second session included the presentation of five lectures as shown in Table 1. The presented papers were related to the strategies of reconstructing the Mosul old city according to the World Heritage conditions, the soil nature and some suggestions to strengthen the foundations of Al-Hadba minaret during reconstruction process, the characteristics of the building materials used in Al-Hadba minaret and Mosque, Mosul's archaeological heritage, and the link between destruction and restoration. Additionally, a lecture on the assessment of geological and engineering problems in the old city of Mosul using remote sensing techniques was presented. After the 2<sup>nd</sup> session, the recommendations of the symposium were announced. Also, two research papers were presented as posters. The two posters deal with historical places in Nineveh governorate and engineering evaluation of Al-Rabieah Mosque.

**Table 1. Lectures and posters presented in the symposium.**

<b>Session No. 1</b>	
Lecture No.1	<b>The reality of Historical and Heritage Buildings in The City of Mosul-Damage and Its Causes</b>
Speaker	Mosab Jasim/Inspectorate of Antiquities in Mosul/Iraq
Lecture No.2	<b>Reconstruction of Al-Nuri Mosque by UNESCO</b>
Speaker	Omar Yasir/UNESCO/Iraq
<b>Session No. 2</b>	
Lecture No.3	<b>Analytical Study and Suggested Solutions to Reinforce Al-Hadba Minaret Foundation</b>
Speaker	Asaad Al-Omari, Amina A. Khalil, and Suhail Khattab/College of Engineering/University of Mosul/Iraq
Lecture No.4	<b>The Antiquities and Heritage of Mosul Between Destruction and Restoration</b>
Speaker	Moataz A. AL-Obaidi/College of Engineering/University of Mosul/Iraq
Lecture No.5	<b>Strategies of Reconstruction the Mosul Old City According to the World Heritage Condition</b>
Speaker	Aws Al-Obaidi/Department of Architecture Engineering/Cihan University/Erbil/Iraq Hande Tulum/Department of Architecture Engineering/Bahcesehir University/Turkey
Lecture No.6	<b>A Detailed Study of The Mortar Construction Material in The Al-Hadba Minaret Historic</b>
Speaker	Asaad Al-Omari/College of Engineering/University of Mosul/Iraq
Lecture No.7	<b>Assessment of Geological and Engineering Problems in the Old City of Mosul Using Remote Sensing Techniques</b>
Speaker	Azealdeen S. Al-Jawadi/College of Petroleum and Mining Engineering/University of Mosul/Iraq; Sabah H. Ali/Remote Sensing Center/University of Mosul/Iraq; and Hadeer G. M. Adeb/Dams and Water Resources Research Center/University of Mosul/Iraq
<b>Posters</b>	
Poster No.1	<b>The most important archaeological monuments in Nineveh Governorate</b>
Authors	Mohammed N J Alzaidy/College of Engineering/University of Mosul/Iraq
Poster No.2	<b>Engineering Evaluation of Al-Rabieah Mosque</b>
Authors	Ahmed I. Mohammed, Mohammed N. Jaroo, Khawla A. K. Al-Juari/College of Engineering/University of Mosul/Iraq

Many historical and heritage monuments in which reconstruction has begun were visited by the participants in the second day of the symposium to speak and discuss the supervising engineers and officials about the reconstruction process. It included a visit to the sites of the Al-Nuri Mosque and its surroundings areas, the Mosul churches complex, and the historical house of Al-Tatunji. Scientific discussions emerged to strengthen the foundations and to suggest several treatments of the geotechnical situation of the area. The resident engineers and the local experts illustrate a lot of useful information and details to the visitors.



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Figure 7. Rehabilitation of one of the historical houses in Mosul old city



Figure 8. Prof. Mahdi Karkush with Prof. Majeed Rasheed in one of the historical buildings in Mosul city, which visited by the President of France, Emmanuel Macron in 2021

*Mahdi O. Karkush, President of the Iraqi Scientific Society of Soil Mechanics and Foundation Engineering*