

Technical session 4c: Preservation of historic sites Séances techniques 4c: Préservation de sites historiques

V.S. Ilyichev

Research Institute of Bases and Underground Structures, Russia

Y. Iwasaki

Geo-Research Institute, Japan

A. Ohshima

Osaka City University, Japan

Y. Higo

Geo-Research Institute, Japan

1 SESSION ORGANIZATION

Technical Session for “4c: Preservation of Historic Sites” was held at 10:30-12:30 on September 14 (Wednesday) with V.A. Ilyichev as the session chair, Y. Iwasaki as the general reporter, and A. Ohshima and Y. Higo as the session secretary.

General reporter and 9 panelists presented in the session as follows.

General Report: *Y. Iwasaki (Japan)*

Discussion Topic I: Authenticity of historical structures and their foundations

C. Tsatsanifos (Greece) - General principle of the authenticity of the foundations of monuments

Discussion Topic II: Characteristics of historic sites and Geotechnical Analysis

T. Tamano (Japan) - Geotechnical characteristics of Japanese castle masonry wall and mechanical analysis for its preservation

M.B. Lisyuk (Russia) - Use of soil-structure interaction analysis for historical monuments preservation

Discussion Topic III: Case Studies: How the historical site was preserved.

E. Santoyo (Mexico) - Behavior of Mexico City's Cathedral after underexcavation and subsoil hardening

K. Avellan (Finland) - Strengthening the foundations of the main building of Tartu University, Estonia

H. Arii (Japan) - Preservation work for the section of the Embankment of Sayamaike Pond, living oldest earth-fill dam in Japan

V.M. Santoro (Italy) - Modern technology introduced to safeguard old Monuments in Angkor

J.L. Justo (Spain) - The restoration of San Pedro Cliff at La Alhambra

S. Hayashi (Japan) - Foundations and structure of Osaka Municipal Central Public Hall Renovation and original construction

Discussion open from floor : chaired by *V. A. Ilyichev (Russia)*

J. Launay (France)

V.M. Ulitsky (Russia)

M. Bustamante (France) - The underpinning of a 17th century complex: the Montpellier Art Museum

Concluding Remarks: *Y. Iwasaki (Japan)*

The session was held in the special hall with a dome graced with murals on the ceiling depicting traditional Osaka festival. The number of the participant in the session was about 100. The session was well organized that the audience can easily understand the present states of the geotechnical problems in the preservation of historical sites. The session consists from general report and three discussion topics. The general report consists of historical review of UNESCO's activity and a general review of presented papers in the past conferences by ISS-MFE/ISSMGE including Osaka conference as well as special review of soil extraction as to rectify leaned towers and uneven settled structures.

The general reporter, Iwasaki, have raised the authenticity problem of foundations.

The topic I “Authenticity” was considered as a little difficult concept, however, Mr. C. Tsatsanifos made a good and concise presentation on the concept and need to consider the authenticity when we deals with foundations to protect upper structures.

2 ACCEPTED PAPERS

6 papers were accepted in the session as shown below.

K. Avellan, M. Maanas, & V. Jaaniso: Strengthening the foundations of the main building of Tartu University, Estonia
M. Bustamante, A. Verdier, & J. Brémond: The rehabilitation works on a 17th century edifice: the Museum Fabre of Montpellier

Y. Iwasaki: Restoration of foundation of northern library of Bayon temple, Angkor

J. L. Justo, J. Saura, N. Vázquez, P. Durand, E. Justo & M. Azañón: The restoration of San Pedro cliff at La Alhambra

N. Nishida, T. Tamano, H. Morimoto, & B. Shrestha: Geotechnical characteristics of Japanese castle masonry wall and mechanical analysis for its preservation

V.M. Ulitsky, A.G. Shashkin, & M.B. Lisyuk: Analyses of historical buildings condition with respect to soil-structure interaction

3 PRE MEETING

A preliminary meeting was hold on September 13 12:30-13:30 at room 1004-1007 to confirm the time schedule of the presentation and to prepare bio data for introduction by the chairman.

4 SESSION

Dr.Higo declared the opening of the session and consequently introduced the chairman Prof.Ilychev, Russia.

Ilychev took the chair and introduced each presenter and managed the rest of the session.

5 GENERAL REPORT

Iwasaki has reviewed the activities of preservation of historical sites based upon two viewpoints. One is how the UNESCO was involved as an international coordinator in cultural preservation. Another is the review of the papers presented in the past and the Osaka conferences on geotechnical aspects of preservation of historic sites as in ISSMFE and ISSMGE as well as several symposiums held by TC19: Preservation of Historical sites.

In the review of the papers, Iwasaki has indicated that such geohazards as slope instability, settlement, and soft ground are major causes of endangering historical sites as shown in Fig.1 Percentage of the geotechnical phenomena treated by the papers in the Arrigo Croce Memorial Symposium, 1996, Napoli. It is clear that geotechnical engineers are requested and responsible to save the cultural heritages for the preservation.

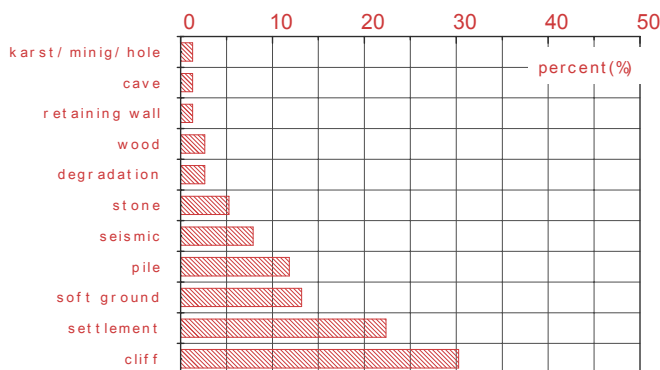


Fig.1 Percentage of the geotechnical phenomena treated in the papers in the Arrigo Croce Memorial Symposium, 1996, Napoli.

Iwasaki focused historical review on soil extraction to rectify inclined structures of Pisa Tower in Italy. A technique to extract soil underneath the Tower was proposed in 1962 in "Geotechnique" by a Italian engineer. A case history on real applications in 1978 was reported in Stockholm Conference 1981. In 1990', the technique of soil extraction was applied in Metropolitan Cathedral in Mexico to rectify uneven settlement based upon careful preliminary experiments.

The general reporter showed three possible measures on Pisa Tower as in Fig.2.

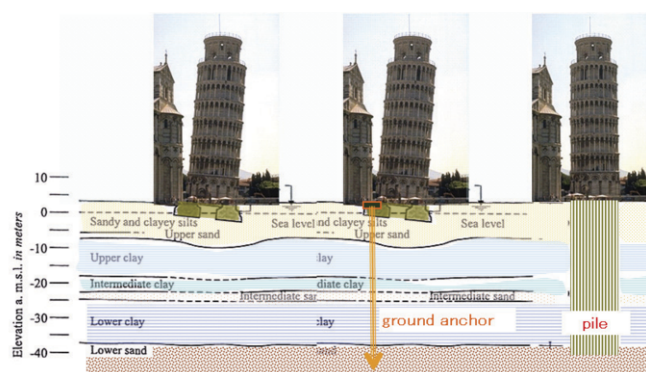


Fig.2 three different counter measures for Pisa Tower

The right one is rectified to upright supported by supporting piles. The center is to keep the balance by ground anchor. The left is to add nothing but to extract soils underneath the Tower. Iwasaki asked the audience "which is the best method to save the Tower among them?" He proposed to consider the difference in these three cases. Is there any idea or concept to evaluate the difference? He further proposed to introduce the concept of "authenticity" in the foundation system of cultural heritages. The authenticity is a general concept for preservation work that states the original structures should be preserved as well as material and their techniques used. The concept has been applied to upper structures, however, never been to the foundation in the past.

When the special committee on Pisa Tower discussed how to rectify, the only consideration was to keep the inclined structure without failure. There has been little discussion based upon the authenticity.

Iwasaki insisted need of the introduction of the concept of the authenticity in the foundation and geotechnical structures of historical heritages.

Finally, the general reporter made a briefing of the each theme of the presentation of the panelists in the session.

6 DISCUSSION TOPIC I AUTHENTICITY OF HISTORICAL STRUCTURES AND THEIR FOUNDATIONS

Discussion Topic I is rather philosophical. Tsatsanifos (Greece) spoke on general principle of the authenticity of the foundations of monuments.

Historic monuments of generations remain to the present day as living witnesses of their age-old traditions. People are becoming more and more conscious of the unity of human values and regard ancient monuments as a common heritage. The common responsibility to safeguard them for future generations is recognized. It is our duty to hand them over on in the full richness of their authenticity."

The principles on the conservation and restoration of historic monuments were initially set at the 1st and 2nd International Congresses of Architects and Technicians of Historic Monuments held in Athens (1931) and Venice (1964) respectively, which adopted the so called "The Athens Charter" and "The Venice Charter."

"The Athens Charter" defines "anastylosis" as the conservation method that intends to keep the authenticity of the monuments: "In the case of ruins, scrupulous conservation is necessary, and steps should be taken to reinstate any original fragments that may be recovered (anastylosis), whenever this is possible; the new materials used for this purpose should in all cases be recognizable."

Based on the authenticity and anastylosis principle, one could argue that also in the case of foundations only repositioning of all of the original material is allowed for the restoration of monuments, however minute in size, to which only a limited number of new pieces, always identifiable should be added as absolutely necessary for the operation.

Hence, the complete compliance with the authenticity and anastylosis principle is not always possible for the foundations of the monuments and major interventions have to be made in order to strengthen them.

7 DISCUSSION TOPIC II CHARACTERISTICS OF HISTORIC SITES AND GEOTECHNICAL ANALYSIS

The second topic is on the geotechnical characterization of historical heritage. It is important to understand the characteristics of not only the ground conditions at the historical site but also geotechnical structure and the effects of the ground to the concerned structure. Two presentations were performed. One is

study of special characteristics of masonry stone wall for castle in Japan by Tamano. Another is a case study of characterization of the interaction between soft ground and a structure in 200 years by Lisjuk.

T. Tamano (Japan) gave a comprehensive study of masonry stone wall of Japanese castle. He pointed out the special curvatures along vertical and horizontal lines of the wall of Osaka castle and showed the geotechnical consideration these curvatures contribute to the safety of the wall stability.

M.B. Lisjuk (Russia) presented a few case studies of soil-structure interaction analysis for historical monuments in Saint Peterberg. He showed the effects to upper structures caused by the geotechnical conditions that have settled by structural load. The tension zones in the upper structure obtained by FEM analysis are found to correspond well with the cracks in the upper structures. The simulation by soil-structure interaction gave us an excellent method to characterize the geotechnical condition at the site and the damaged structure.

8 DISCUSSION TOPIC III CASE STUDIES: HOW THE HISTORICAL SITE WAS PRESERVED

Under the discussion topic III, six experts spoke their experiences in different aspects and in various parts in the world.

Safeguarding works of historical structure on soft soil ground were reported by Santoyo on soil extraction and by Avellan on retrofitting by additional piles.

E.Santoyo (Mexico) explained the developing process of the technique of the soil extraction that initially applied to rectify the uneven settlement of the Central Cathedral in the Mexico city. He showed handy equipment that was developed in Mexico and aims at precise extraction of soils underneath the structure.

K.Avellan (Finland) presented the typical and traditional wooden pile foundation used at soft ground in the Nordic region and explained how the wooden pile rotten due to the lowering the underground water level in the recent decades. He showed the process to strengthen the wooden piles of the foundation of the main building of Tartu University in Estonia.

H.Arii (Japan) reported a case study on geotechnical characteristics of ancient earth dam and the process of cutting, special chemical treatment to preserve the soil, and display of the real dam section in a museum. She also explained that ancient techniques of geotechnical engineering in Japan like sand bags and plant twigs found in the excavated dam section.

V.M.Santoro (Italy), who is a principal member of Italian Team for Safeguarding Angkor, presented his study of foundation and geotechnical works in Angkor, Cambodia. He has strengthened the direct foundation of the Pre Rup Tower by introducing a box concrete underneath the masonry tower structure. He also reconstructed the failed embankment of Angkor Wat using geotextile. Santoro has been applying the modern geotechnical technology for safeguarding old Khmer stone masonry structures.

J.L.Justo (Spain) discussed the instability of slope of San Pedro Cliff at La Alhambra and presented the soil anchoring technique applied to the slope to increase the stability based upon the earthquake resistant with a return period of 1,000 years.

S.Hayashi (Japan) discussed problems of the preservation of the central Osaka city public hall that was supported by wooden piles and presented the base isolation technique applied to the foundation against the anticipated strong earthquake ground motion in Osaka.

9 FLOOR AND WRITTEN DISCUSSIONS

There are very active discussions from floor, Launay(France), Bustamante(France) and Ulitsky(Russia). Launay presented his

experience in Angkor to provide a concrete retaining wall that was designed to provide drainage function in the high steep soil mound of "Baphuon Temple" that was found failed due to steep and high soil mound caused by heavy rain and pointed out that there is a possibility to modify the original structures.

Bustamante presented his paper on the application of micropiles to replace old concrete foundation of Montpellier Art Musium and to make a new basement below the existing structures. He was originally assigned as a panelist. However, during the process of arrange of the session, his name was lost in the list. He was finally welcomed in the session and presented his paper.

Ulitsky presented his additional comments on his coauthored paper of interaction analysis of soil and structures.

A written discussion was received from K.Avellan as follows, It is rather common to use the original material for example wood but sometimes the authorities do not allow wood and then there will be steel or concrete structures. The most important discussion on the authenticity of foundation is how to preserve the original situation with as less disturbance as possible.

The service time of strengthened foundation is also interesting. Of course the foundation should stay as long as the monument should stay (forever). In most cases we make the solution without any code, sometimes the client has an opinion of that and then comes the monetary problems. I personally think that a good service limit time of strengthened foundations of monuments of national heritage for Nordic and Baltic countries should be at least 500 years.

10 CONCLUDING REMARKS

Iwasaki summarized the presentations of the panelists and concluding remarks as follows,

1. Geotechnology is shown to provide very useful knowledge and methods to understand the specialty of the historical sites and causes of damages.
2. Geotechnical problems related with slope, soft ground, ground settlement, earthquake, lowering water level and etc. are reported to cause or have caused to threaten the historical monuments that we human being try to preserve in the future.
3. To preserve the monuments, various efforts are also reported as strengthening the existing slope and foundation, rectifying the uneven settlements of the structures by jacking up foundations and soil extraction, adding base isolation system against earthquake, and applying the chemical treatment of soil to display earth dam section in a museum.
4. Authenticity of foundation is discussed for the first time in its history of preservation of the monument and geotechnical engineering today.

The concept of the authenticity has been discussed for the historical structures above the ground. The foundation has been only discussed to support the upper structures.

In the past, we never discussed the authenticity for foundation system. We just thought the foundation could be anything to preserve the super structure. The authenticity of the foundation should be discussed in depth further in the future leading to be able to have a common concept with conservators. During the process of selecting suitable method among available counter measures, we have to compare the possible methods based upon not only principle of the methodology, simplicity, construction easiness, reliability, cost as in the past, but also the authenticity of the foundation system in the future.

11 ICOMOS MEETING IN XI'AN, CHINA

Iwasaki participated in the 15th general assembly of ICOMOS (International Council on Monuments and Sites) meeting in

Xi'an China, from October 17 to 21, 2005. He attended the meeting of structure of architectural heritage of one of the international scientific committee of ICOMOS to discuss any possibility to have cooperative work with ISSMGE. We have agreed to exchange thoughts and ideas between two our groups. They also agreed the necessity of discussion on the authenticity of the foundation problem.

In the future activity of ISSMGE on preservation of historic sites, we need to have cooperative works with sister societies of IAGE(International Association of Engineering Geology) and ISRM(International Society of Rock Mechanics) as well as ICOMOS to discuss under wider groups who are concerned with the preservation of historic sites.

12 FRENCH, THE MOST SENSITIVE LANGUAGE TO COMMUNICATE

The following is a personal experience of the General Reporter of the session TS-4c: preservation of historic site.

12.1 *Difficulty to communicate in English with French*

In my general report, I wanted to summarize all papers accepted in the proceedings. Among six papers, there is a paper in French. I sent an E-mail asking the author of the paper in French to translate into English so as to understand more clearly than the abstract. The author has not responded my request. I sent the same mail to the secretary of French Geotechnical Committee. The secretary has not responded. From March to July, I have tried several contacts with the author in vain. Due to the difficulty of the communication with the author, we discussed if the author is to be included in panel member. All of sudden, the author sent a mail to the secretary asking if he could be a panelist in the session. We sent him a mail asking again to submit his paper in English version. Again he became a shell closing his mouth tightly. We decided to delete his name from the panel member and to let him make presentation from floor if he appeared at the session.

12.2 *The reason why French writes their paper in only French*

During the conference, I have discussed this language problem with several people. Among them, it was the most understandable yet not agreeable opinion that the Vice President for Europe, Prof. Roger Frank, explained how the French writes paper in French language. I told him that one of the major objects to have international conference is to exchange our ideas and experiences through papers submitted to our conference. I further asked him "If you, member in French region, want to transmit your experiences to the international world, why don't you write your paper not only in French but also in English as well?" He replied "We, French, write papers in French because we want to leave French language in geotechnical science in the future not to transmit our experiences to others."

Now, I became to understand the very basic reason why they stick to their own language. However, the question remains why they did not respond to my E-mail.

If one of the major reasons that ISSMGE was established was to exchange ideas and experiences among different regions and countries, French are not qualified on this point. In the result, French might well be regarded as taking every available information through the ISSMGE and prevent their information by the barrier of language. The language barrier made by our members in French has been increased over a level to be acceptable.

12.3 *Need to break the language barrier*

Based upon my experience as a general reporter, I feel strongly the need of improvement of language barrier for practical reason of writing general report.

Under the present situation, it is very difficult for general reporter to make review the whole papers in the proceedings if any paper written in French. This causes unsatisfactorily results of the content of the report.

To avoid this difficulty, it would be most preferable for the French author to write his or her paper in English and to provide it to the general reporter. However, since they intentionally deny writing in English, we have only two alternatives. One is to pay or ask someone to translate. Another is just to neglect the portion in French. I took the latter one.



Group Photo Technical Session 4c: Preservation of Historic Site

To break the language barrier, it is necessary to take some actions if our society aims to provide fair, equal, and transparent service to the members. The new president of the society must take actions to realize. Any paper written in French must have an English version that should be included in at least in CD-Rom version of the proceedings. If the language barrier disappears, the general reporter becomes to concentrate more technical issues and general members can access information from French.

12.4 *Process of ISSMGE to fair, equal, and transparent society*

Obviously the best way is for the French Geotechnical Society to realize the change of the world and to use English as the only official language in our society.

However, it may need some steps to realize the fair, equal, and transparent society until the French Geotechnical Society understand what we need to do on the language barrier.

The first step is to realize the principle of fairness and equality of financial overburden of the members to participate international conference. We see two problems in our society. One is registration fee. At present, the financial expense is equality distributed among members who participate in the conference. It is unfair to ask every member to pay the equal fee. Additional cost for simultaneous translation should be supported by any member who wants language translation and possibly by French Geotechnical Society.

Another is the proceeding papers. For each paper, the author should put the title and abstract of the paper in French. At present, the author has to translate himself or pay for the translation. If the French Geotechnical Society pay the fee or help the translation, the unfairness of the language problem shall be partially dissolved.

I like to see the discussion on the language barrier at the advisory committee and/or establishing a new non technical special committee on fairness, equality, and transparency society.