THE RECONSTRUCTION OF THE TEMPLE OF ZEUS AT NEMEA:
PROGRESS REPORT FOR THE YEAR 2005

Nicos Makris, Director of Nemea Reconstruction
Professor, Department of Civil Engineering, University of Patras, Greece
Senior Research Engineer, University of California, Berkeley, USA

Architectural Studies and on Site Supervision:
Aikaterini Sklere

Consultants:
Professor Manolis Korres
Dr. Kostas Zambas

January 2006
PREFACE

The temple of Zeus at Nemea as well as the temple of Apollo in Ancient Corinth are the two most emblematic monuments of classical architecture in the province of Corinthia. It is therefore evident that their protection and conservation is an important and urgent matter.

Specifically, the temple of Zeus at Nemea has been engraved in the memory and the lithographies of past visitors with the image of a monument in ruins which was caused by mankind that was seeking building material during the early Christian period. Recent archeological discoveries have revealed that a large fraction of the original material of the exterior colonnade has survived and its current condition suggests that the monument should be reconstructed. Such a perspective is supported by the need to preserve the ancient material together with the need to project the distinctive architectural elements of the monument.

Early reconstruction interventions to the temple of Zeus were conducted in the early 80’s following the initiative of the director of Nemea excavations, Professor Stephen G. Miller. The reconstruction effort uses as a compass the re-synthesis study of the temple that was conducted by Professor Frederic A. Cooper, which revealed that more than 70% of the original material has been survived. At that time the intervention was limited to the reconstruction of a portion of the north side of the crepida. The original permit was granted for the pilot reconstruction of two columns along the north side of the temple, which due to lack of funding was completed much later between the years 1999-2002. On March 4, 2004 following the strong recommendation of the ΛΖ’ ephorate of antiquity of Corinthia, the Ministry of Culture issued a new permit for the reconstruction of four additional columns. The reconstruction effort at Nemea enjoys priority from the newly born ΛΖ’ ephorate of prehistoric and classical antiquities of Corinthia. The intention of our service is to include the archeological site of Nemea with its Sanctuary, the stadium and the archeological museum in the catalogue of monuments of Universal Cultural Heritage issued by UNESCO.

The Director of the ΛΖ’ Ephorate

Alexander Mantis
Archeologist
September 2004
ACKNOWLEDGEMENTS

The reconstruction project of the Temple of Zeus at Nemea is enjoying the financial and administrative support of the association “OPHELTIS – The friends of Nemea”. The scope of the association is the promotion of the cultural heritage of the archeological site of Nemea and its immediate goal is fundraising for the reconstruction of the Temple of Zeus. At present, the larger portion of the donations are coming from the Greek private sector. The board of the association consists of:

1. Papalexopoulos Theodoros, Chairman
2. Leventi Aspasia, vise-Chairman
3. Delivorias Aggelos, vise-Chairman
4. Samaras Nikolaos, Secretary
5. Georgiadis Alexander, Treasurer
6. Keeley Robert Member
7. Korres Manolis, Member
8. Koronaios Panagiotis, Member
9. Chronis Vaggelis, Member

The reconstruction team of Nemea deeply appreciates the support of “OPHELTIS – The friends of Nemea” and all of its donors.
Introduction

Following the successful reconstruction of columns K-25 and K-26 which was completed in summer 2002, the reconstruction team of the Temple submitted via the American school of Classical Studies the study for reconstructing four additional columns in order to complete the North East corner of the Temple. Figure 1 shows schematically the configuration of the Temple before the approval of the new proposal. The new proposal for reconstructing columns K-27, K-28, K-29 and K-30 was approved from the Greek Ministry of Culture in March 2004 and the new phase of reconstruction is under way. Figure 2 shows schematically the configuration of the Temple upon the completion of the current reconstruction phase which is under way. The new morphology of the Temple will improve appreciably the understanding of the architecture of the temple since its current view creates some confusion to the visitor.

Figure 1. Schematic which shows the morphology of the temple upon the completion of the pilot reconstruction of columns K-25 and K-26 during summer 2002.
With the reconstruction of the four columns of the north-east corner (K-27, K-28, K-29 and K-30), there is a closure of the exterior colonnade starting from the two recently reconstructed columns, K-25 and K-26 to the solely standing column from the ancient times, K-31. The closure of the north-east corner will also offer to the visitor a sense of the interior space and magnitude of the monument. The reconstruction project includes (a) infrastructure work (surveying plans, construction of new working space, installation of wheel crane); and (b) reconstruction work (wire cutting and transportation of new building material, preparation of fillings, adhesions, preparation of exterior surfaces and placement of finished stones to their final position).

**Infrastructure Work**

*Surveying Study and Precision Measurements*

During 2005 a detailed surveying study was completed by Dr. G. Georgopoulos and Dr. E. Telioni in order to determine the original dimensions of the Temple,
Figure 3. Surveying plan of the crepida of the Temple of Zeus at Nemea which concludes on the optimum location of the columns of the peristyle.

the precise level of the euthenteria and the stone layers above, as well as the traces of the vertical axis of the columns. In this effort we benefited greatly from the invaluable help of Dr. Costas Zambas. Within the contest of the exercise to determine the traces of the vertical axis of the columns the following tasks were completed: (I) Segments from the broken epistyles were put together in order to measure their length with accuracy – a piece of information which assists towards a better estimation of the dimensions of the peristyle. (II) All the segments of the frieze were re-measured for a second confirmation of their dimensions. After all these measurements were confirmed, we concluded to the plan-view shown in Figure 3. The locations of the center of the columns are placed following an optimization analysis which took into considerations the distorted dimensions of the current base of the Temple, building rules from the ancient times – that the vertical axis of the columns is usually but not always aligned with the joint of the stones of the layer below the stylobate; and the length of the epistyles which have survived to date. (III) The width of the levels of the crepida was measured precisely together with the location of column K-
31 – the only column of the peristyle that is standing from the ancient times.

*Observation of Column K-31 During the Restoration of the Nearby Stylobate*

The work of the new reconstruction phase started with the restoration of the stylobate of column K-31 the only column of the peristyle which is standing from the ancient times. Its stylobate was severely damaged with a large fraction of the east side of a 2mx2m stone that was missing (see Figure 4). This job was particularly challenging since an old filling that was made back in 1924 out of mortar, pieces of stones and ceramic material had to be removed as shown in Figure 5 (left). In order to achieve this, the entire column had to be supported via a steel ring which embraced the first drum which was resting on a steel beam. Figure 5 (right) shows the supported column and the new filling of its stylobate in place. During all these activities the position of the column was monitored for possible micromovements by our surveying engineer, Mr G. Papastamos. The repetitive measurements during the monitoring of the column K-31 before and after the intervention concluded that the column did not suffered any measurable dislocations.

*Figure 4. Close view of the base of column K-31 which shows the poor condition of its stylobate and the stone layer below.*
Construction of a metallic shed equipped with a wheel-crane

In January 2005 was completed the construction of a new metallic shed which was donated by the local steel fabricator, BAVELIS Inc. In February 2005 we completed the installation of a 7 ton wheel-crane. The wheel-crane can sweep an area outside of the covered space so that it can lift and carry in the interior of the shed stone blocks deposited by the crane at the outside.

Reconstruction Work

The reconstruction work includes the wire cutting of new stores, the preparation of new stores and fillings, the adhesion of fillings, the finishing of final surfaces and the insertion of empolia among other tasks.

Extraction of new material

By the end of the third quarter of year 2005 we started the planning of the extraction of new stone material from a nearby rocky site that was excavated in the past during the construction of the Korinth - Tripolis freeway. The original design of the freeway was altered and that site was abandoned. Nevertheless, the original freeway excavation had revealed a healthy front of limestone as shown in Figure 6. By October 2005 we started a major operation by drilling holes in the limestone front in order to pass the cutting wire which created vertical sections on the rocky volume at a 2m (6.0ft) spacing. Figure 7 shows
nearly rectangular stone blocks which were created from the wire cuts and subsequently were pushed away with steel flat jacks (steel pillows) which were inflated hydraulically as shown in Figure 8.

Figure 6. View of a healthy front of limestone showing the vertical sections generated with the cutting wire.

Figure 7. Nearly rectangular limestone block which will provide the new material that we need for the crepida and the columns.
Figure 8. Close view of an inexpensive (15 dollar) steel flat jack (steel pillow) which has been inflated hydraulically to push away the cutted stone block.

Building Works

During 2005 we reconstructed part of columns K-30 and K-29 together with the crepida in the vicinity of their footprints. For instance, in order to be able to start the reconstruction of K-30 and K-29 we had to prepare and install 40 new stones at the crepida, while the reconstruction of the entire Northeast corner of the crepida requires the preparation of 70 new stones. Table 1 summarizes all the activities which have been completed during the year 2005. For instance, the stone block Σ3 (K30-4) which appears in the first row and first column of Table 1 is the third filling of the 4th drum of column K-30. The letters A, B, Γ, Δ in Table 1 correspond to the four levels of the crepida (A=euthyntirea, B=first level, Γ=second level, Δ=stylobate).

The reconstruction of the crepida

Before reconstructing the columns it is necessary to reconstruct the wings of the base of the temple which consist of four layers of massive rectangular stones which support the gravity loads of the monument. Because of its large size, the reconstruction of the crepida has consumed an appreciable fraction of our effort given that a large number of the rectangular blocks of the crepida were
<table>
<thead>
<tr>
<th>Date</th>
<th>Work</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>142</td>
<td>24</td>
<td>Preparation of north wall Foundation of filling 253 (2004)</td>
</tr>
</tbody>
</table>

**Table 1. Reconstruction works during year 2005.**
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
<td>Value 4</td>
<td>Value 5</td>
</tr>
</tbody>
</table>

**Table 1. (continue)**

<table>
<thead>
<tr>
<th>Value 6</th>
<th>Value 7</th>
<th>Value 8</th>
</tr>
</thead>
</table>

**Additional values**

- Value A
- Value B
- Value C
- Value D

**Notes**

- Note 1
- Note 2
- Note 3
- Note 4
removed over the years since they were much more attractive to the subsequent occupants of the nearby area than the cylindrical column drums. The size of the reconstruction effort related to the crepida is not obvious to the visitor since the stylobate (level Δ) covers the three levels below (levels A, B, and Γ). The need for new material is resolved with the wire-cutting of stones from a nearby area, close to the ancient quarries (see Figures 6, 7 and 8). Large stone blocks are subsequently transported at the periphery of the archeological site and they are sliced with a wire-saw at the desired dimensions.

Figure 9 shows a recent view of the crepida of the Temple from northeast which reveals the large size of the reconstruction needs. One can easily observe the four levels of the crepida starting with the stylobate=Δ level at the top down to the euthyntirea=A level at the bottom.

Figure 9. Recent photograph of the crepida of the Temple of Zeus at Nemea from northeast.

Reconstruction of the columns

Table 1 summarizes the various tasks that have been completed on the drums of the columns under reconstruction. By the end of 2005 we have installed the 10
first drums (out of 13 total) of column K-30; as well as the three first drums of column K-29. Figure 10 shows a recent photograph of the Temple of Zeus at Nemea, taken from the east.

Figure 10. Recent photograph of the Temple of Zeus at Nemea from the East showing the first 10 drums of column K-30 and the first 3 drums of column K29.

Projected Tasks for 2006

The tasks which are planned for year 2006 are summarized in Table 2.

Table 2. Projected Tasks for Year 2006

| March 2006 | End of wire-cutting of stones for this year and transportation of stone blocks from the quarries to the archaeological site. |
| June 2006  | Completion of preparation and adhesion of fillings of |


**Cost of the Reconstruction**

For the year 2005 the cost of the reconstruction of Temple of Zeus at Nemea reached the sum of 272.030 euros. The breakdown of this sum is presented in Table 3. This sum includes the expenses related to the extraction and wire-cutting of the new material (20.383 euros) and the expenses related to the purchase and installation of a wheel crane (9.860 euros).

<table>
<thead>
<tr>
<th>Table 3. Itemized expenses during year 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>------------------------------------</td>
</tr>
<tr>
<td>Salaries</td>
</tr>
<tr>
<td>Insurance</td>
</tr>
<tr>
<td>Hardware</td>
</tr>
<tr>
<td>Materials</td>
</tr>
<tr>
<td>Maintenance</td>
</tr>
<tr>
<td>Extraction of new stone material</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
RECONSTRUCTION TEAM

General Direction
Dr. Nicos Makris, Professor of Structures and Applied Mechanics
Department of Civil Engineering
University of Patras
Patras, GR 265 00
makris@ce.berkeley.edu
nmakris@upatras.gr

Past Direction
Dr. Stephen G. Miller, Professor of Classical Studies
Ancient Nemea
205 00 Korinthias
sgmnemea@socrates.berkeley.edu
Department of Classics, MC #2520
University of California
Berkeley, CA 94720-2520

On-Site Supervision
Aikaterina Sklere, Architect
Ancient Nemea
205 00 Korinthias

Consultants
Ioanna Dogani and Amerimni Galanou
Monis Petraki 2
115 21
dogani@otenet.gr

Ioannis Arbilias
Seirinon 9
146 01, Nea Erithrea

Dr. Kostas Zambas
Skiathou 49A
112 54, Athens
zambas@hol.gr

Dr. Manolis Korres
Professor of Architecture
National Technical University of Athens
Patison 42, Athens

Technicians
Nikolaos Benekos
Apostolos Delis

Athanasios Karantasis
Ilias Papoutsis

Christos Saisanas
Panayiotis Sotiropoulos

George Tourgelis
Panayiotis Tsiros

Panayiotis Vakrinakis