THE RESTORATION & SEISMIC STRENGTHENING OF

KARUNAMAYA TEMPLE | BUNGAMATI

PROJECT DOCUMENTATION/ANALYSIS

REVISED: JULY 2015

PROJECT DOCUMENTATION PREPARED
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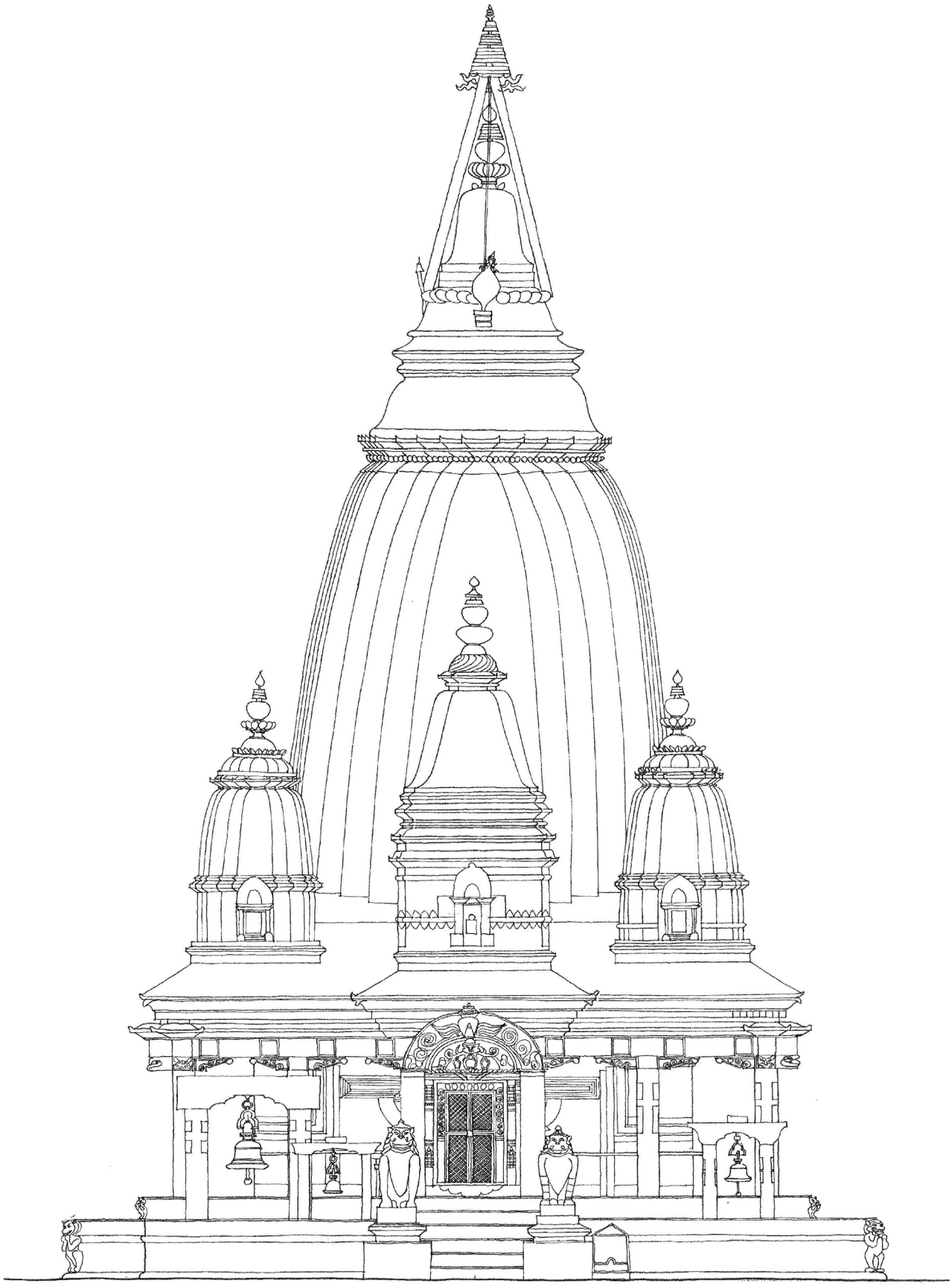
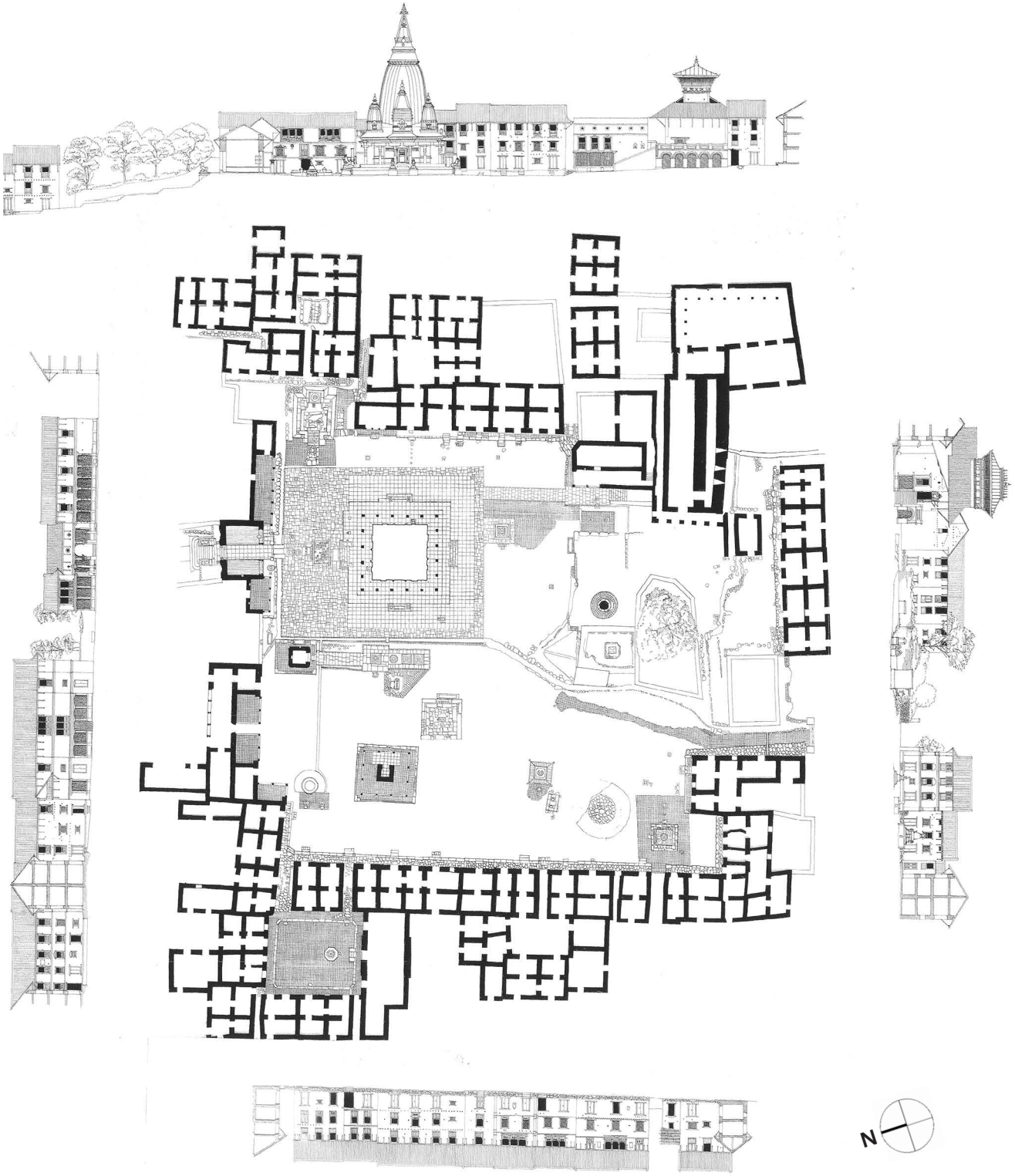
FOR UNESCO KATHMANDU

COVER: **KARUNAMAYA (MATSYENDRANATH) TEMPLE ON THE DAY WHEN THE PULLING OF THE CHARIOT COMMENCES FROM BUNGAMATI**
Photograph Thomas Schrom | April 22, 2015

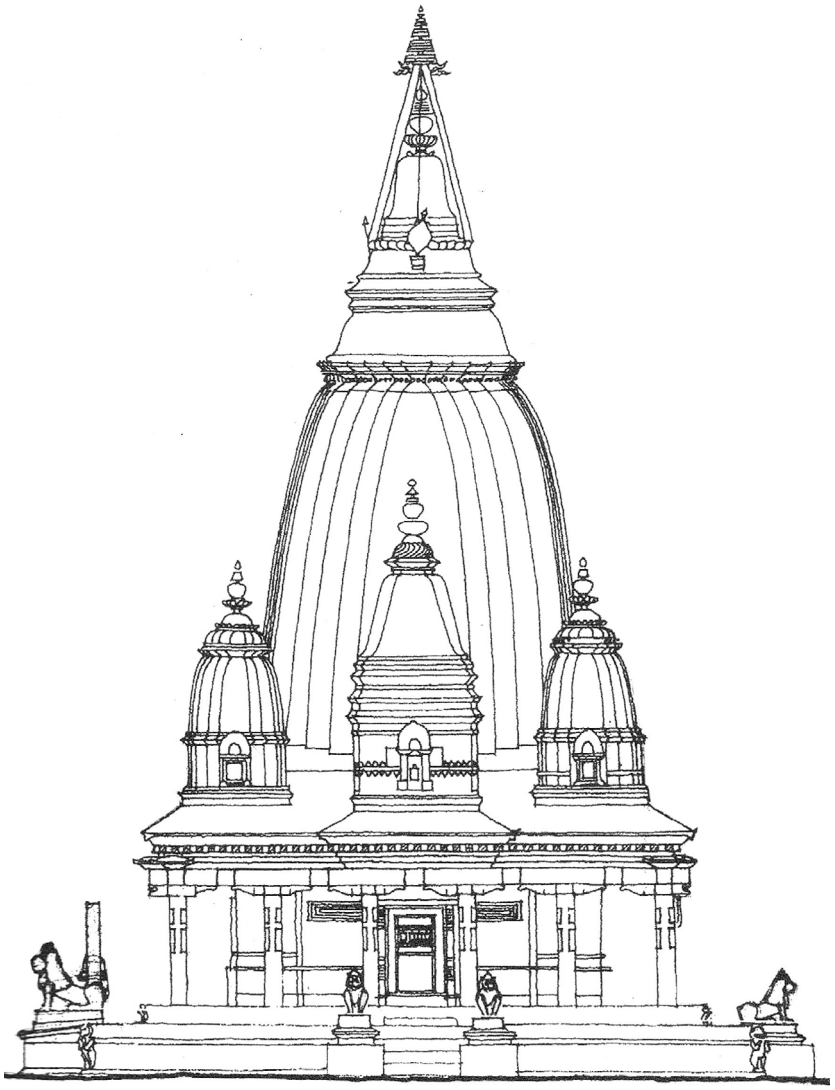


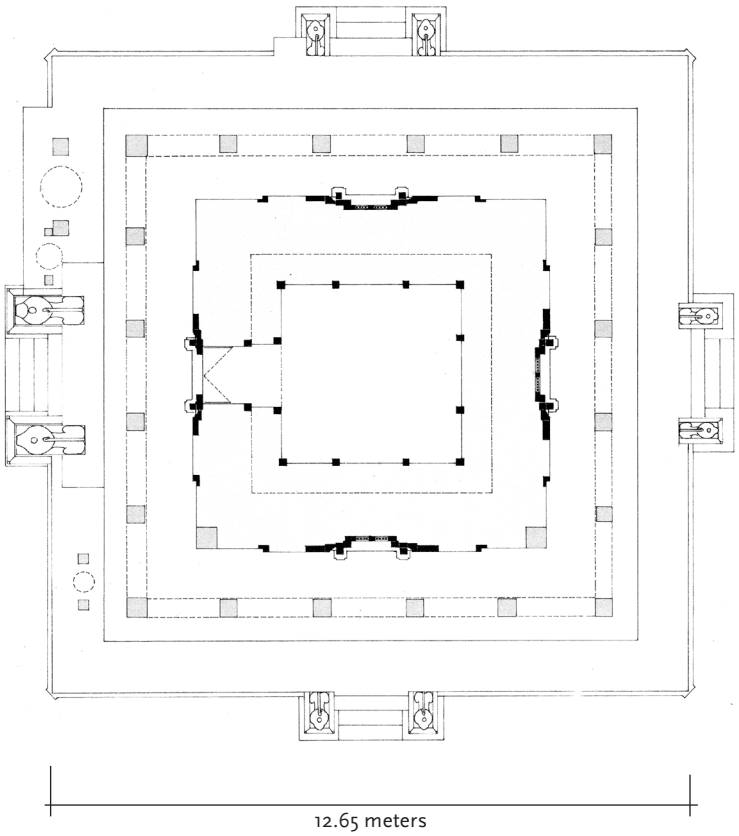
KARUNAMAYA TEMPLE | NORTH ELEVATION
Drawing Jorgen Thomsen, 1968

BUNGAMATI | PLAN
Drawing Jorgen Thomsen, 1968

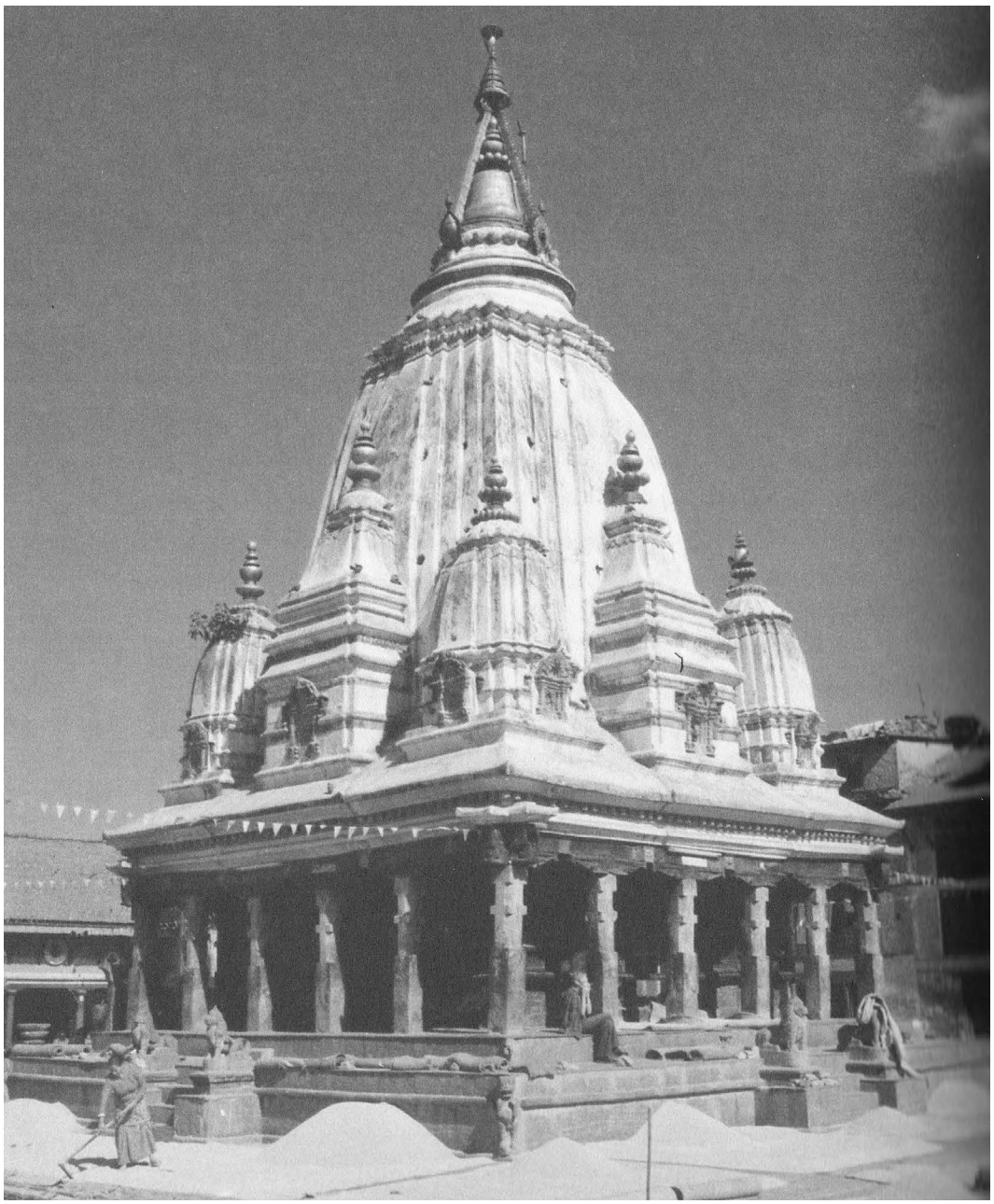


BUNGAMATI MAIN SQUARE | PLAN AND ELEVATIONS
Drawing Jorgen Thomsen, 1968





KARUNAMAYA TEMPLE
WEST ELEVATION
Drawing Jorgen Thomsen | 1968
FLOOR PLAN
Drawing Bijay Basukala | 2007
from: Niels Gutschow, Architecture of the Newars, p. 153, 534



VIEW FROM THE SOUTH WEST
Photograph Niels Gutschow | 2007

SUMMARY

The Temple of Karunamaya (also known as Matsyendranath Temple) dates back to the 17th century. Only parts of the plinth (platform), the inner cella's walls and its four ground floor doors were preserved till the devastating earthquake in 2015.
A major earthquake in 1833 caused this 17th century temple to collapse. No historic documentation of the original structure exists but it is assumed that it was a three-tiered pagoda. During the 1830's the temple was rebuilt in a new figuration: The inner cella was preserved in its 17th century form featuring four original doors. The outer arcade received large new stone pillars bearing a heavy timber frame. The upper structure was rebuilt in the shape of a sikhara temple rather than the traditional three-tiered roof configuration covered with terracotta tiles. (For more information see: Gutschow, Architecture of the Newars, pp. 534/535)
Years of negligence and lack of maintenance have caused the timber structure to deteriorate to a point that it lost its structural integrity. Most timber remnants that are haphazardly stacked on site display serious decay and damage from wet rot.

DOCUMENTATION AND SAFEGUARDING OF HISTORIC MATERIAL

An inventory and conditions report need to be produced for all timber components stored on site. Most importantly all remnants of the four 17th century ground floor doors need to be identified and the doors re-assembled and brought to a dry and safe storage area. Any other valuable carved pieces should be secured as well. Wherever the origin of structural timber can be determined exact measurements have to be taken in order to achieve optimal accuracy in the restoration design.
Salvaged fragments of the 12 terracotta niches, tympanums and metal finials of the miniature towers require professional documentation and preparation for future restoration. Debris should be carefully screened in order to retrieve as much of the original material as possible.
Similar documentation should be carried out for custom-made historic brick and stone components including the lions and corner horses.

SITE SURVEY AND ARCHAEOLOGICAL INVESTIGATION

A comprehensive site survey including examination of the plinth and the foundations is a must for the development of a structural reinforcement and seismic strengthening concept. Ideally, archaeologists and structural engineers would work closely together. The archaeological investigation will be managed and supervised by staff from the Department of Archaeology. External experts might be engaged to support the professional documentation and analysis of the digs.

DESIGN DEVELOPMENT AND PRODUCTION OF WORKING DRAWINGS

The Department of Archaeology has taken the lead in compiling historic photos and researching documentation sources. An engineer has been contracted by the DoA and will be responsible for developing the restoration design and producing the construction drawings. A complete set of drawings should include detailed designs for foundations, the building's plinth, floor plans, sections, and elevations. Particular attention needs to be paid to civil engineering details such as calculating loads and designing foundations and the bearing structure accordingly. Ideally, the temple structure should be designed in a way that it conforms to the norms of Nepal's building code.
Once the restoration design has been verified and approved by all parties a comprehensive quantity survey and cost estimate can be worked out.

CONSIDERATIONS FOR THE TEMPLE'S RECONSTRUCTION

1. DESIGN

The lack of any documentation of the original 17th century three-tiered pagoda temple (with the exception of the inner cella's walls and 4 partly surviving doors) would make it difficult and highly questionable to attempt a recreation of the

"original". Therefore, the most practical approach is to rebuilt to the post 1833 configuration which is a traditional temple on the ground floor and a sikhara temple above. The building is photographically well documented, however, except for a floor plan, no precise survey or construction drawings are known to exist.

2. NEW FOUNDATIONS AND PLINTH

The foundations were never meant to support the weight of the massive brick sikhara dome. The poor condition of the mud and brick sub structure was obviously a major cause for the temple's collapse. For future reconstruction it is highly recommended to consider the complete redesign and rebuilding of adequate foundations with seismic strengthening features and also the complete reconstruction of the plinth.

Post disaster inspection revealed that the 20 massive stone pillars supporting the outer edge of the structure were only loosely resting on the plinth below. Traditionally, stone pillars are connected by means of deep mortise and tenon joints to large horizontal base stones that often form the edge of the plinth and evenly distribute the weight of the superstructure to the base. This design detail should be considered for the reconstruction.

In order to strengthen the connection between foundation, base stone and pillar the use of stainless steel pins is highly recommended. Similarly, the structural stability of the connection between pillar, corbel, and cross beam can be improved by stainless steel connectors.

3. GROUND FLOOR STRUCTURE:

The walls of the cella dating back to the 17th century were not sufficiently strong to support the massive weight of the brick dome above. Sometimes after the 1833 renovation a 50cm wide wall was added to the inside of the temple and an additional 12 pillar timber structure built to provide additional support for the structure above.

Continuous water infiltration particularly around the edge of the building had caused massive decay and rot of bearing beams. Post earthquake inspections confirmed that almost all structural timber has been severely affected by rot. All salvaged timber components have been stacked in a random manner on site and no attempt has been made yet to identify and match remnants of the structure. It would be important to find out how much of the 17th century doors has survived the earthquake and to what extend salvaged materials can be used for the temple's reconstruction.

4. THE BRICK DOME

The sikhara style brick dome has been executed with custom-made bricks laid in mud mortar. Over the years the dome structure had been covered by many layers of lime wash, cement plaster patches, and enamel paint. It is suspected that water infiltration through fissures in the dome affected the bearing timber structure below. For the reconstruction scheme a completely new structural design needs to be developed. A solid platform (diaphragm) above the ground floor level should be created to distribute the weight of the dome structure equally to supporting timber beams, walls and pillars below. Seismic strengthening features such as the use of marine grade plywood diaphragms should be considered. When rebuilding the dome substituting mud mortar with high quality lime and brick dust mortar *(surkhe)* could be a good alternative. Solutions need to be found to adequately drain water from the brick structure avoiding contact with the supporting timber beams.

5. PROCUREMENT OF MATERIALS

Timber:

All of the main bearing timber beams will need to be replaced with new hard wood *(sal)* timber. It will be difficult if not impossible to find the massive beams required at the Kathmandu timber yards. Sourcing of trees from the Terai will require considerable time and effort.

Custom made brick:

As the examples on the next pages illustrate the design requires many customs-shaped bricks. Finding the expertise to produce and fire such bricks is not easy and should be initiated immediately.

Stone:

The sourcing of stone in the required sizes will need substantial lead time.

KARUNAMAYA TEMPLE
View from South–West
Photograph David Andolfatto | 2010

KARUNAMAYA TEMPLE
A crude RCC structure had been grafted on to the northern entrance covering a modern repoussé arch and tympanum.
Photograph David Andolfatto | 2010

PIT NEAR THE NORTHERN ENTRANCE
A collection of stone fragments and stone sculptures kept in a pit to the north of the temple.
Photograph David Andolfatto | 2010

TYMPANUM (*TORAN*) OVER THE NORTHERN GATE
Both the inner and outer tympana feature
Padmapani Lokesvara in the center.
Photograph David Andolfatto | 2010

TYMPANUM (*TORAN*) OVER THE EASTERN GATE
The central image of a yellow tantric deity flanked
by two attendants is surmounted by a *kirtimukha*.
Photograph David Andolfatto | 2010

TYMPANUM (*TORAN*) OVER THE SOUTHERN GATE
The central image of Namasangiti is flanked by two attendants and surmounted by Garuda.
Photograph David Andolfatto | 2010

TYMPANUM (*TORAN*) OVER THE WESTERN GATE
The central image of Namasangiti is flanked by two attendants and surmounted by a *kirtimurkha*.
Photograph David Andolfatto | 2010

View from the North
Note the thin stone veneer which detached from the plinth in some places.
Photograph Thomas Schrom | July 20, 2015

Detail of a cross beam
A typical example of material failure.
Photograph Thomas Schrom | July 20, 2015

Foundation of the inner cella and surrounding plinth
The use of thin square stone cladding is unusual in traditional temple architecture. Note the damaged corner of the plinth that use to support one of the heavy stone pillars.
Photograph Thomas Schrom | July 20, 2015

Corbel
This decayed corbel has completely lost its bearing capacity.
Photograph Thomas Schrom | July 20, 2015

Four of the 20 stone pillars which supported the arcade
Note the very shallow tenons which did not provide sufficient positive bond to the structure below.
Photograph Thomas Schrom | July 20, 2015

Remnants of the timber structure
All of those beams are severely deteriorated and structurally unsound.
Very little of the original material will be reusable in the reconstruction.
Photograph Thomas Schrom | July 20, 2015

Fragments of a damaged lion
Photograph Thomas Schrom | July 20, 2015

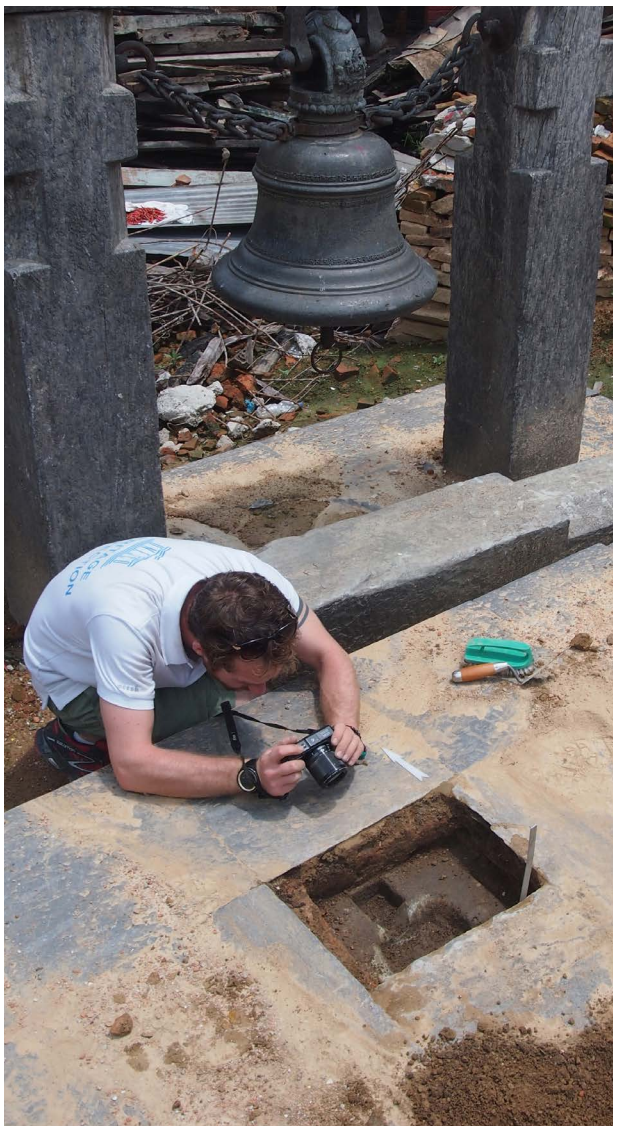





Examples of custom-made brick found in the rubble
Only a small percentage of historic brick will be reusable for the reconstruction. The production of these special bricks is an expensive and time-consuming process. Only a few brick kilns in the valley can supply such brick.
Photographs Thomas Schrom | July 20, 2015

Main beam
Most of the bearing timber components are in similar state of decay and will not be usable in the reconstruction of the temple.
Photograph Thomas Schrom | July 20, 2015

Beam end
This is an extreme example of the effects of wet rot.
Photograph Thomas Schrom | July 20, 2015



Base of pillar near the north-east corner
The flagstone paving laid in mud mortar was probably added after the 1934 earthquake.

End of stone pillar
Part of the pillar's base was covered by flagstone paving.

Base stone
It is unclear why the base stone features two mortises since the pillar only has one tenon.

Fragments of a band of decorative terra cotta moldings
Each side of the temple featured about 40 such heads called *dhalay khow* in Newari. According to an informant the heads represent Garuda, tigers, horses and lions.

Side view
The individual pieces measure approximately:
l=48 cm, w=10 cm, h=11 cm

Mythical animal on the north-west corner of the lower plinth
Such representations are often called "horses" even though they are winged and feature the face of Garuda.

A lion on the north-east corner of the lower plinth

Stele on the northern lower plinth
The inscription is partly obscured by debris. It should be brought to a safe storage area.

A column from one of the 12 terra cotta niches
Heavy layers of lime and enamel paint obscure this terra cotta fragment which makes identification of the figure impossible.

Beam end from the inner cella
This beam is most likely part of the original 17th century temple and could possibly be reused in the reconstruction.

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