

TURKEY: (No 356)  
Historic Area of Istanbul

scr356-1999a.pdf

PROF. ING. GIORGIO CROCI  
ORDINARIO DI TECNICA DELLE COSTRUZIONI  
NELLA FACOLTA' DI INGEGNERIA DI ROMA  
ST. VIA FONTE DI FAUNO 2A ROMA  
TEL. .. 39-06-5746335 - FAX .. 39-06-5781268  
E-MAIL: mc 3832 @ mc link.it

# UNESCO

## REPORT ON THE MISSION AT HAGIA SOPHIA (2<sup>ND</sup> VISIT)

*Giorgio CROCI*

With reference to the agreement between UNESCO and the Turkish Authorities, I have undertaken a mission to Hagia Sofia on the 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> of June 1999.

- During the meeting I met the following people:

- *Dr. Emel Orgen, Anitlar Ve Muzeler, Genel Muourlugu*
  - *Ulku Izmiriligil (archaeologist/architect)*  
*Director of the Central Laboratory for Restoration and Conservation*
  - *Ali Kikickaya (archaeologist)*  
*Director of Hagia Sophia Museum*
  - *Serdar Tugrul (engineer)*  
*Director of Surveying and Monuments of Istanbul*
  - *Prof. Dr. Mufit Yorulmaz (engineer/architect)*  
*Technical University of Istanbul*
  - *Prof. Dr. Zeynep Ahunbay (architect/restorer)*  
*Technical University of Istanbul, Head of the Department of Restoration, Director of Icomos Turkey*
  - *Prof. Dr. Mustafa Erdik*  
*Bosphorus University, Department of Earthquake engineering*
  - *Prof. Nevzat Ilhan, Icomos Turkey*
  - *Dr. Eng. Gorun Ozsen, Yuksek Mimar*
  - *Dr. Arch. Gorul Ozmen*
  - *Dr. Eng. Nevzat Ozinawç*
  - *Dr. Arch. Manolya Altink*
  - *Dr. Eng. Vefa Ilter*
- First of all the representative of the Ministry of Culture Dr. Emel Orgen, has communicated that the Constitution of the International Committee is going to be approved by the Ministry of Culture; it has been suggested to invite Prof. Cakmak (Princeton University) to be part of the Committee and it has been

decided to prepare a document, signed by all the presents, to be handed to the Ministry of Culture (annexe 1).

- It has also been decided to ask the Ministry on the possibility of having some money for the management of the Committee.
- As regards the technical aspects it has been agreed to investigate, through endoscopic analysis, the two main pillars which support the dome. If the endoscopic, which has to enter 2-3 meters inside the masonry, is not available in Istanbul, it will be asked a cooperation from abroad. This research appears very important because presently little is known on the bearing capacity of these pillars;
- Another delicate point is the dome. Theoretically the structure appears to be sound if we refer to a regular geometry and an homogeneous material. The situation, however, may be very different if we take into account the complex reality produced after the subsequent collapses and rebuildings. Therefore, it is necessary to carry out deeper analysis in relation with the present cracks and deformations. During a careful inspection of the dome, from the top of the scaffolding that presently is inside the building, it has been confirmed the impression that the large deformations, cuspids and loss of curvature might significantly reduced the bearing capacity.

Appropriate investigations and further structural analysis referred to the real deformed shape appear indispensable.

- As regards the global theoretical structural behaviour of the monument under the effect of seismic actions, Prof. Erdik has shortly summarised the results of the mathematical model prepared with Prof. Cakmak (substantially in agreement with the results obtained by the University of Rome too); the dome itself behaves well, but it is sensitive to the deformations induced by the understructures and out of phase motions of the pillars.

North-West is the critical direction and the connection between the dome and the semidomes may alternatively result detached and compressed during the earthquake.

- Finally it has been discussed and prepared the agenda for the next meeting to be held in November 1999. Prof. Croci has met Prof. Wenzel in Dresden and it has been proposed the date of 3, 4 and 5 November. It has also been stressed the importance that the Ministry of culture approves the Committee by that date (Annexe 2).

**COMMITTEE FOR THE SAFEGUARD OF SAINT SOPHIA**

*Proposal for the Ministry of Culture*

1) Following the meeting held on the 18<sup>th</sup> and 19<sup>th</sup> of March in Hagia Sophia and the meeting of 8 and 9 June 1999 where have participated:

- Ministry of Culture : *Dr. Emel Orgen*
- Directors: *Dr. Ulku Izmiriligil, Ali Kikickaya, Serdar Tugrul*
- Professors and professionals: *Anitlar Ve Muzeler, Genel Muourlugu, Prof. Dr. Mufit Yorulmaz, Prof. Dr. Zeynep Ahunbay, Prof. Dr. Mustafa Erdik, Prof. Nevzat Ilhan, Ilhan, Dr. Eng. Gorun Ozsen, Dr. Arch. Gorul Ozmen, Dr. Eng. Nevzat Ozinawç, Dr. Arch. Manolya Altink, Dr. Eng. Vefa Ilter*
- UNESCO representative: *Prof. Giorgio Croci*

It has been stressed the importance establishing a permanent Committee composed by the present National Scientific Committee members and foreign experts jointly chosen by the Turkish Authorities and UNESCO.

Presently these members have been individuated in Prof. Giorgio Croci (University of Rome) Prof. Fritz Wenzel (University of Karsle) and Prof. Cakmak (University of Princeton)

2) Tasks and powers of the Committee:

- Analysis of all the data up to day acquired and, if the case, proposal of new investigations
- Analysis of the project proposed and, if the case, preparation of new proposal and projects to be approved and presented to the Ministry
- Evaluation of the safety levels in the present situation
- Coordination of all the activities related to Hagia Sophia
- Permanent monitoring and survey of the monument
- Individuation of specific expertise in relation to particular problems to be faced
- Programming future activities
- Any other issue suggested by the Ministry

3) Structure of the Committee

Chairman (Ministry of Culture): leads the Committee, prepares the strategies and discuss them with the members, disseminates the information to the members, establishes the date of the meetings, etc.

Secretary: is charged of the practical organization, prepares the minutes of the meetings, organizes a documentation center, etc.

**MEETING IN HAGIA SOPHIA**  
**PROVISIONAL AGENDA (3, 4 and 5 November 1999)**

Between the 3, 4, 5, 6 of November 1999 a meeting is scheduled in Hagia Sophia with the following programme.

Dr. Emel Orgen (Ministry of Culture) will organize it and will manage to transmit to the foreign members the most important results of the investigations available up to day.

Wednesday 3

Afternoon: Arrival at Istanbul and first visit of Hagia Sophia

Thursday 4

Morning:

- Official opening of the works
- Welcome from the Chairman, communications
- Second visit to Hagia Sophia
- Begins the examination of the data

Afternoon:

- Continues the examination of the data (investigations, monitoring, etc.)
- Presentation of the seismic studies by Professor Erdik  
(The Chairman will provide for having during the meeting the essential data, including the drawings on the geometry)

Friday 5

Morning:

- Presentation of the projects and proposals of strengthening and restoration
- Discussion on the stability of the dome in relation with its deformation.  
(Prof. Yorulmaz will provide some plans and sections of the deformed shape)

Afternoon:

- New proposals
- Indication of the investigations, studies and researches to be developed to ascertain the stability of the structures
- Conclusions and proposals for the next meeting

Saturday 6 Departure for Istanbul

## Report on Prof. Giorgio Croci's mission at Hagia Sophia

Professor Giorgio Croci, President of ICOMOS International Scientific Committee on Analysis and Restoration of Structures of Architectural Heritage, have undertaken his second mission to Hagia Sophia on the 7th, 8th and 9th of June 1999. It was realized upon UNESCO World Heritage Center's approval of the Technical co-operation request of Turkish Ministry of Culture, General Directorate of Monuments and Museums.

The meeting for discussing the structural safety of the monument was held with the participation of professors from the National Scientific Committee for the conservation of Hagia Sophia: Müfit Yorulmaz (engineer/architect; Technical University of Istanbul), Zeynep Ahunbay (architect/restorer, Technical University of Istanbul, head of the Department of Restoration, director of Turkish ICOMOS ) Mustafa Erdik (Bosphorus University, Department of Earthquake Engineering) and with Ms.Emel Örgen (representative of Ministry of Culture), Ms Ülkü İzmirilgil (architect/archaeologist; director of Central Laboratory for Restoration and Conservation), Mr.Serdar Tuğrul (engineer; director of Istanbul Monuments and Survey Department), Mr.Ali Kılıçkaya (archaeologist; director of Hagia Sophia Museum), Mr.Nevzat Özinanç, Mrs.Vefa İltter and Gönül Özmen, engineers and architect in the surveillance of Hagia Sophia restoration, Mrs.Manolya Altınok from the Monuments Council responsible for the protection of Historic Peninsula of Istanbul and members of Turkish ICOMOS, Assoc.Professor Nevzat İlhan Professor Görün Özşen (Yıldız Technical University, Faculty of Architecture) were also present to contribute in matters related to their expertise.

Professor M.Erdik summarized the results of their work on Hagia Sophia, reporting about the critical points of the structure. By comparing the analysis of Erdik and Çakmak with his work, Professor Croci concluded that similar results had been obtained in the research conducted until now.

Professor Erdik suggested the organization of an international conference to bring together all the scholars who are working on Hagia Sophia and have the chance to discuss the results of the latest research on the monument. He also suggested that it would be very useful to publish the proceedings of this conference by the Turkish Ministry of Culture.

An international committee for the safeguarding of Hagia Sophia was proposed. This would consist of national bodies and experts as well as international or UNESCO experts. The task and powers of the committee were discussed. The chairman of the committee was to lead the committee, prepare the strategy and disseminate information. Secretary would prepare the minutes of the meetings and coordinate the smooth movement of research and documentation. Further activities were suggested and to add other issues suggested by the Ministry to the list of works to be undertaken was accepted.

In order to analyze the present condition of the dome, Professor Croci suggested the examination of the cracks on the pendentives and the dome by using the scaffolding in the northeast quarter of the dome. He also proposed endoscopic analysis in order to learn about the material properties and the bearing capacity of the main piers. Since the equipment for this research is not available in Turkey, it has to be hired or bought for the purposes of the research. Professor Croci also underlined the importance of knowing more about the present form of the structure and the difficulties in transforming it into a mathematical model. The cracks and cusped parts of the structure were inspected on the scaffolding under the northeast part of the dome. After this examination, Professor Croci had doubts whether the bearing capacity of the dome was reduced in the regions where the ribs had lost their original curvature and geometry.

The agenda for the next meeting which was intended to be in November was discussed and agreed upon. Professor Croci promised to meet Professor Wenzel and make sure that he attends the next meeting in the first week of November.

**FINANCIAL STATEMENT**  
**UNESCO / World Heritage Center**  
**Mission at Hagia Sophia (7 - 9 June 1999)**

I. Per diem for 3 national experts from Universities ( 80 x 3 days)	<b>USD 720</b>
• Professor Müfit Yorulmaz (Technical University of Istanbul)	USD 240
• Professor Dr.Zeynep Ahunbay Technical University of Istanbul, head of the Department of Restoration, director of Turkish ICOMOS	USD 240
• Professor Dr.Mustafa Erdik Bosphorus University Department of Earthquake Engineering	USD 240
II. Lunch and dinners for the mission participants (USD 50 / 8 persons / 3 days )	<b>USD 2 400</b>
Professor G.Croci Professor M.Yorulmaz Professor Dr.Z.Ahunbay Professor M.Erdik Ali Kılıçkaya (director of Hagia Sophia Museum) Ülkü İzmirligil (director of Central Laboratory for Restoration and Conservation) Serdar Tuğrul (director of Survey and Monuments in Istanbul) Emel Örgen (representative of Ministry of Culture)	
III. Reproduction of the work documents and reports for the participants (8 persons ), including English summaries	<b>USD 1 000</b>
IV. Miscellaneous	<b>USD 380</b>
Communication	USD 80
Coffee break	USD 200
Stationary	USD 100
<b>TOTAL</b>	<b>USD 4 500</b>









