# Phnom Bakheng Progress Report August 2009

Since the last progress report submitted in May 209 site mobilization measures have been completed, the tower crane has been successfully installed, and the first phase of restoration work has commenced at the lower terrace of the northern half of the East Elevation. Archaeological excavation in front of the East Elevation –South side and detailed condition surveys have continued. Some additional emergency stabilization and protection measures for surrounding brick shrine structures are being planned and will be executed in due course.

## 1. Crane installation

After extensive preparation and planning, the new tower crane was successfully erected at Phnom Bakheng in mid June 2009. The first step was constructing a steel and concrete crane platform to form a bridge over archaeological remains of a collapsed brick shrine.

Fig 1: installed tower crane at North East corner

Fig 2: steel structure for crane platform with temporary wooden supports for concrete form

Steel elements were transported to the site and concrete poured at the top of the hill to create the necessary platform. A ramp was also built to the platform to allow the crane to be towed to its proper place.

Fig 3: set up of steel structure for crane platform

Fig 4: pouring of concrete platform

The tower crane had to be transported up the hill along a very small and steep pedestrian path which was modified to accommodate the crane transport. This was done with a locally rented bulldozer and took a couple of hours. The operation was supervised by the WMF technical team in collaboration with local operators and members of APSARA National Authority.

Fig 5: transport of tower crane up to Phnom Bakheng

The team then moved the crane onto the platform by building a temporary ramp out of sand bags and then pulling the crane using two chain hoists attached to the front of the steel platform.

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Fig 6: pulling the tower crane onto the platform

Fig 7: test erection of the crane

Once the crane was positioned onto the platform, the crane could be erected for the first time with the assistance of the crane company technician. The concrete ballasts were then installed and the crane was tested and adjusted using test weights.

Fig 8: adjusting crane settings by test weights

Fig 9: ceremony

Finally, the crew held a ceremony to bless the crane and pray for a safe project. Since then the crane has been operating without problems and the dismantling phase of the Phnom Bakheng conservation project is progressing well.

Fig 10: ceremony

## 2. Set up of work area


Fig 11: work site plan

After the successful installation of the tower crane, the work area was defined and fenced off for visitors' safety. Three signboards were installed that provide information about the technical aspects of the project, expected duration, and related funding.

Fig 12: fenced in work area and signboards

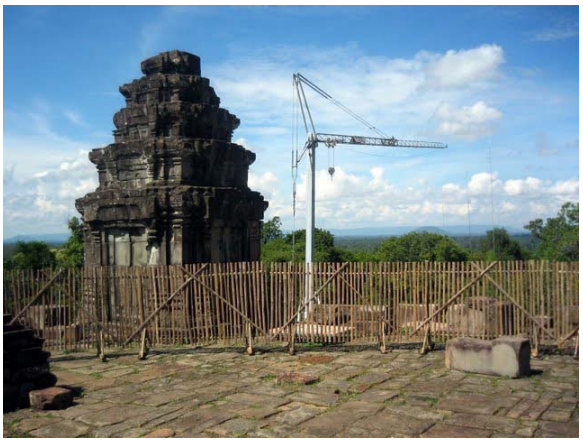

Fig 13: barrier on upper terrace of the temple

The required work area was determined by the reach of the crane, the space required for storage, and the size of the conservation workshop. This was planned together with the technical staff of the APSARA National Authority and can be modified if required.

Fig 14: closed off work area

Fig 15: conservation workshop

Within the work area a small conservation workshop was set up and the storage area for dismantled stone blocks was laid out.

Fig 16: generator

Fig 17: water container and collectors at workshop

The generator and related electric cabling for running the crane and small tools in the conservation workshop was set up. A water container and gutters to collect rainwater from the workshop were installed.

## 2. Preparation and transport of new stone blocks

Fig 18: stone saw at Conservation d' Angkor

In order to facilitate sizing of the new sandstone blocks for replacement of broken and missing pavers and wall units, an existing stone saw in the compound of the Conservation d'Angkor was repaired and the crew has begun cutting stones with this device.

Fig 19: sizing stone blocks

The team has started to transport laterite stone blocks and sandstone blocks required for the repair of the facades up to the top of Phnom Bakheng using a truck on the repaired pathway.

Fig 20: transport of laterite blocks

Fig 21: transport of sandstone blocks

## 3. Disassembly of North East corner level F

After detailed documentation of site conditions, plans for disassembly including a stone numbering system and storage locations were established. The terrace of the lower level (level F) was cleared and stones were removed to a safe location.

Fig 22: North East terrace of level F

Fig 23: stone blocks in storage

The team then began dismantling pavers and stone blocks from unstable areas in the first section of the work area on the NE corner.

Fig 24: crane in operation

Fig 25: disassembly of North side of East Elevation

Units were moved to the allocated rows in the storage area and blocks that require repair were transferred to the conservation workshop.

Fig 26: removal of stone blocks

Fig 27: transport of stone blocks to storage

To date all stone blocks in the defined area of the North East corner have been removed and the exposed bedrock has been cleaned of soil, vegetation, and remains of deteriorated laterite. The documentation team is currently preparing detailed drawings of the condition of the bedrock to determine required repairs for this section.

Fig 28: North side of level F after disassembly

Fig 29: North East corner - exposed bedrock

Since this is the initial work area and the lowest of the corners, thus the most vulnerable, it was decided that almost all stones are to be removed to enable good observation of the bedrock condition. Information obtained from this first examination is expected to aid planning for disassembly required in other areas.

## 4. Stone Conservation

Fig 31: conservation workshop

The conservation of damaged stone blocks has commenced. The team is using stainless steel pins and fiber glass dowels of different sizes, and an epoxy based adhesive, to reattach broken stone fragments. This measure serves to stabilize stone blocks to be reused in the repaired wall section.

Fig 32: preparation of stone to insert stainless steel pins

Fig 33: reattaching stone fragment using epoxy based adhesive

Fig 34: structural consolidation of stone block by insertion of stainless steel pins and epoxy adhesive

## 5. Archeological excavation in front of south side of East Elevation

The excavation in front of the East Elevation South side is progressing well. Up to now 11 of the anticipated 16 trenches have been opened. Soil between the brick shrine structure and the lower wall of the temple pyramid has been removed.

Fig 35: opened trench between brick shrine and lowest wall of temple pyramid

Fig 36: exposed architectural elements

Wooden shoring has been installed in the door frames of the exposed brick shrine to ensure structural stability during the excavation.

Fig 37: Shoring brick shrine G4- North side

Fig 38: Shoring brick shrine G4 – South side

During the last three months several artifacts and architectural elements have been unearthed. They are documented and inventoried properly and stored away in the workshop near the site.


Fig 39-40: unearthed objects

Fig 41: unearthed statue

## 6. Road maintenance

Fig 42: drainage pipes

During the rainy season intensive maintenance of the repaired pathway leading up to Phnom Bakheng is required. The work crew is checking the condition and performance of the repairs with regard to structural stability and drainage, and undertakes small repairs if required every week. At the bottom of the hill additional drainage pipes were installed to direct water run-off and limit erosion of the natural hill.