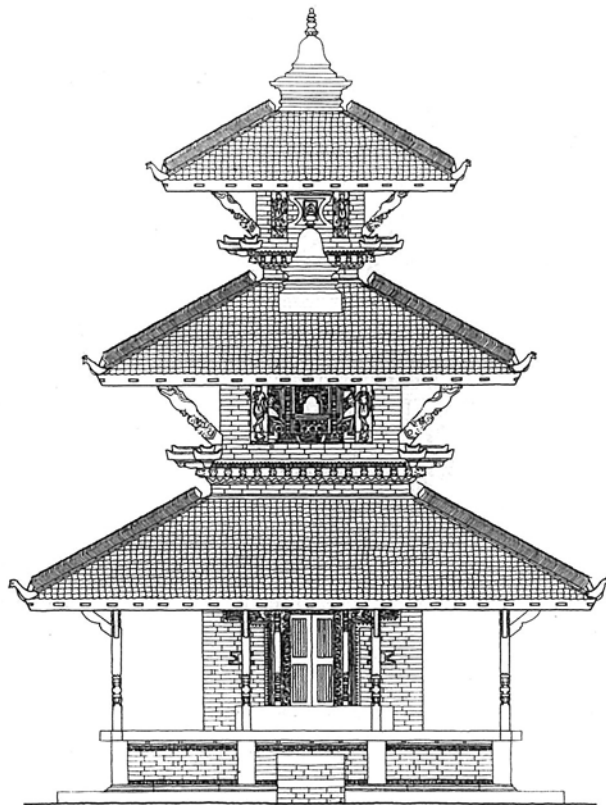


TUM BAHA NARAYAN TEMPLE



HISTORIC STRUCTURE REPORT

PATAN DARBAR WORLD HERITAGE SITE
KATHMANDU VALLEY PRESERVATION TRUST

SUMMER, 2000

A MODEL PROJECT WITH SEED FUNDING
BY NEPALESE DONORS
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WITH GENEROUS SUPPORT FROM
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WOODCOCK FOUNDATION (U.S.A.)
MR. & MRS. ADAM GILCHRIST
PATAN PROGRAMME (G.T.Z.)

IMPLEMENTED BY
KATHMANDU VALLEY PRESERVATION TRUST

IN COOPERATION WITH
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Roof largely collapsed. Seen from west. Photo 1994



1.0 INTRODUCTION

When work started, August 1999 Tum Baha Narayan Temple was in an advanced state of ruin. In 1999 less than 25% of the roof structure was intact: the middle roof was completely missing and the upper and lower roofs were severely damaged and in danger of collapse. The series of events that led to its dilapidation include the theft of the icon 20 years ago and the roof struts 15 years ago eventually leading to roof collapse. The surviving structure left exposed to the elements was subjected to the monsoon rains. Water damaged and weakened many timber elements and washed out mud mortar between bricks leaving them vulnerable to displacement and compromising structural integrity. The debris provided an environment where vegetal growth thrived and rooted in the remains of the ruin.

The efforts of the locals to “beautify” the fabric of the temple by replacing historic veneer bricks in the plinth wall, although well meaning, sacrificed historic temple fabric. In this case, the older high quality veneer brick was replaced with inferior common brick. The theft of the principal icon and roof struts and subsequent failure of the local *guthi* to take up repair measures demonstrate the complexity of both preservation and social issues facing the kingdom of Nepal.

The Tum Baha Narayan is an example of a private Hindu shrine constructed and endowed by affluent families and mostly dedicated to gods of the Brahmanic tradition, to Shiva or Vishnu-Narayana. Almost all of these “private” temples have ended up in ruin over the past three decades as the nationalization of temple trusts (*guthi*) left original endowments penniless. An example of this is the case of Tum Baha Narayan.

A dispute between the historical donor family of the structure and the local neighbors stalled any attempt at repairs. Fear that the party who undertook repairs might take “possession” of the temple resulted in an untenable situation. The Trust was able to intervene after two years of discussion as a neutral, non-threatening, International Non-government Organization, working on a “turn key basis” and returning the temple back to the locals, breaking the deadlock and allowing repairs.



2.0 CONSTRUCTION HISTORY

There is one stone inscription tablet embedded in the south facade at the ground floor level providing documentary evidence concerning the construction history at Tum Baha Narayan. It dates the establishment of the foundation at 1575 A.D.

Visual inspection of the temple fabric provided information regarding construction history. Also, there were major earthquakes in each of the last two centuries, which assisted in dating the temple fabric. One of the surviving roof struts may date from before the 1833 earthquake. It is unknown whether the temple was damaged in the 1833 earthquake, however local elders report no major damage from the 1934 earthquake which ravaged the Kathmandu Valley. Therefore, the remaining roof struts are probably from the 19th century (post 1833) as is consistent with their carving quality.

Interviews with the local elders also provided information on the approximate dates of more recent construction history. Locals mention repairs to the plinth and wall fabric in 1974. The principal icon was stolen in 1980. The roof struts were stolen in 1985 and the roofs collapsed soon afterward.

The positions of the two *gajuras* indicate the history of votive contributions, unfortunately there are no records indicating the dates they were installed.



South facade: September 1997



North facade: September 1997



Stone inscription on ground floor level on south facade



3.0 ARCHITECTURAL DESCRIPTION

Tum Baha Narayan temple is a pagoda type three roof temple typical of the Kathmandu Valley. Although not unusual in organization of the façade and stepping roofs, the timber colonnade is a unique feature for such a small temple. It is a “local monument” an offering of the local community, which is characterised by its diminutive size closer to the ground, and simpler carving which contrast grander, more elaborate examples in the Darbar Squares built by the Royals. The middle and upper roofs are each supported by a series of 12 decorative carved *sal* timber roof struts and the lower roof by a decorative carved *sal* timber post and beam colonnade at the ground floor as well as less ornately decorated carved struts. A covered timber arcade is at the ambulatory ground floor level. The temple rests on two stepped plinth, one 24“ (60 cm) high, and another 4” (10 cm) high above the original pavement level. Timber planking is located on top of the second plinth.

The ground floor plan of the temple is a perfectly symmetrical square punctured by one opening to the inner sanctum at the principal west elevation. The cella wall is continuous up to the middle story where windows are centered on all four elevations producing identical symmetrical organization of the walls. At the upper story a series of four smaller blind windows puncture the walls of the upper story. The thickness of the cella wall at the ground floor is 25” (63 cm) and continues up to the upper level where the wall thickness is 20” (50 cm) thick. . The upper story rests upon a timber beam that is secured in the cella wall that continues to the ground story and into the foundation. The foundation wall thickness varies between 16” (40 cm) under the door entrance, to 32” (80 cm) under the other three cella walls.

Iconography

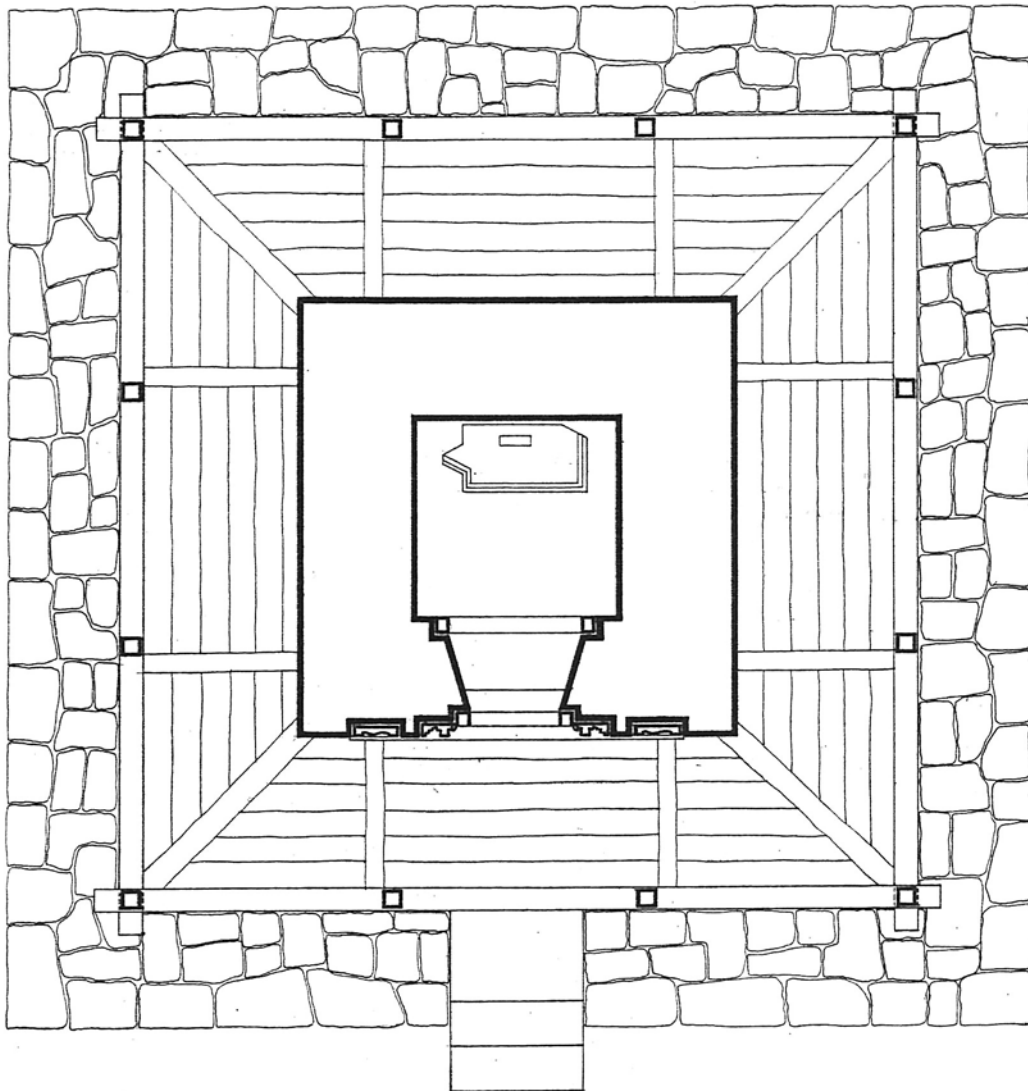
The installed iconography of the temple reveals Brahmanical rather than local gods. This is believed to be the only temple in the Kathmandu Valley dedicated to *Gajendramoksa*.

The principal figurative carvings:

1. Ground Floor Level

I. Door frames

- A. **Door surrounds** – lintel triad of gods (unknown because features are worn) possibly the *Janagannatha* figures of *Valabhadra*, *Subhadra*, and *Krsna*
- B. **Forward-standing posts** – a pair of timber posts on principal elevation with *kalash* water vessel with leaves at base

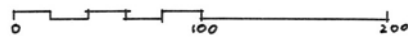
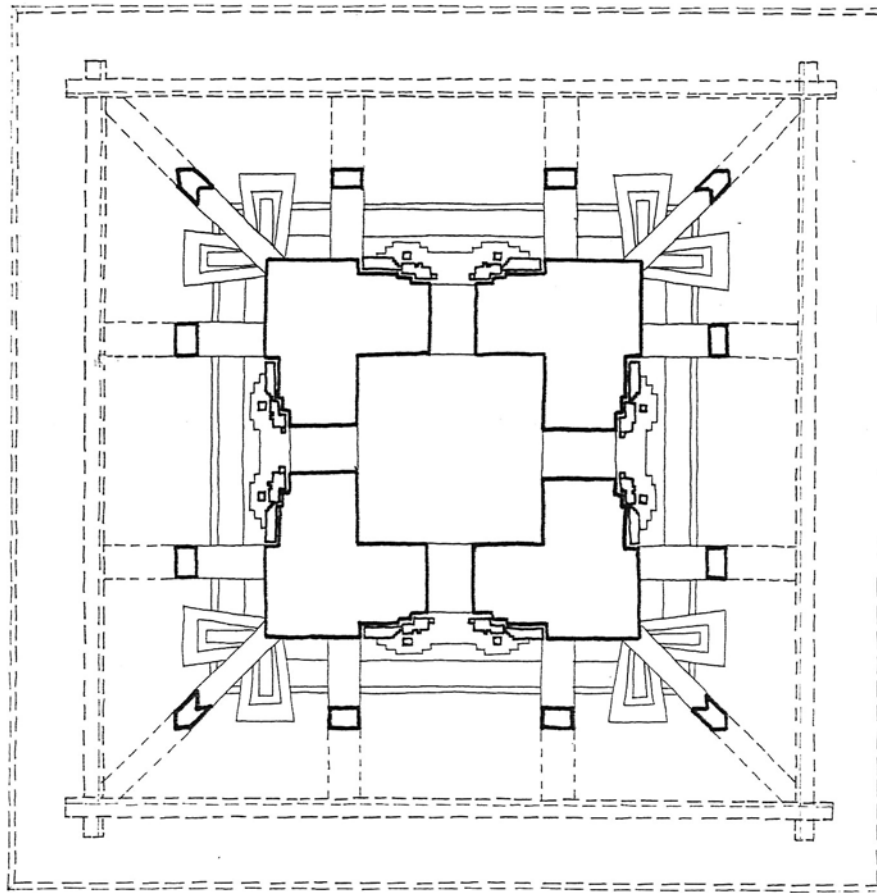


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TUM BAHANARAYAN

PROPOSED GROUND FLOOR PLAN

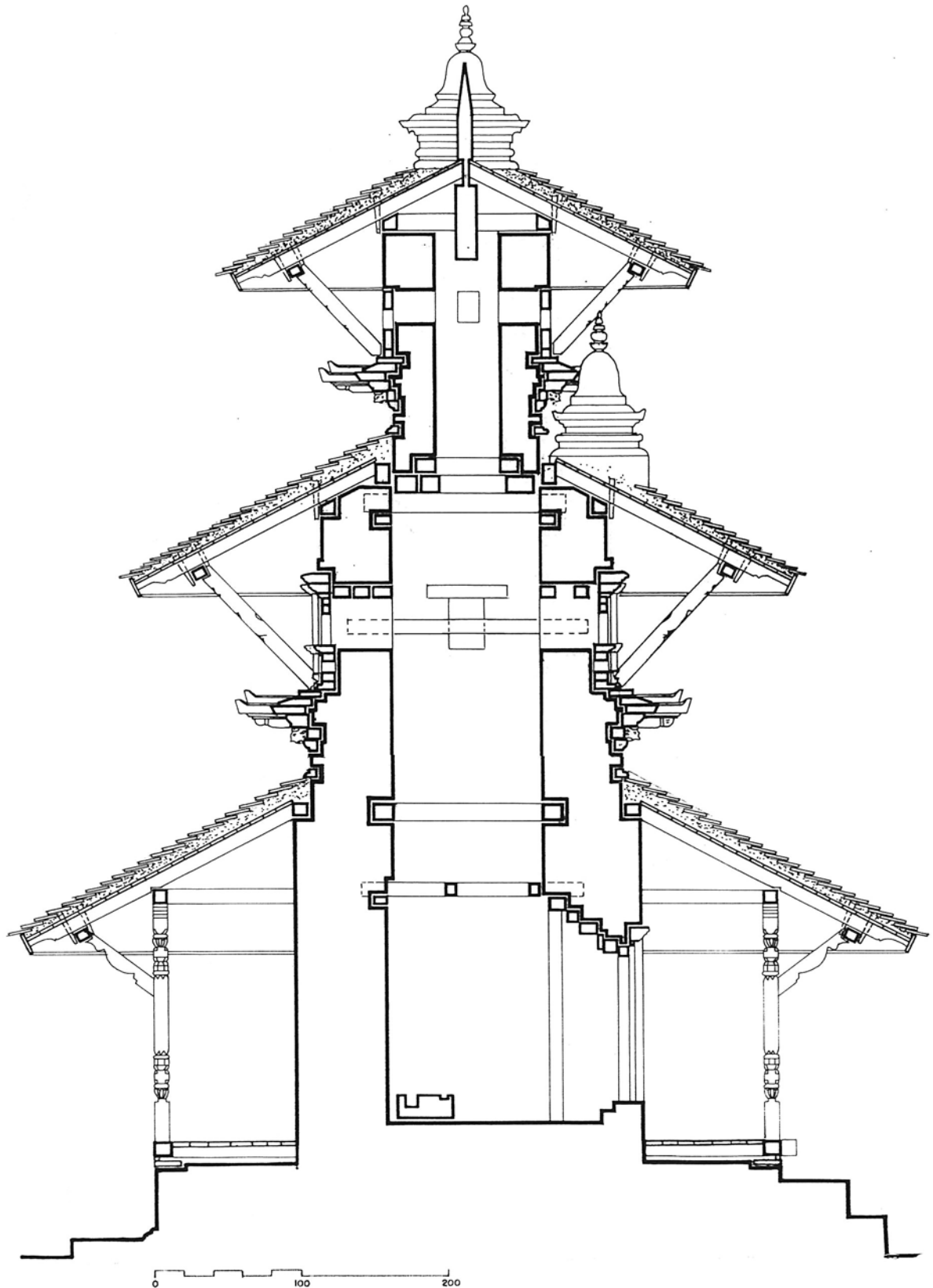
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TUM BAHANARAYAN

PROPOSED FIRST FLOOR PLAN

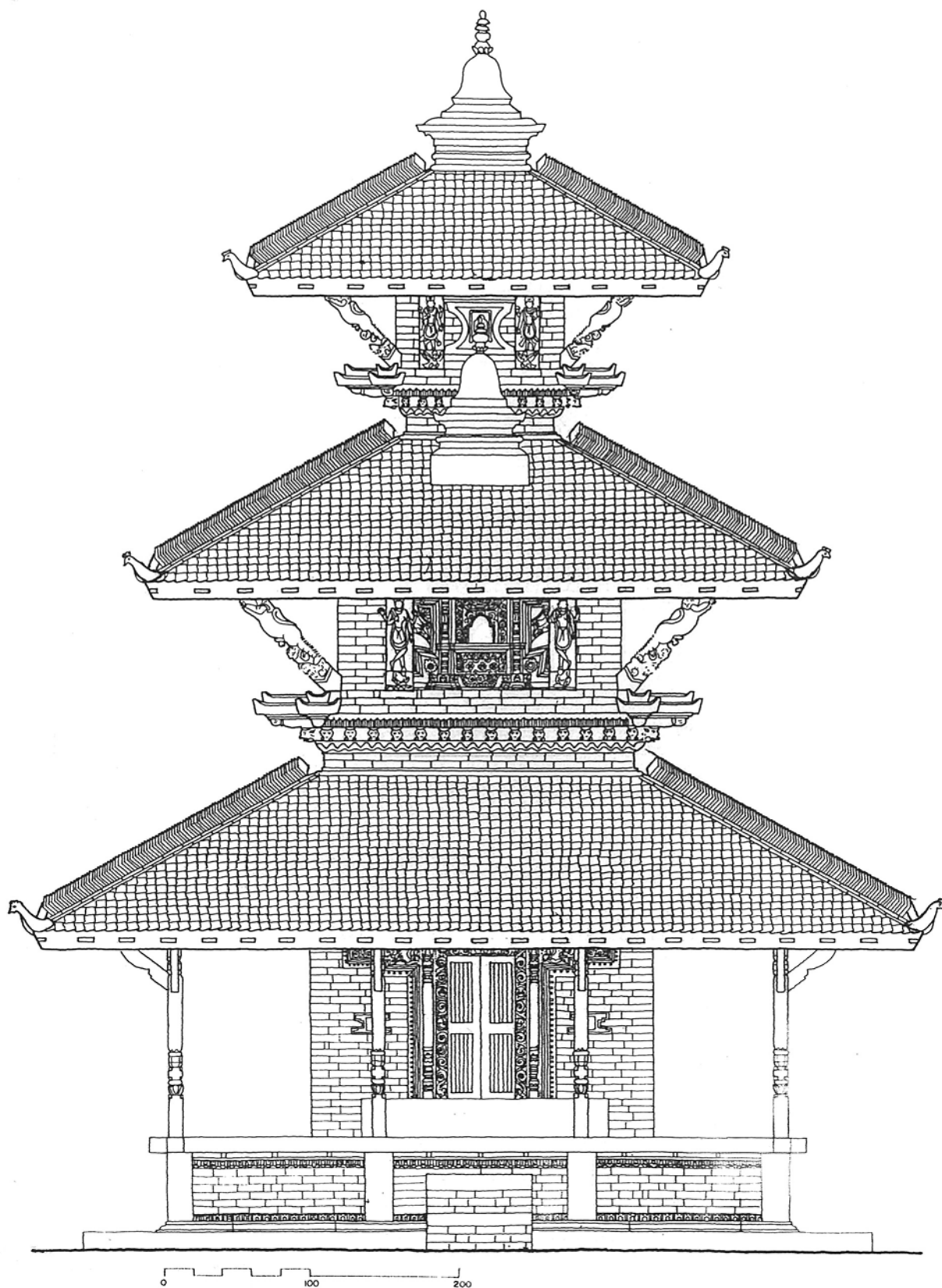
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TUM BAHANARAYAN

PROPOSED:SECTION AT EAST-WEST

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TUM BAHANARAYAN

PROPOSED: PRINCIPAL ELEVATION

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Above: Narayan image on the uppermost part of door lintel. Lower half of the figure is broken.

Below: Three unidentified deities on the lower part of the door lintel. Because of its location in the most touchable area, there is heavy wear. Also the presence of several nails has contributed to the weakening and breaking of the wood.



Left: extended timber column on main entrance doorway. Face of the small deity is worn due to weathering

Right: upper right corner of main door frame. Vertical member has a crack on right side, but structurally is still sound.



Detail of extended lintel on both sides of the extended door lintel. Each side shows *gandhara* with garland on front and at the back *makara* offering water.



Blind window at the ground level beside main sanctuary room of the temple. Main figure on the middle of the blind window is "*Kalas*".



Existing roof struts from middle level

- C. **Projecting lintels (*lapu*)** – flying *ghandharvas* mixed with floral motif and crocodiles (*makara*)
 - D. **Principal deity of Vishnu**
 - II. **Blind window** – central figure are *kalas*
 - III. **Cornice** – *Kimkini jala* symbolising “welcome to everyone”
- 2. Middle level
 - I. **Roof struts (Newari: *tuna*)**
 - A. Principal strut

The surviving principal figures are incarnations of Vishnu standing upon *yaksa* figures. The upper strut registers consist of floral patterns.

Since this temple is dedicated to Vishnu, the strut iconography most likely consisted of a series depicting his 12 incarnations (*Dradasa Visna*) each representing a month of the year. This is also a representation of the Sun-God, another form of Vishnu.
 - B. Corner struts (Newari: *ku salah*) are typically rendered as repeating mythical horse-like figures on both levels.
 - II. **Central windows (*ganhjhyah*)** – Horses or *ku salah* form the curved brackets; geese inhabit the extended sills; lions or *simha* sit at the base of the projecting columns and *kalasa* occur at both the capital and base; floral motifs cover the remaining surfaces. The four windows are symmetrical and identical designs.
 - III. **Cornices** – Repeated miniature carved heads of the half lion, half boar mythical animal *sardula* are depicted in the usual pattern in the lower cornice.
- 3. Upper level
 - I. **Roof struts**
 - A. Principal strut

The principal figures are incarnations of *Vishnu*. The lower portion depicts his vehicle *Garuda*. The upper strut registers consist of floral patterns.

Since this temple is dedicated to *Vishnu* it is likely the strut iconography consisted of a series of his 12 incarnations (see middle level roof strut description).
 - B. Corner struts (*ku salah*) are typically rendered as repeating mythical horse-like figures on both levels.
 - II. **Cornices** – At the corners the upper layer of cornice cantilevers in the shape of hand (*lah kah*). Repeated miniature carved heads of the half lion, half boar mythical animal *sardula* are depicted in the lower cornice.





4.0 EXISTING CONDITIONS

- 4.01 Foundation/wall structure and timber colonnade
- 4.02 Wall fabric
- 4.03 Wall openings and decorative elements
- 4.04 Roof structure and struts
- 4.05 Roof cover and decorative elements
- 4.06 Interior

4.01 Foundation / wall structure and timber colonnade

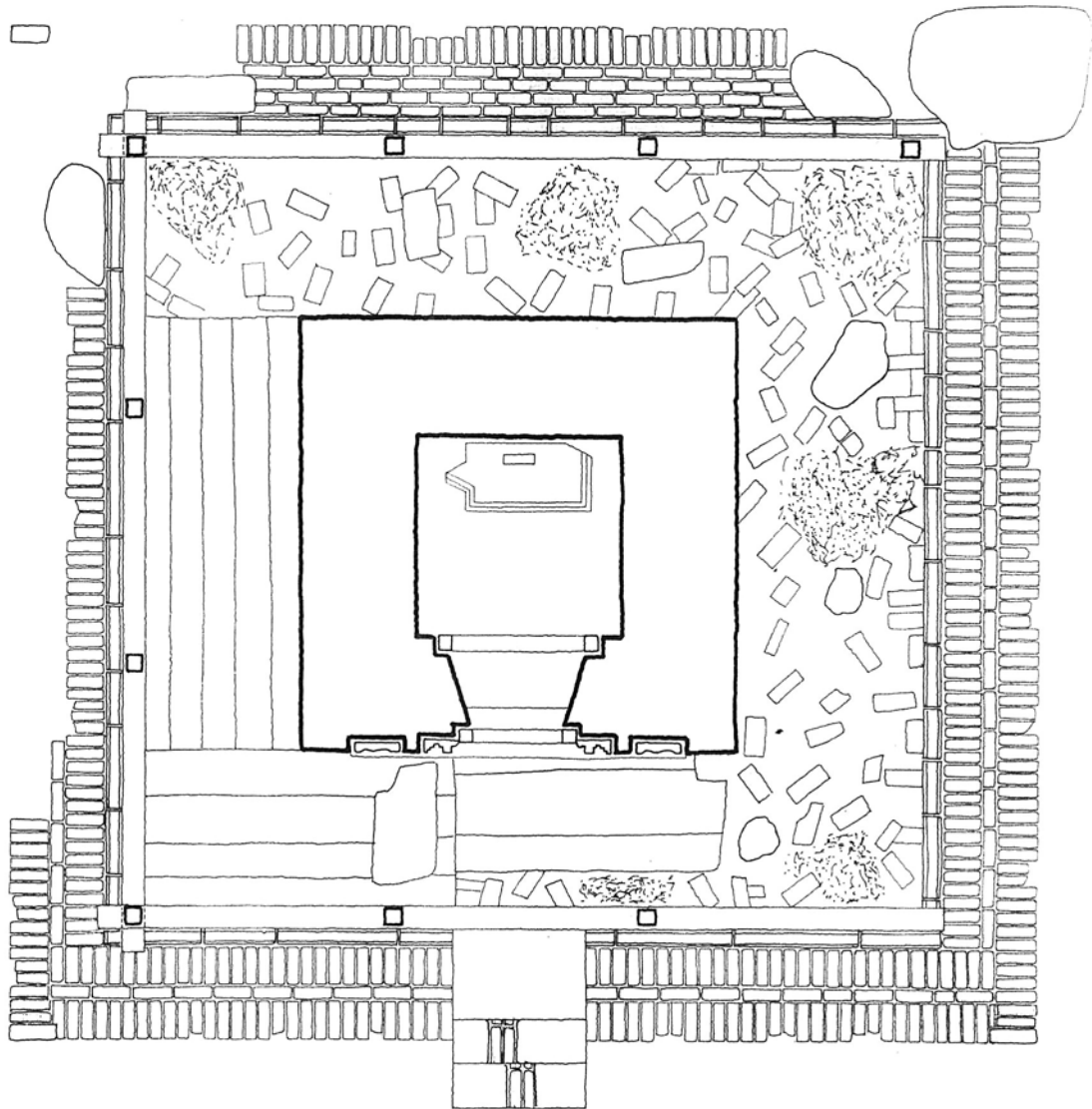
Foundation and wall structure

The foundation was studied by excavating a trench, revealing a mixed rubble/mud mortar section 51" (1.3 m) wide and 47" (1.2 m) high in the central area under the inner sanctum. Underneath the outer timber arcade the trench varies between 20" – 24" (0.5 - 0.6m) wide and 47" (1.2 m) high. These trenches show the straight foundation wall extends more than 47" (1.2 m) below the street level. There is no evidence of foundation settlement.

The walls despite exposure for over a decade to the elements are in good structural condition.

Timber colonnade

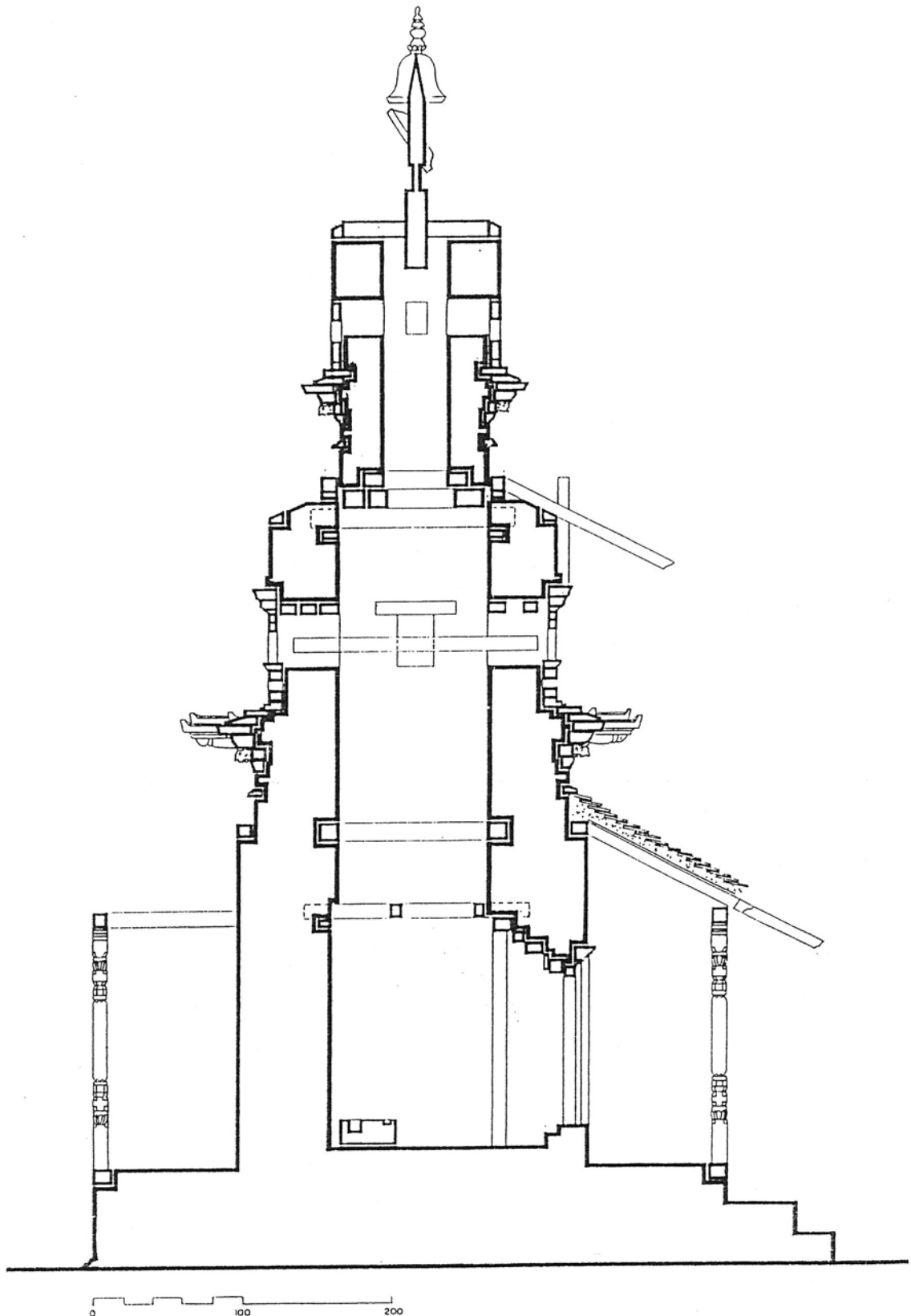
Severe structural problems are evident in the ground floor timber colonnade. Due to exposure to the elements and roof collapse, much of the timber arcade, i.e. post and beam structural elements are damaged or lost. Of the 12 carved *sal* timber columns only 8 survive from the west and north elevations, four of these eight have extensive wet rot damage. The timber planking and timber plinth beam (Newari: *lak-si*) upon which the columns rest is completely damaged. The timber planking on the floor incorporates random salvaged and reused door frame components.



TUM BAHANARAYAN

EXISTING PLAN

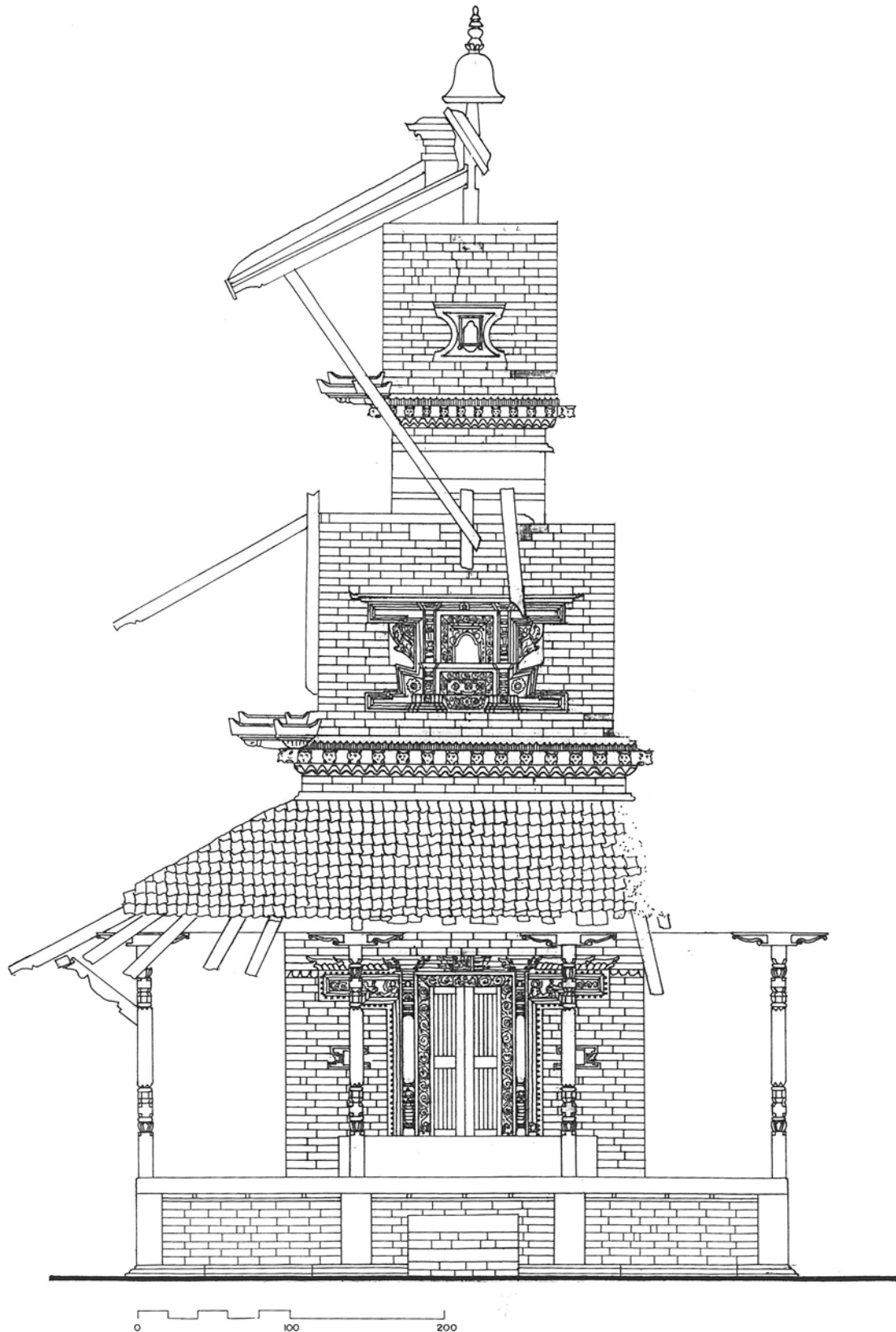
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TUM BAHANARAYAN

EXISTING CONDITION: SECTION AT EAST-WEST

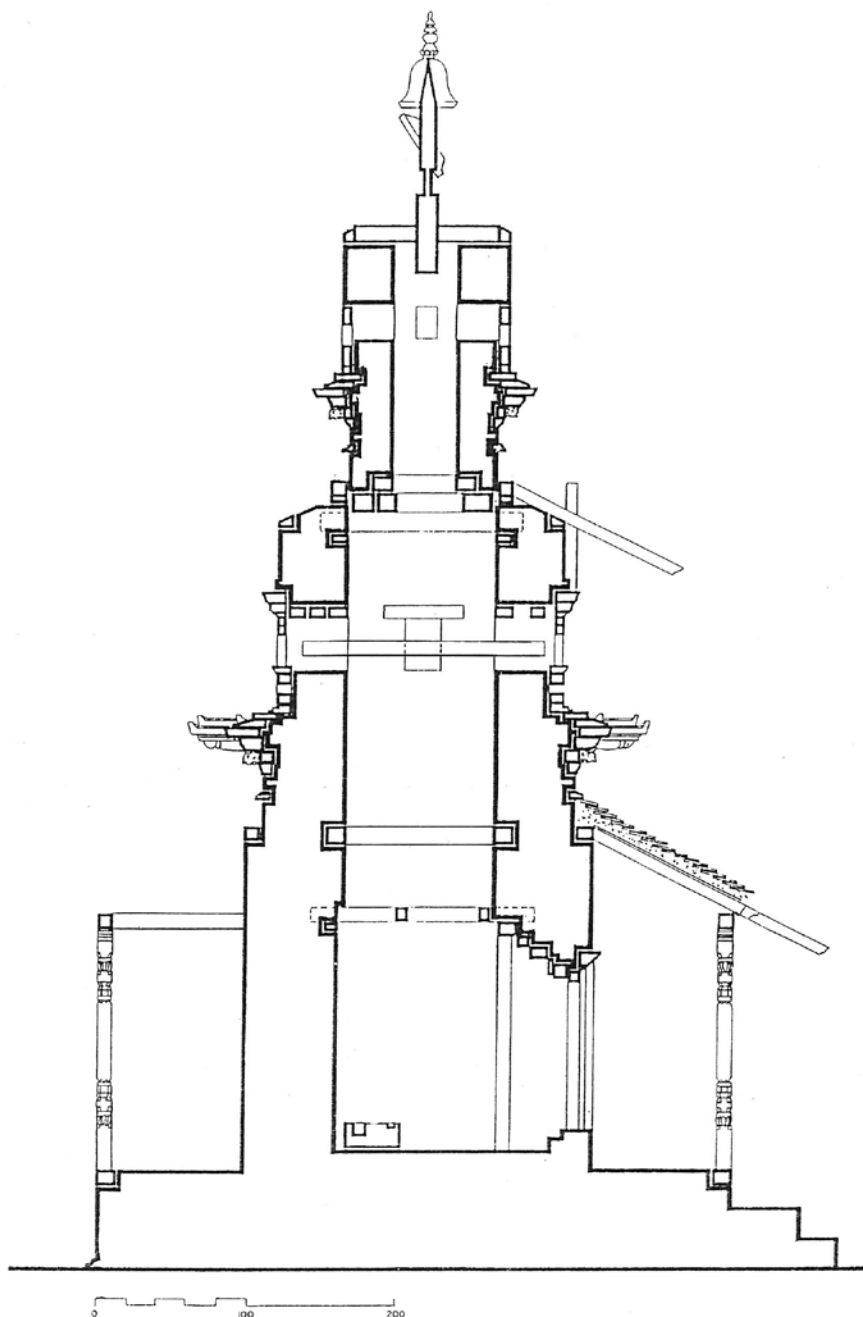
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TUM BAHANARAYAN

EXISTING CONDITION: PRINCIPAL ELEVATION

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TUM BAHAN ARAYAN TEMPLE

SECTION EAST-WEST: EXISTING CONDITIONS

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Existing Condition

EAST-WEST SECTION

Gajura (terracotta pinnacle) lost two months back

Galsi (pinnacle king post) completely damaged

Pinnacle terracotta base completely damaged

Upper roof: wall plates, rafters, purlins, and eaves board severely damaged by wet rot or lost

Masonry wall damage in the upper 12 layers of brick

Small window: good condition

Roof struts: 2 of 12 salvaged

Lah-kah (extended terracotta cornice): lost

Timber cornice: 20% damaged by wet rot

Middle roof timber members – rafters, purlin, eaves board were completely damaged or lost

Wall plate: inner-damaged 20%,

Wall plate: outer-100% damaged by wet rot

Upper layers of brick damaged by vegetal growth

Roof struts: 3 of 12 salvaged

Gajhyah (decorative carved wooden window): fair condition

Wood cornice: good condition

Lah-kah (extended terracotta cornice): 20% damaged

Jhingati (terracotta roof tiles): fair condition

Lower roof: 50% damaged on two sides by wet rot and other two sides collapsed

Wall plate: outer damaged completely

Wooden cornice in good condition

Timber bracket completely damaged

Timber posts: 8 surviving in fair condition

Brick wall in good condition except for a few bricks damaged by moisture

Stone threshold: good condition

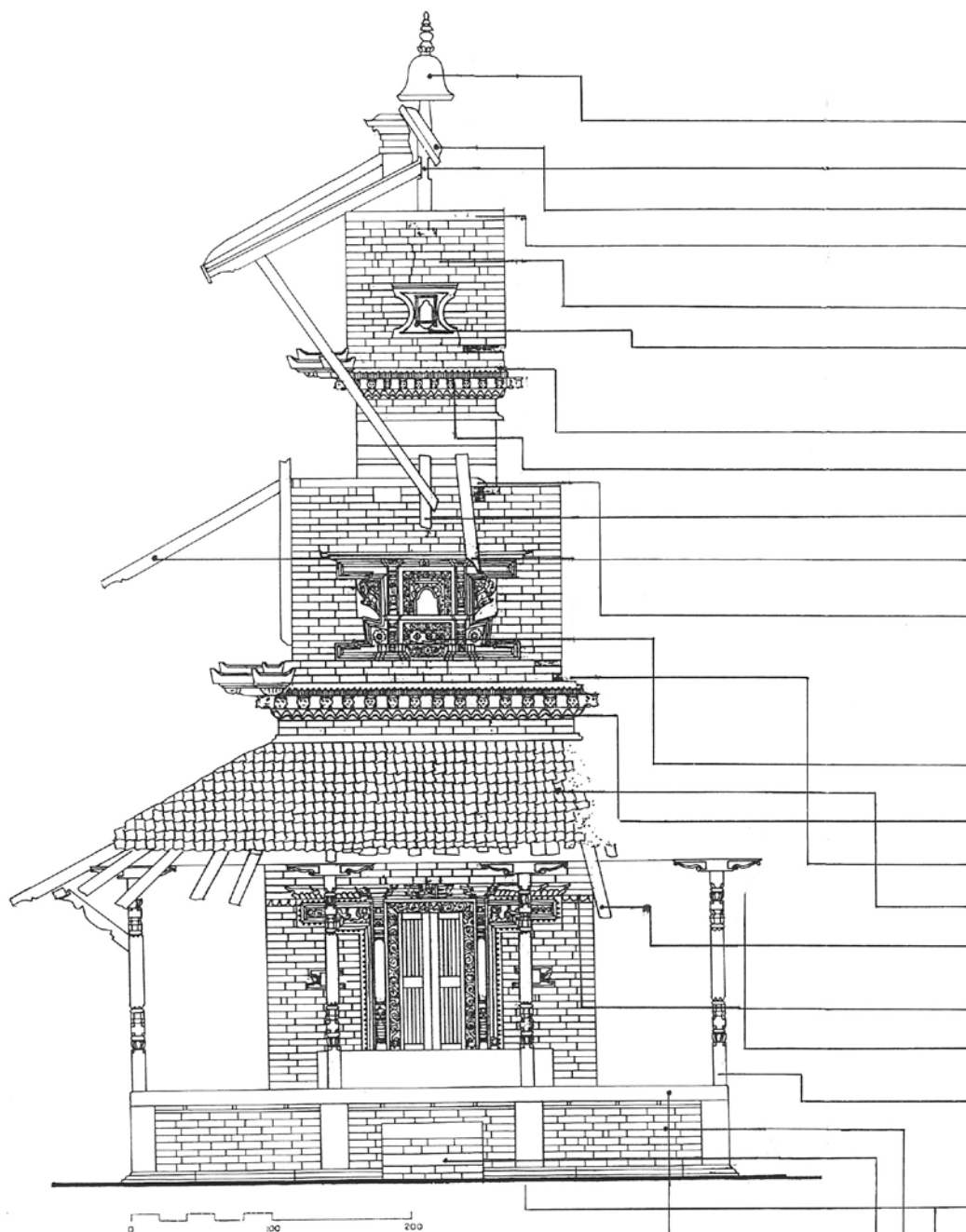
Laka-si (timber plinth beam) completely damaged

Plinth wall 60% of bricks are replaced with mismatched common brick or random rubble

Stone steps: good condition

-I-loh (base stone for timber post): good condition

-base layer of brick broken in several places



Existing Condition

WEST (PRINCIPAL) FACADE

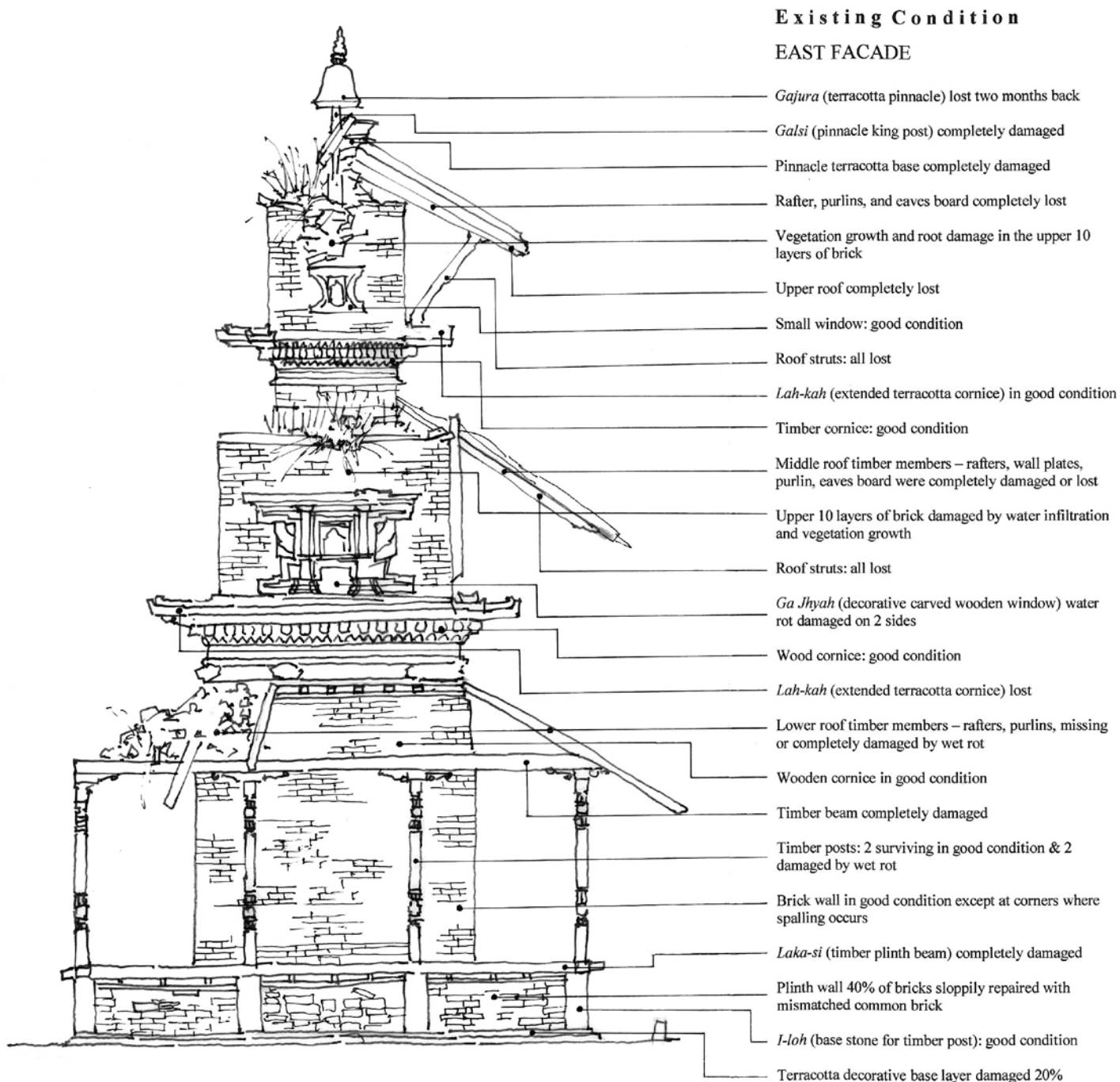
- Gajura* (terracotta pinnacle) lost two months back
- Galsi* (pinnacle king post) completely damaged
- Pinnacle terracotta base completely damaged
- Upper roof: wall plates, rafters, purlins, and eaves board severely damaged by wet rot or lost
- Masonry wall damage in the upper 12 layers of brick
- Small window: good condition
- Roof struts: 1 middle strut salvaged
- Lah-kah* (extended terracotta cornice): lost
- Timber cornice: 20% damaged by wet rot
- Gajura* (terracotta pinnacle) at middle roof salvaged
- Middle roof timber members – rafters, purlin, eaves board were completely damaged or lost
- Wall plates: inner-damaged 20%, outer-100% damaged by wet rot
- Upper layers of brick damaged by vegetal growth
- Roof struts: 1 middle & 1 corner salvaged
- Ga'jhyah* (decorative carved wooden window): damaged middle fragment
- Wood cornice: good condition
- Lah-kah* (extended terracotta cornice): lost
- Jhingati* (terracotta roof tiles): 40% surviving
- Lower roof timber members – rafters, purlins, missing or completely damaged by wet rot
- Wooden cornice in good condition
- Timber bracket completely damaged
- Timber posts: 2 surviving in good condition & 2 damaged by wet rot
- Brick wall in good condition except at corners where a few bricks are damaged by moisture
- Stone threshold: good condition
- Laka-si* (timber plinth beam) completely damaged
- Plinth wall 60% of bricks are replaced with mismatched common brick or random rubble
- Stone steps: good condition
- I-loh* (base stone for timber post): good condition
- Terracotta decorative base layer: good condition

TUM BAHAN ARAYAN TEMPLE

PRINCIPAL WEST FACADE: EXISTING CONDITIONS

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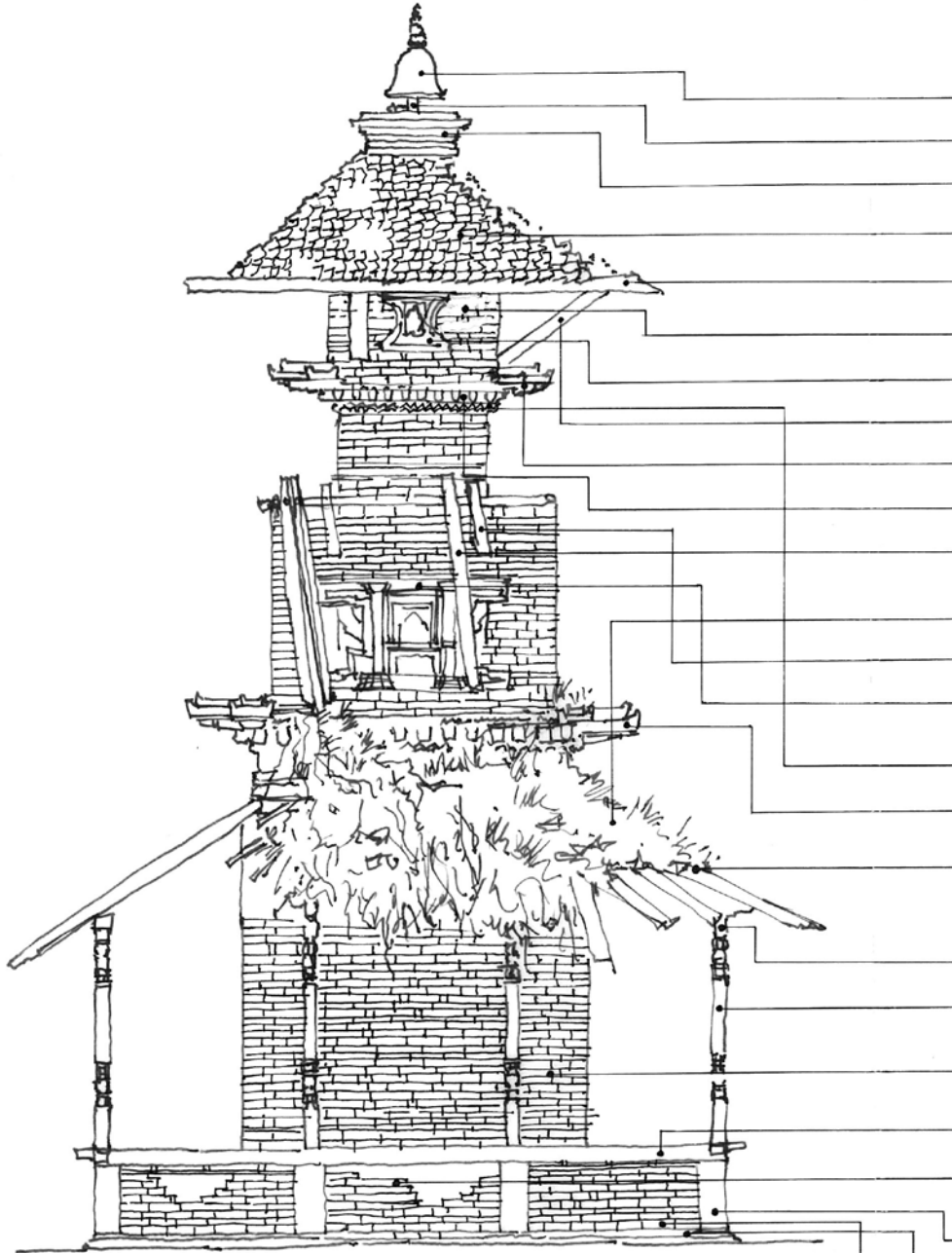
EAST FACADE: EXISTING CONDITIONS

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FALL, 1998

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Existing Condition

NORTH FACADE



- Gajura* (terracotta pinnacle) lost two months back
- Galsi* (pinnacle king post) completely damaged
- Pinnacle terracotta base completely damaged
- Jhingati* (terracotta roof tiles) 25% good condition
- Wall plates, rafters, purlins, and eaves board severely damaged by wet rot
- Masonry wall damage in the upper 10 layers of brick
- Small window: good condition
- Roof struts: 1 corner strut salvaged
- Lah-kah* (extended terracotta cornice) in good condition
- Timber cornice: good condition
- Middle roof timber members – rafters, wall plates, purlin, eaves board were completely damaged or lost
- Upper 10 layers of brick damaged by water infiltration
- Roof struts: all lost
- Ga Jhyah* (decorative carved wooden window): lost upper fragment
- Wood cornice: good condition
- Lah-kah* (extended terracotta cornice) slightly chipped
- Lower roof timber members – rafters, purlins, missing or completely damaged by wet rot
- Wooden cornice in good condition
- Timber bracket completely damaged
- Timber posts: 2 surviving in good condition & 2 damaged by wet rot
- Brick wall in good condition except at corners where a few bricks are damaged by moisture
- Laka-si* (timber plinth beam) completely damaged
- Plinth wall 40% of bricks are sloppily repaired with mismatched common brick or random rubble
- I-loh* (base stone for timber post): good condition
- Terracotta decorative base layer: good condition
- Base layer of brick: good condition

TUM BAHAN ARAYAN TEMPLE

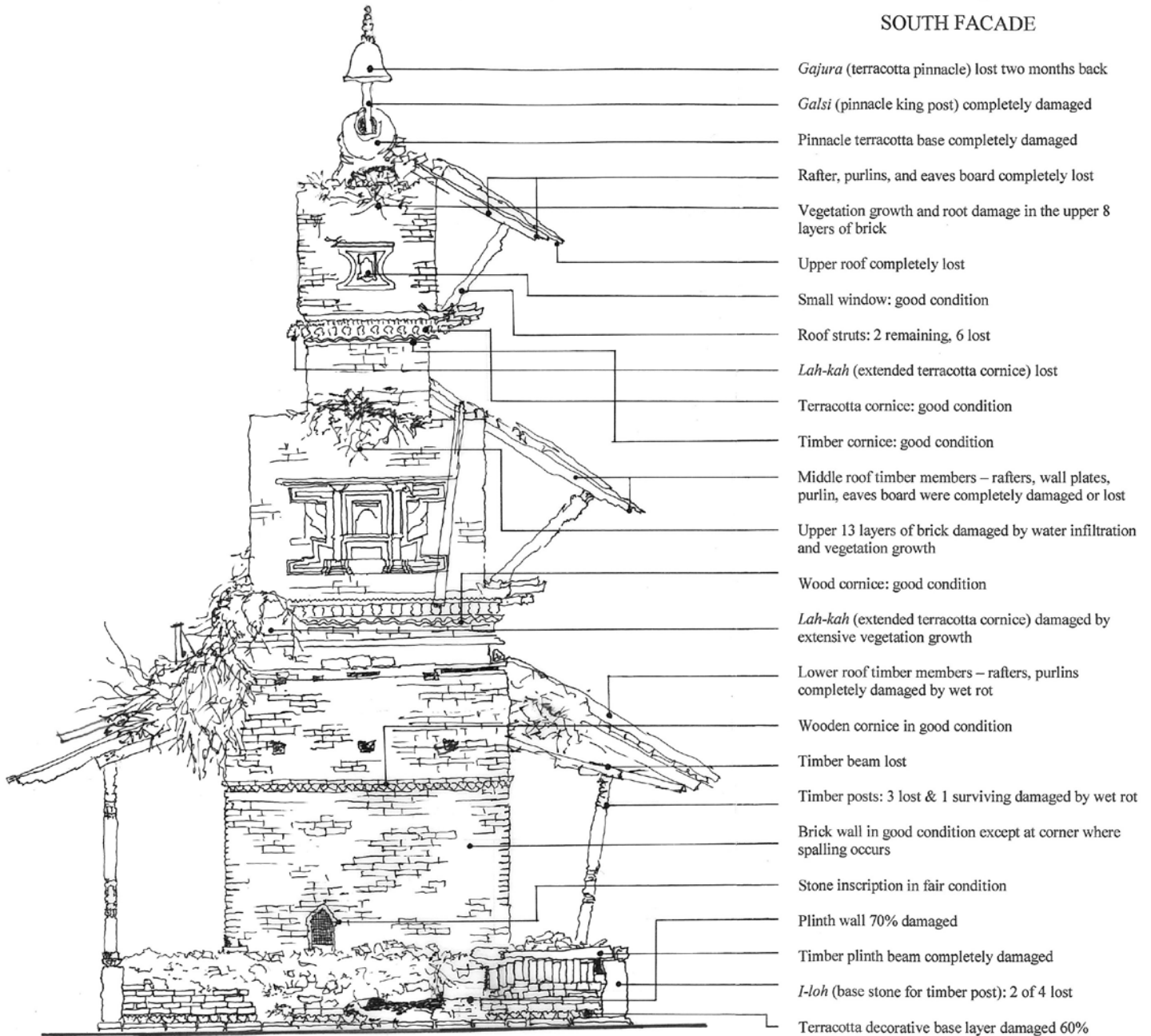
NORTH FACADE: EXISTING CONDITIONS

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Existing Condition

SOUTH FACADE



TUM BAHAN ARAYAN TEMPLE

SOUTH FACADE: EXISTING CONDITIONS

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FALL, 1998

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Original column and capital assembly, west elevation, fall, 1998. The notch accepts lost roof strut.

4.02 Wall Fabric

Plinth

The plinth wall was in poor condition with mismatched bricks and rubble laid with no mud mortar. Evidence of sloppy repairs circa 1974 substituted common brick in mismatched sizes for the original veneer brick (Newari: *daci-apa*). Such well meaning attempts by locals to repair the damage did little to remedy the situation.

After 1985, collapse of the upper roof, middle roof, and the subsequent falling debris resulted in major damage to the plinth wall structure. The south facade exhibits the most extreme damage with more than 70% of the veneer bricks either missing or damaged. Also, two of the four plinth base stones (Newari: *i-loh*) which provide a base for the timber posts above are lost. On the remaining three facades at least 40% of the bricks has either been replaced with common brick of mismatched size or crude rubble. The terracotta decorative bricks at the base of the plinth wall are 40% damaged and 20% lost. As a result of this plinth wall damage, much of the fill is displaced and spilling out onto the base layer of brick which is cracked in a few places. One of two stone steps on the principal west elevation leading to the deity sanctum is missing.

Ground floor walls

The inner masonry wall at this level is in good condition. The stone threshold remains in excellent condition as well as the majority of bricks in the wall. In the corners a few bricks show efflorescence (mineral salt deposits on the surface), spalling, and the mud mortar pointing has washed out. It is possible some of this damage was caused by rising ground dampness and accelerated to major damage by exposure to rain caused by the missing roofs.

Middle level walls

There is significant damage due to exposure to the elements from the missing middle roof. Vegetal growth is entrenched in the upper layers of brick. On the south facade a *pipal* tree has taken root resulting in water infiltration, moisture damage, and displacement to the upper 13 courses of brick. The remaining three facades have similar damage to the upper 10 courses of brick where the mud mortar is washed out leaving the face veneer bricks unstable. Vegetal growth has also taken root in the exposed areas.

Upper level walls

Water has penetrated the upper layers of brick causing extensive dislocation and damage to 40% of the walls due to the missing upper roof (see annotated drawing).

4.03 Wall openings and decorative elements

Ground floor level

The decorative carved *sal* timber elements of the doorway to the now-lost principal deity show wear from weather and touch but are otherwise in good condition. The blind

windows on either side of the entrance are in fair condition with small cracks typical of the unseasoned wood. In Nepal historical openings are typically made of unseasoned timbers which later shift resulting in such small gaps in the joints. These spaces, which are usually less than 1" in size, do not pose structural problems.

The decorative carved *sal* wood cornice that wraps around the structure is in good condition, however the cornice adjacent to the main doorway entrance of west facade is not symmetrical on both sides. The left side of the masonry wall is 2" longer than the right resulting in gap between the extended door lintel and the timber cornice. The gap was filled by a piece of brick probably installed by a previous renovation.

Middle level

The loss of the middle roof has resulted in damage in much of the timber decorative elements underneath due to exposure to the elements. The exception is the decorative carved wood cornice that wraps around the brick wall just above the lower roof, which survives in good condition. The extended terracotta cornice (Newari: *lha-kah*) at the corner lies above the cornice and three of the eight originals are missing. The surviving five *lha-kah* are in good condition except for minor displacement and chipping.

The decorative carved wooden windows (Newari: *ga jhyah*) are damaged on three of the four facades. On the principal west facade the window is damaged by wet rot extensively at the upper portion. On the north facade window is in good condition. On the east facade the *ga jhyah* exhibits wet rot damage on the upper portion, middle sill, and lower portion. In addition some decorative panels and the middle decorative arched window are damaged by moisture. The south *ga jhyah* is damaged in the upper portion and in the arched window. The area of the frame behind the right carved forward standing column also suffers wet rot.

Upper level

The four small carved *sal* wood windows that on each of the facades are in good condition despite exposure to weather due to the lost upper roof. The timber cornice survives in fair condition, but 20% is damaged by wet rot. Two of the eight *lha-kha* are lost from the southwest corner. The remaining extended decorative timber cornices are in good condition.

4.04 Roof structure and struts

A roof collapse occurred after theft of the supporting roof struts 15 years ago that accelerated damage and eventually brought down the majority of the roof fabric of the three roofs and left the remaining timber structural elements damaged and exposed. Although the pine roof rafters deteriorated, the *sal* (*shorea robusta*) timber elements fared well despite exposure. Many of the decorative carved *sal* elements like the cornices that wrap the masonry core, the windows, and doors survived in good condition because their location allowed drying to occur. However, even the *sal* timber if subjected to continuous damp with no opportunity to dry deteriorate badly. Two *sal* carved roof struts



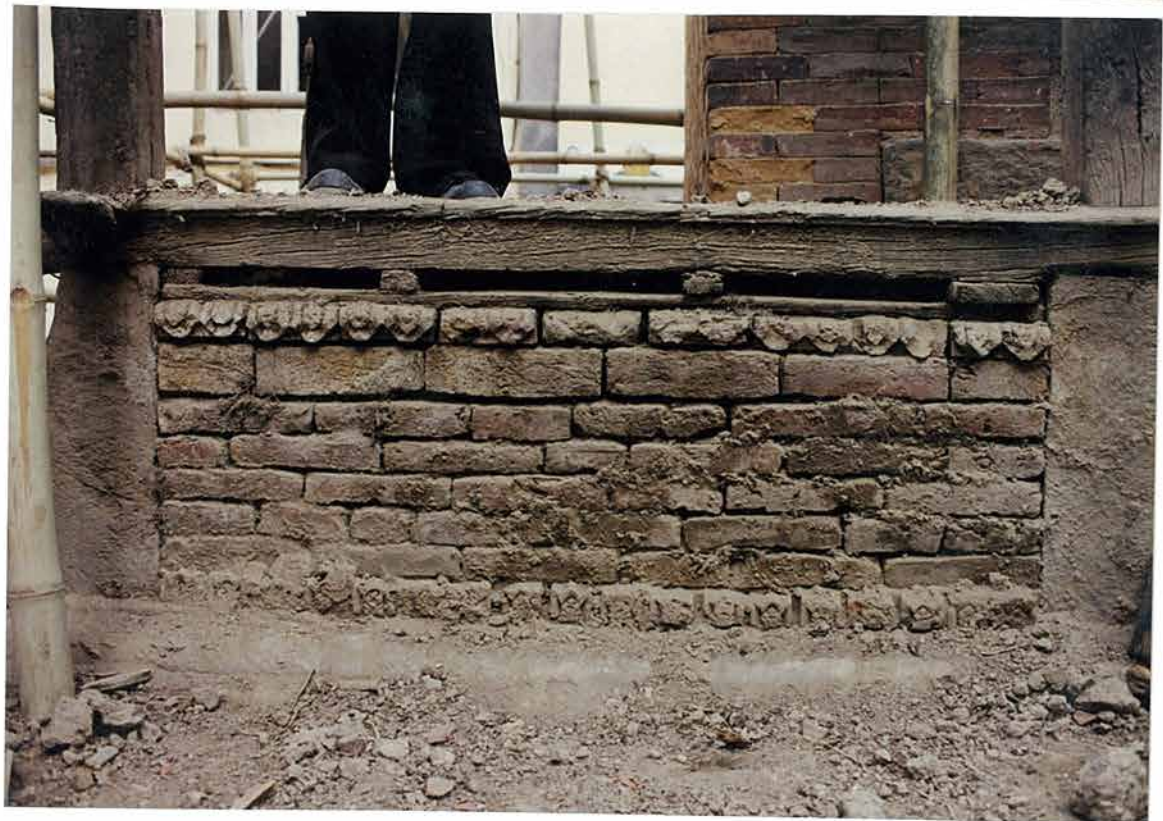
Above: A crack on ground floor wall on right side above extended timber doorway lintel.

Below: Plinth, south elevation, fall 1998. Rebuilt in common brick of mixed sizes, circa 1974.

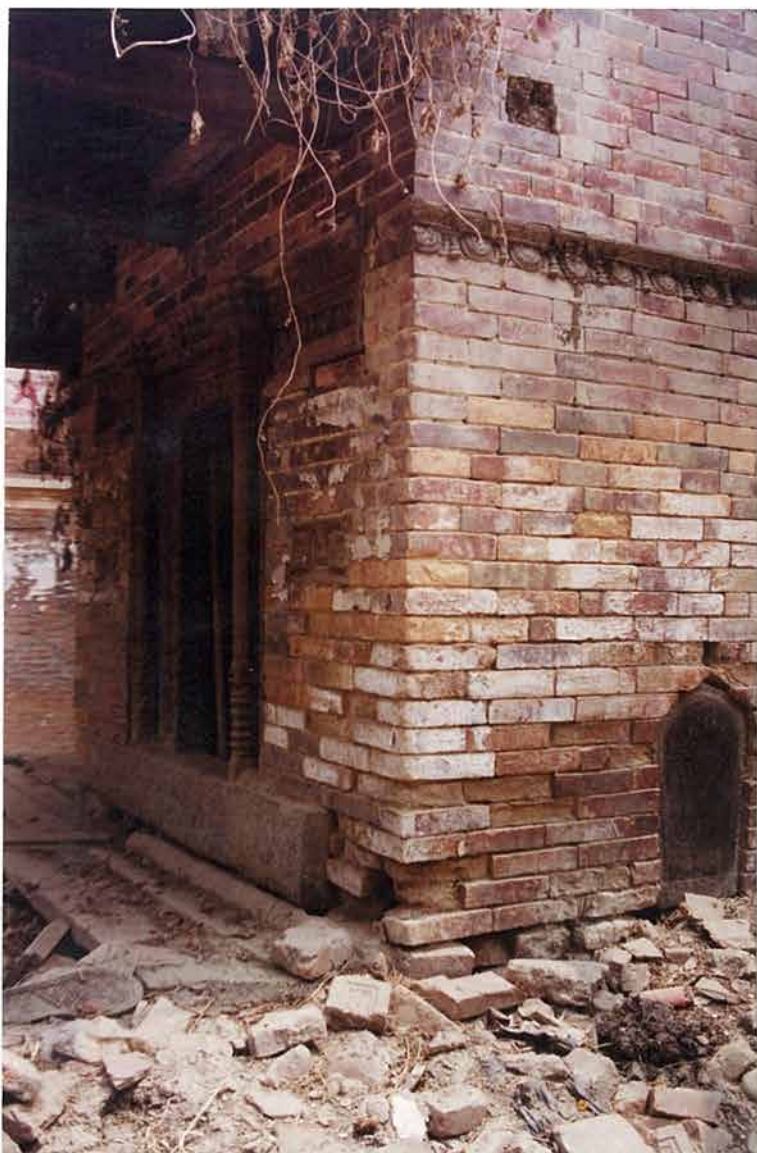


Above: North facade of ground floor wall was damaged due to the efflorescence of the salt. Brick courses below plinth planking was reconstructed in common brick.

Below: The main doorway on the west facade in good condition. The stone threshold protected the carved doorway from rising dampness.



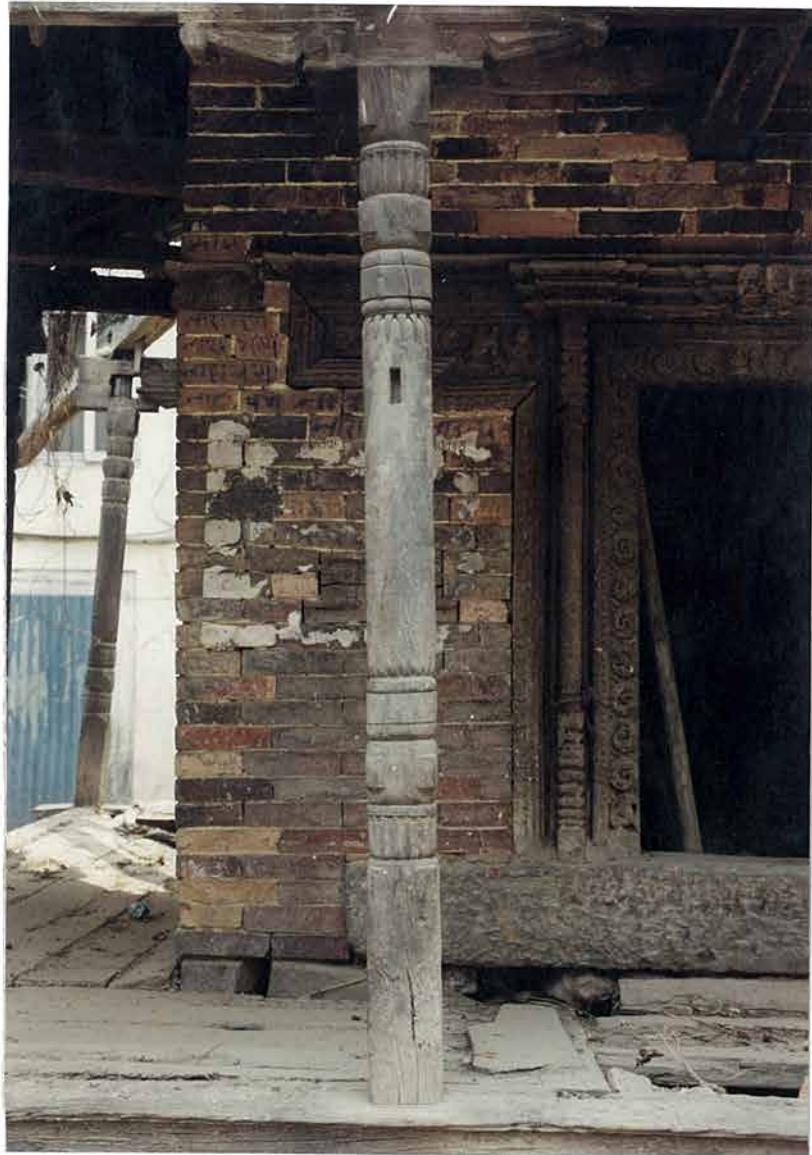
Plinth, west elevation and right corner, fall 1998.
Rebuilt in decorative and common brick of mixed sizes, ca. 1974.



Left: west-south corner at the ground level. The lowermost bricks are damaged due to rising ground dampness particularly at the corner. The main doorway is intact.

Below: most of the plinth planking is lost. On the south elevation base stones for the two middle timber posts were also lost. Photo December 1997.

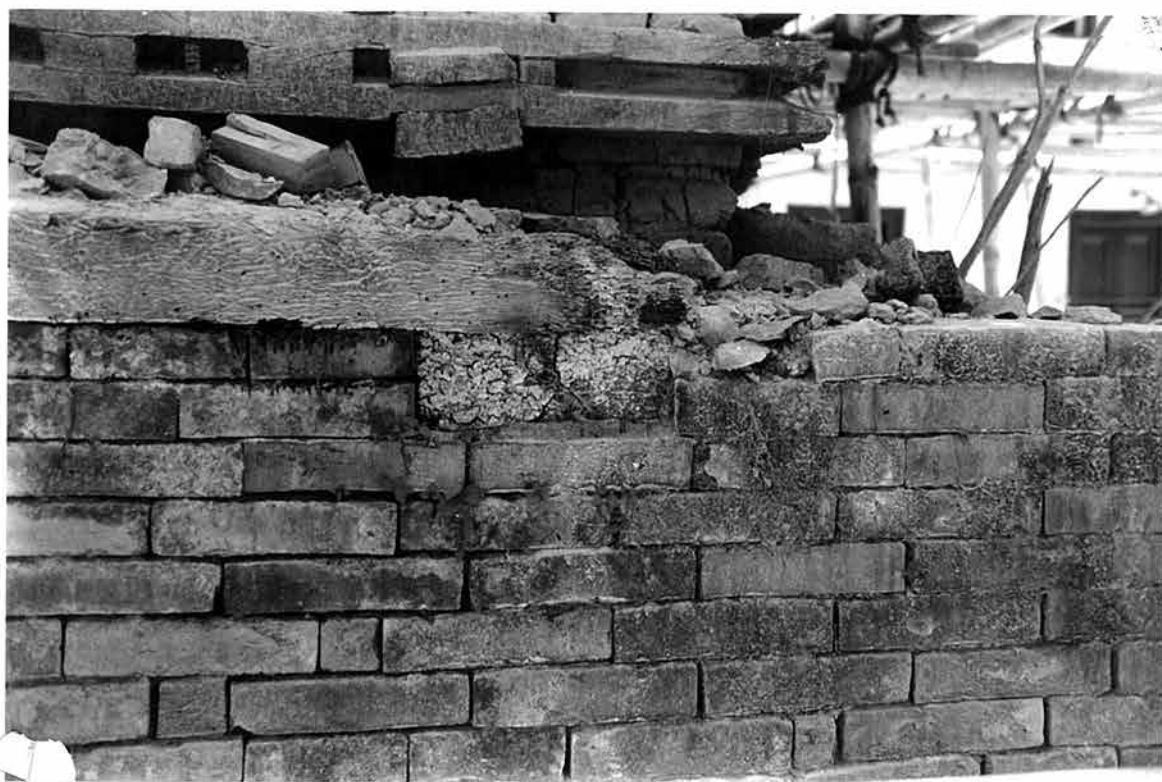




Some of the floor planking and many timber posts were still there until December 1997, when this photo was taken.

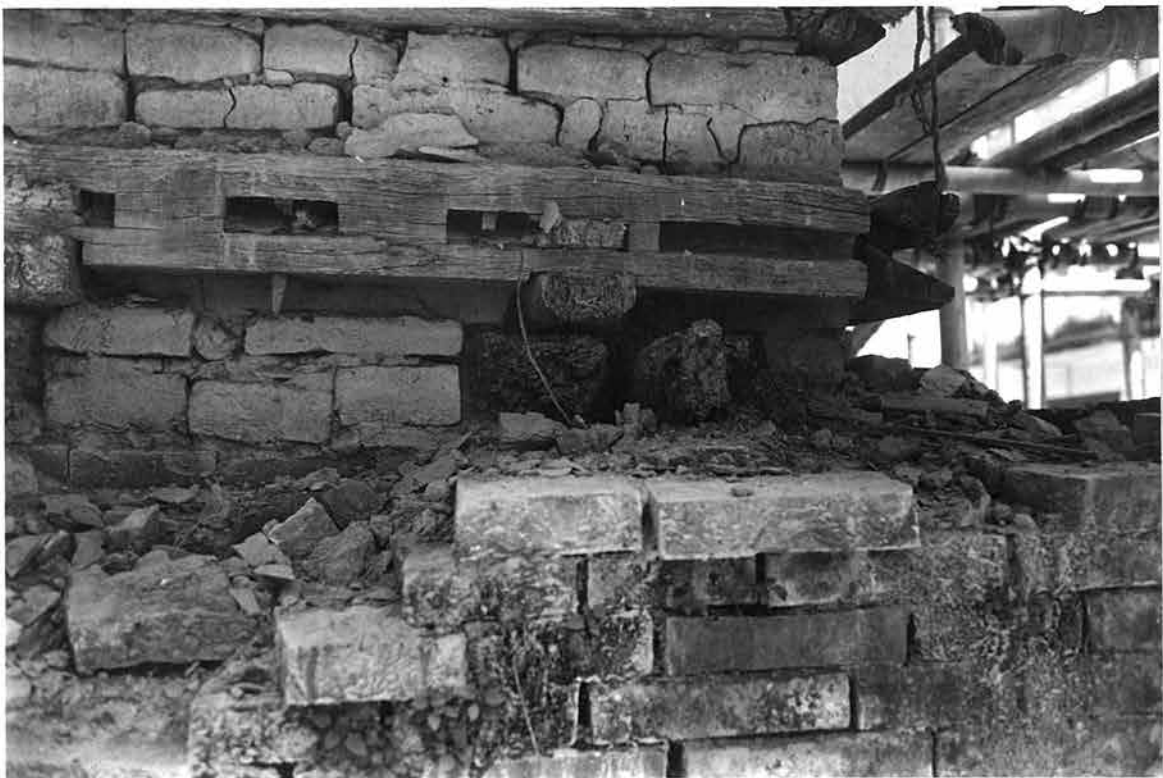


Existing lintel of the door frame on the ground floor level. The edge of the masonry wall is 2" longer on the left side leaving a space between the extended door lintel and timber cornice that is filled by a piece of brick.



Above: water damage at middle level showing outer wall plate and washed out mud mortar at upper layers of brick.

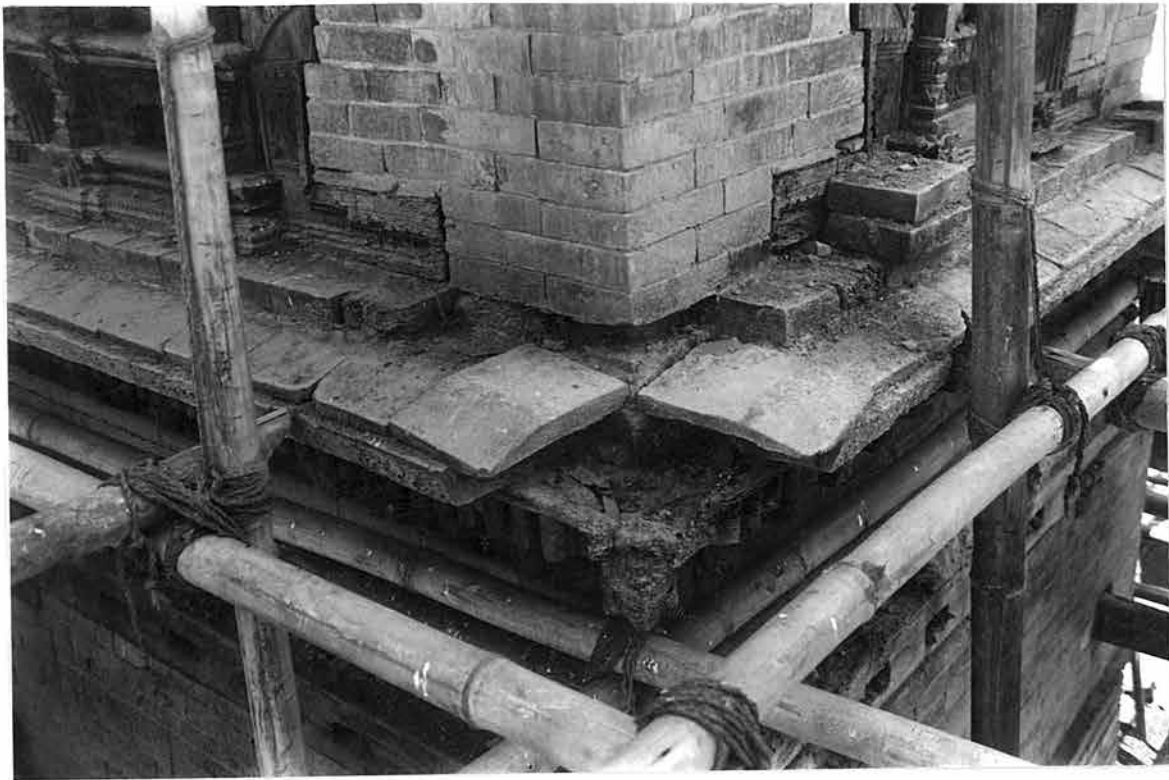
Below: south facade at missing middle roof level showing brick wall damaged by vegetal growth and washed out mud mortar.



All the rafters are damaged due to several years of monsoon rain exposure but upper wall plate stil intact, except on the corners.

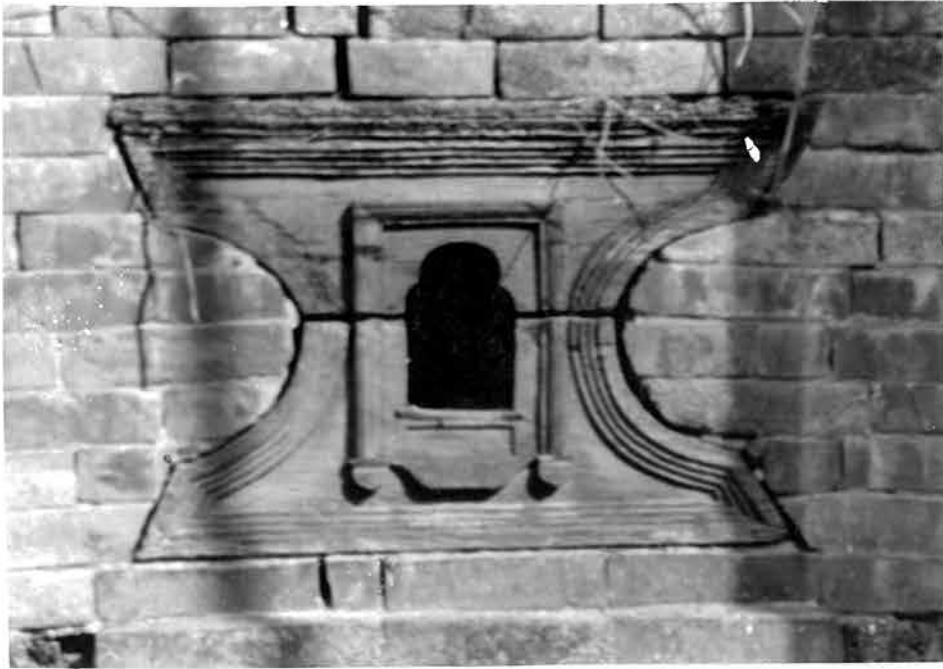
Above: upper wall plate on lower roof.

Below: upper wall plate on middle roof.



Top: completely missing *lah kah* and *lah phvah* at south-west corner.

Bottom: missing *lah kah* at north-west corner.



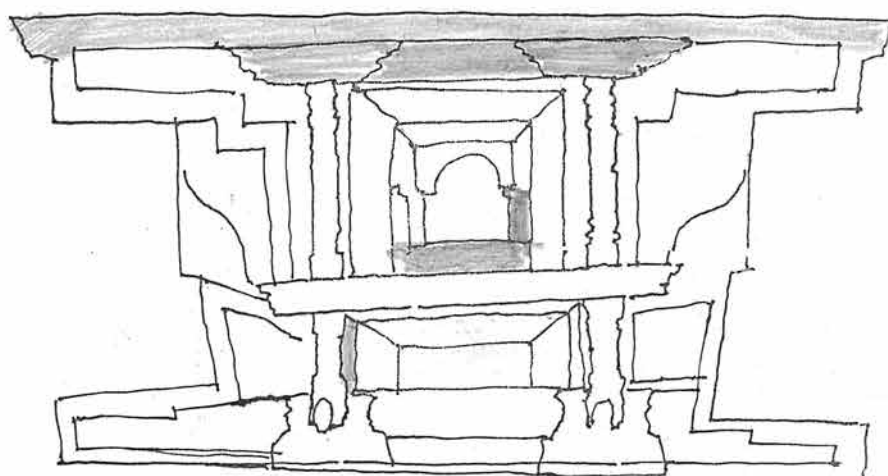
Middle window on the uppermost level. The carved details are much simpler compared to the lower levels .



Corner lap joint of outer wall plate on middle level damaged by exposure to weather.



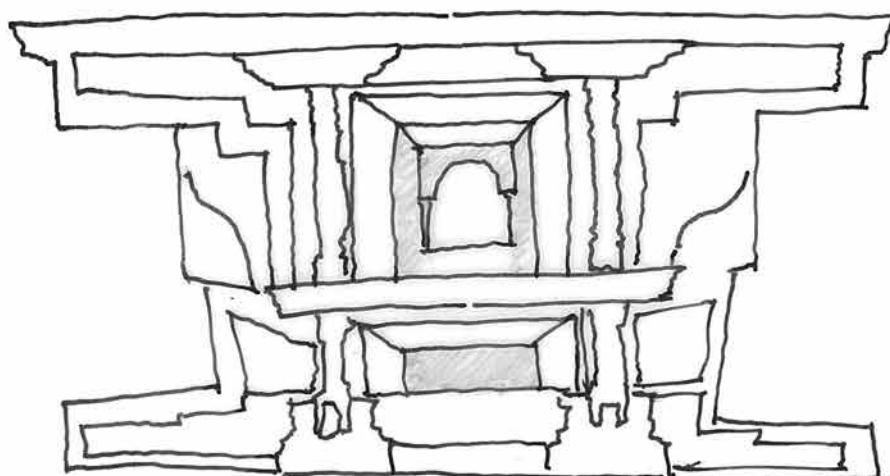
Existing Condition of Decorative Carved Window (*Gh jhyah*)
PHOTO OF *GH JHYAH* AT WEST FACADE



MISSING OR DAMAGED ELEMENTS OF WEST WINDOW



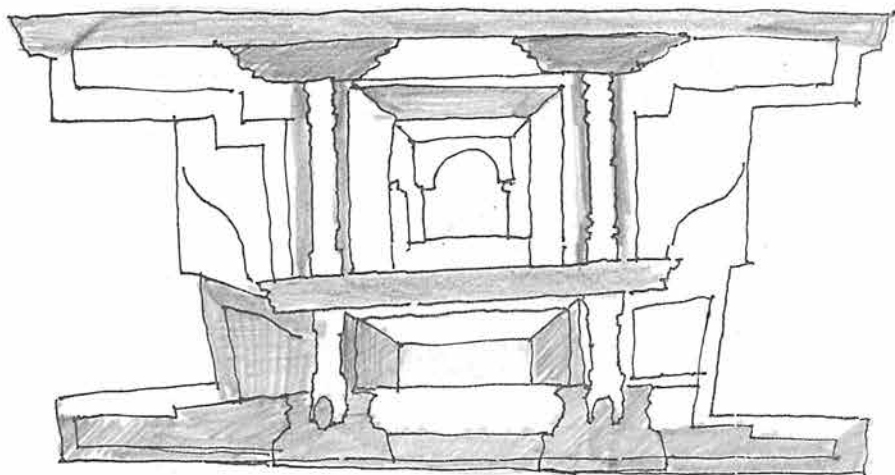
Existing Condition of Decorative Carved Window (*Gh jhyah*)
PHOTO OF *GH JHYAH* AT NORTH FACADE



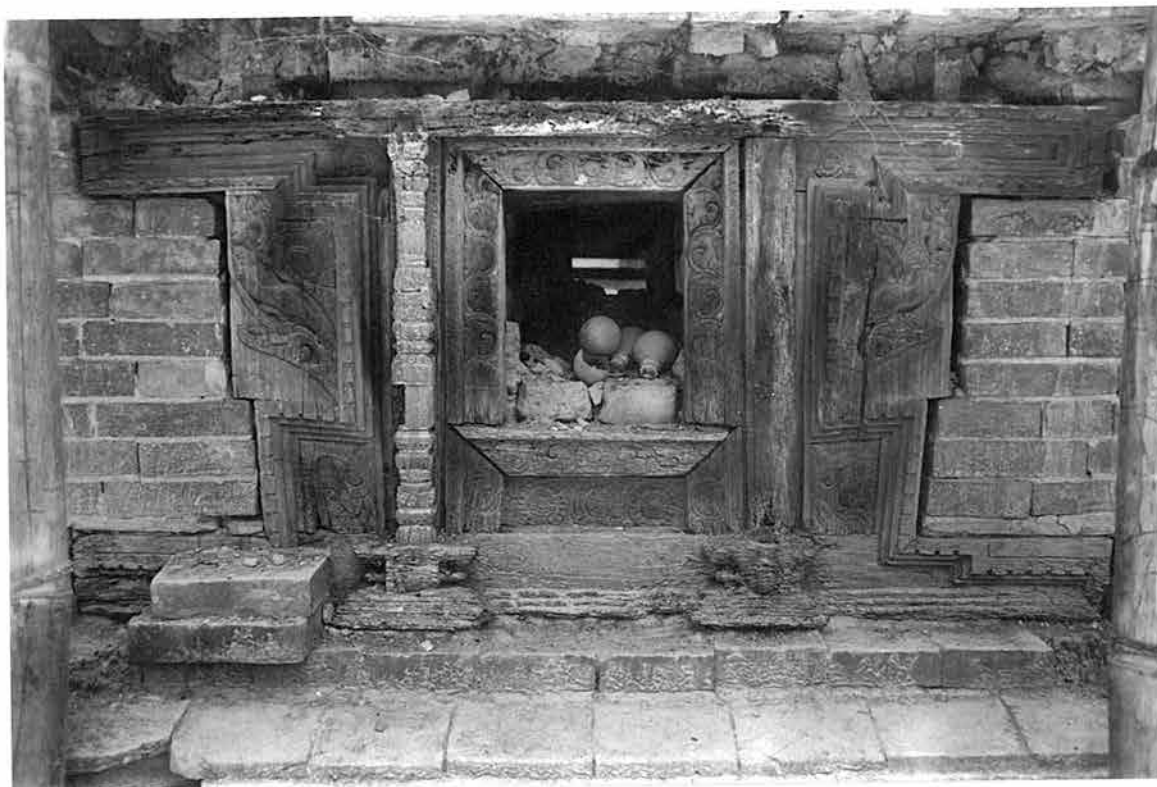
MISSING OR DAMAGED ELEMENTS OF NORTH WINDOW



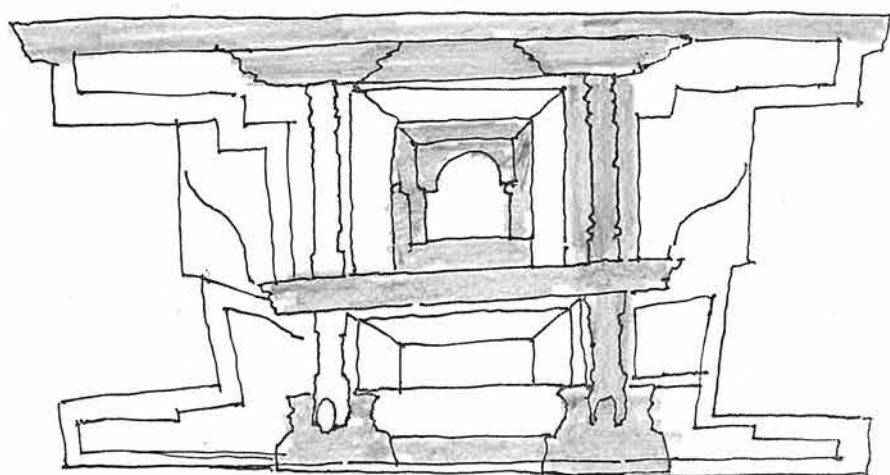
Existing Condition of Decorative Carved Window (*Gh jhyah*)
 PHOTO OF *GH JHYAH* AT EAST FACADE



MISSING OR DAMAGED ELEMENTS OF EAST WINDOW



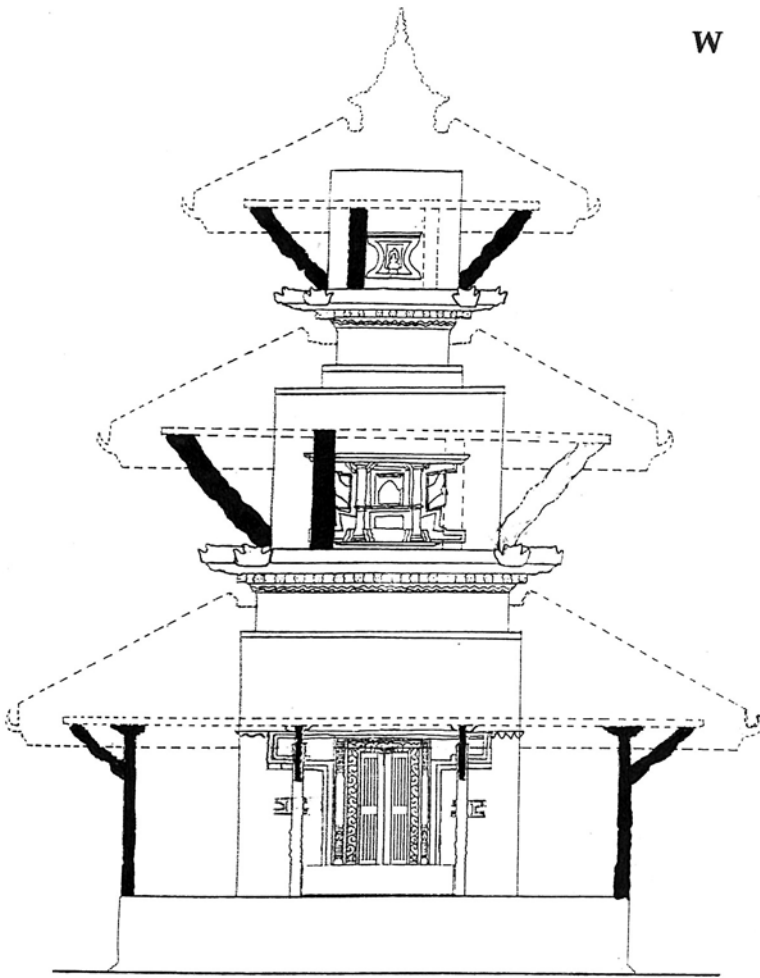
Existing Condition of Decorative Carved Window (*Gh jhyah*)
PHOTO OF *GH JHYAH* AT SOUTH FACADE



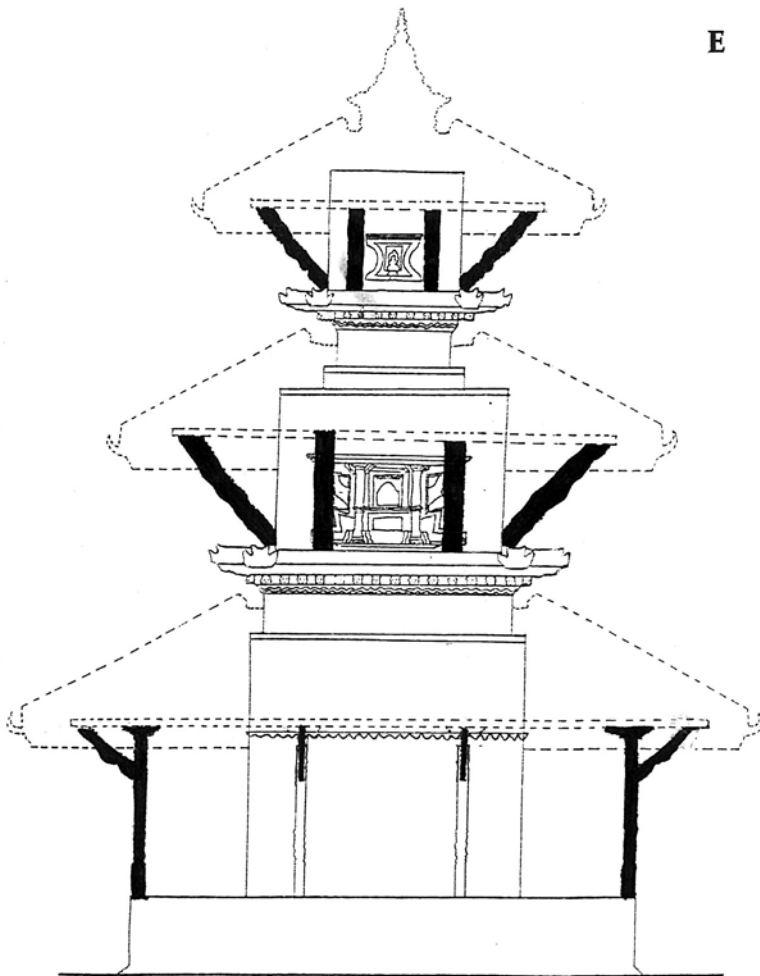
MISSING OR DAMAGED ELEMENTS OF SOUTH WINDOW

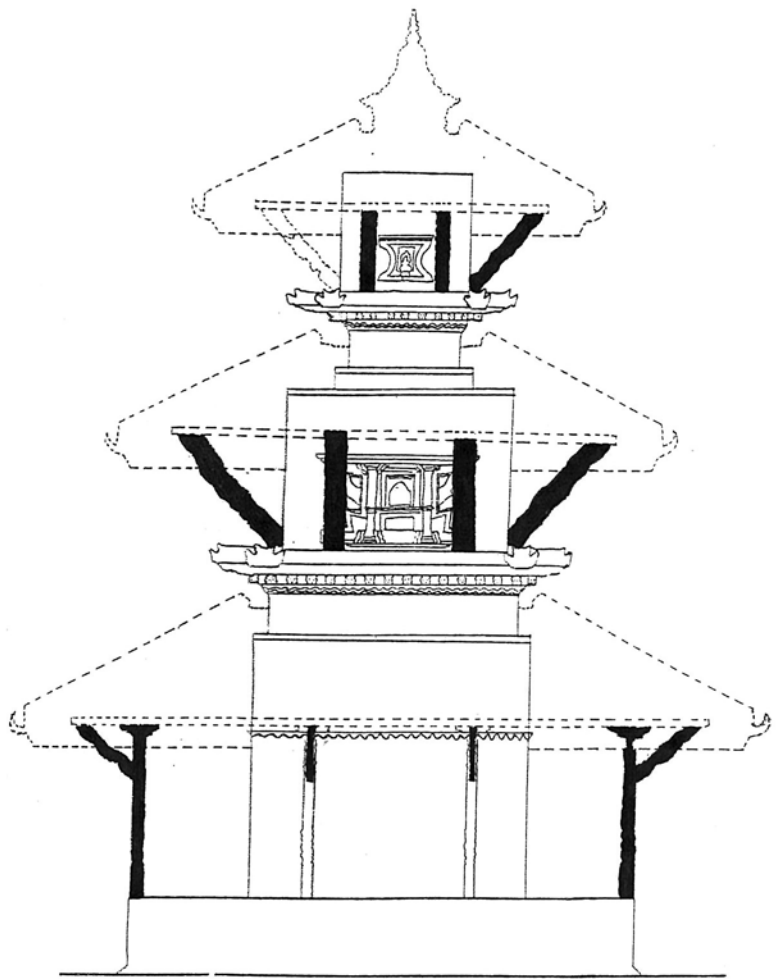
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LOST TIMBER
CARVED ELEMENTS

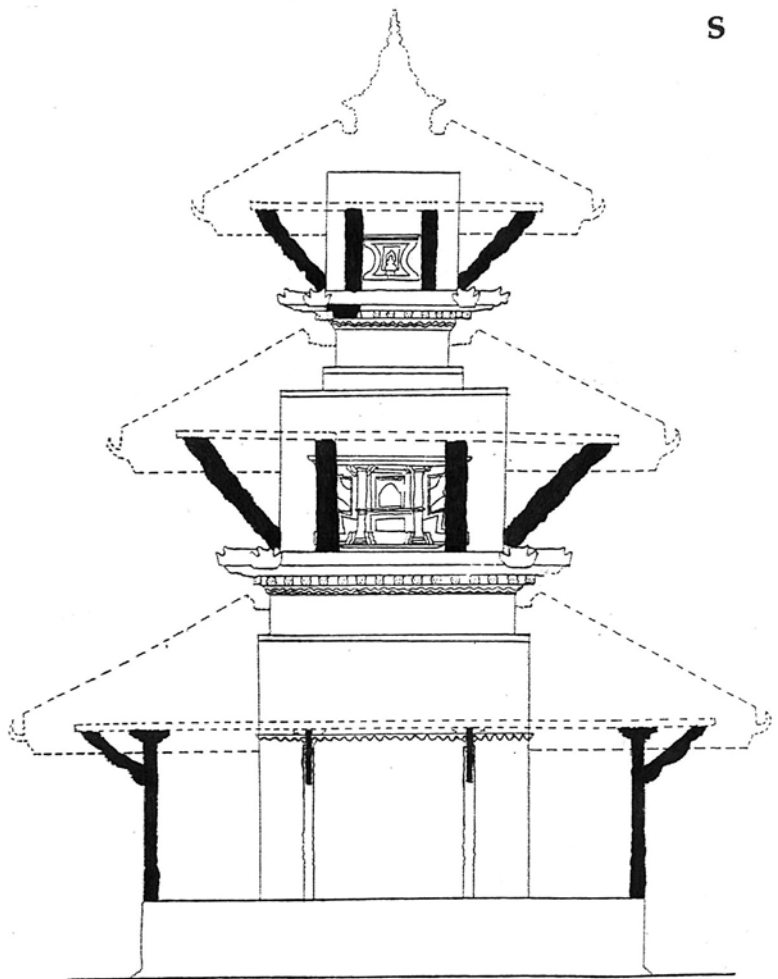


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recovered from the pile of debris at the base of the temple are examples of this condition. Few of the carved features were discernable and the struts suffered severe wet rot. The lower roof survived with the most *jhingati* available in a salvageable state, however all of the timber structural elements (rafters, purlins, and eaves boards) were badly damaged. The middle roof was completely gone except for a few timber members that show evidence the roof length before the collapse. The upper roof was considerably damaged with less than 25% of the roof remaining on the north side. Although the *jhingati* or terracotta roof tile may be salvaged, the purlins, rafters, wall plates, and eaves board are severely damaged by wet rot. The pinnacle king post (Newari: *galsi*) is in poor condition.

Roof struts

The lower roof was supported by a series of 20 carved *sal* timber roof struts. All except one were stolen or lost. It was recovered from the pile of debris at the base of the temple where it lay buried for probably 15 years. This badly deteriorated strut provided enough evidence about the length, form, and extent of carving to determine that it was a simple geometric decorated form. Documentation shows that all the struts at the lower level were identical.

The middle roof collapsed completely and no elements were salvaged except for three roof struts, and the terracotta *gajura* or pinnacle. Two of three recovered roof struts were in good condition. The exact location of these struts is unknown, however one is a corner strut and the other a middle strut. The historic temple configuration had a series of 12 decorative carved struts supporting the middle roof. Therefore, nine of the roof struts were stolen.

Of the 12 struts that supported the upper roof only four survive with the remaining eight either lost or stolen. Of the four surviving struts, one was in a corner location and the other three from middle positions. Only two of the four were in good condition and were corner and middle struts.

4.05 Roof cover and decorative elements

Roof cover lost as discussed in 4.04. The terracotta traditional bell-shaped pinnacle (Newari: *gajura*) at the middle level was recovered in a badly damaged state with cracked and missing pieces. Another *gajura* from the upper level is lost. In addition, the pinnacle terracotta base is completely damaged.

4.06 Interior

All floor tiles were broken or displaced in the inner sanctum. The main idol of Vishnu was stolen about 20 years ago.



Existing roof struts from middle level



Existing roof struts from upper level



Existing roof struts from upper level



5.0 RECOMMENDED WORK

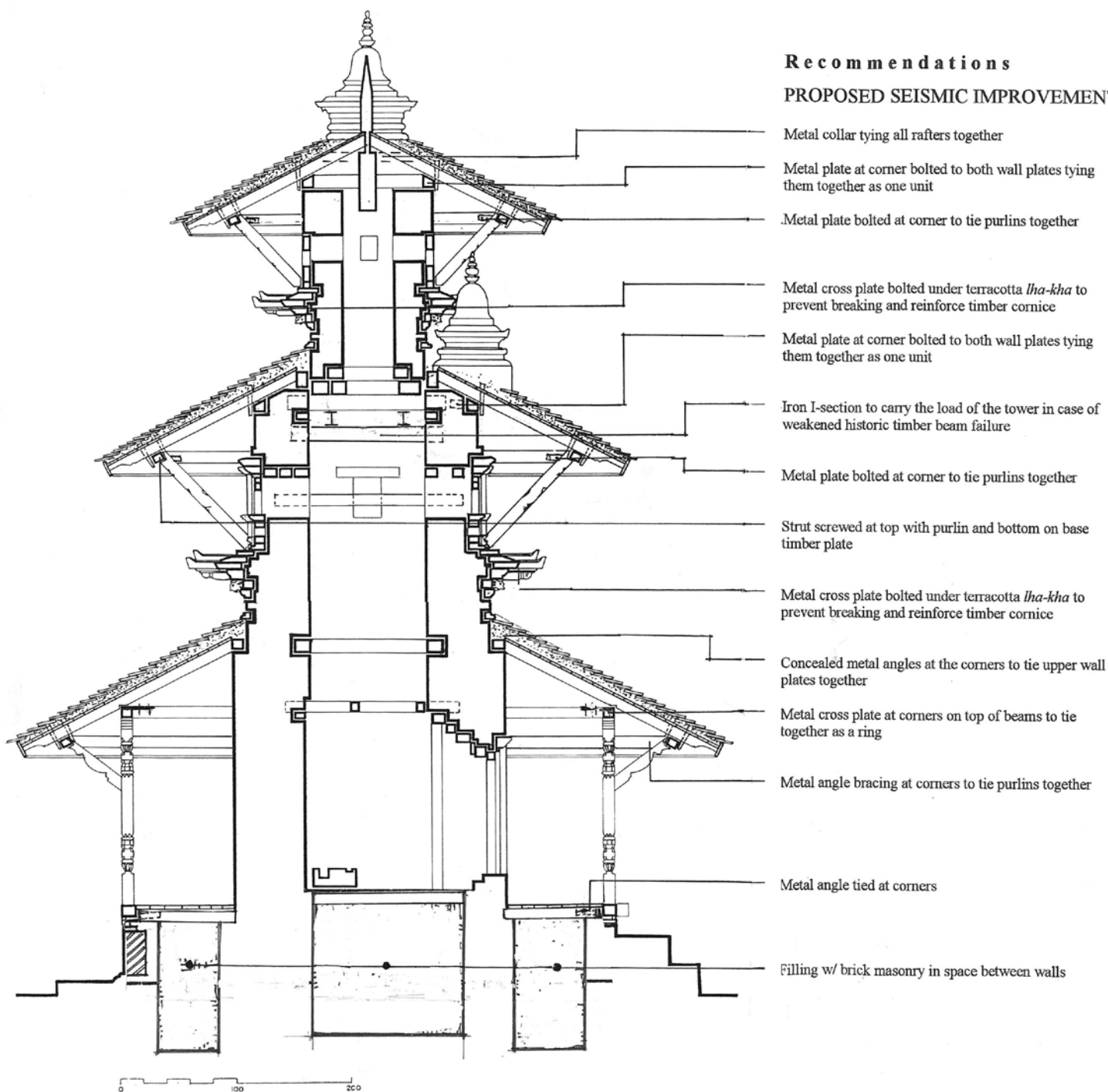
- 5.01 Foundation/wall structure and timber colonnade
- 5.02 Wall fabric
- 5.03 Wall openings and decorative elements
- 5.04 Roof structure and struts
- 5.05 Roof cover and decorative elements
- 5.06 Interior

5.01 Foundation/wall structure and timber colonnade

General seismic reinforcement issues

Earthquakes are a fact of life in Nepal. The most recent major devastating seismic event in Nepal took place in 1934 and the effects are still seen today in damaged buildings throughout the Kathmandu Valley. Any local restoration project must consider both the reinforcement of the existing structure and the introduction of new structural members to withstand earthquakes. This effort is balanced against the desire to maximize historical fabric and configuration. Based on past experience with other pagoda structures of this scale, the Kathmandu Valley Preservation Trust employed seismic strengthening techniques that are largely small scale interventions that respect and retain the historic fabric and configuration.

As a model for Kathmandu Valley Preservation Trust reinforcements the Uma Maheswara and Sulima Ratneswara Temple which was designed together with engineers Manohar Rajbhandari and Prayag Joshi were used. These temples although two roof configurations compared favorably to three roofed Tum Baha in terms of scale, size, and center of gravity. Interventions were limited to numerous small scale reinforcement measures in the timber roof structure to help the historical timber frame act as a brace for the overall structure. In addition, the maintenance of mud mortar was desirable both as a historical feature and for its damping effect during an earthquake. The mud absorbs the shock waves of the seismic event without fracturing adjacent bricks and other wall areas.



TUM BAHAN ARAYAN TEMPLE

SECTION EAST-WEST: RESTORATION
 PATAN DARBAR SQUARE WORLD HERITAGE SITE
 FALL, 1998

KATHMANDU VALLEY PRESERVATION TRUST

Foundation

In Tum Baha Narayan, the damaged plinth wall presented an opportunity for partial excavation of the foundation that provides much needed information on possible seismic strengthening schemes in future KVPT projects. Brick masonry, mud and, dirt were used in filling the area between and around the foundation walls. This recreates a large mass in the traditional plinth that may act as a huge shock absorber in an earthquake according to recommendations from Dr. Walter Mann (University of Darmstadt) during his inspection of Kulima Narayan temple restoration in 1998.

Strengthening of timber structural connections

During his visit in May 2000, Seismic expert Robert Silman praised the program of small scale interventions developed by the Trust to tie the structure together and resist earthquakes, the weakest points in traditional structures occur at the joints. Strengthening with concealed modern materials, while maintaining historic configuration is desirable in terms of both preservation and seismic issues.

The Trust uses sal timber for major members in any preservation project it undertakes. Pine is used for the roof rafters according to tradition.

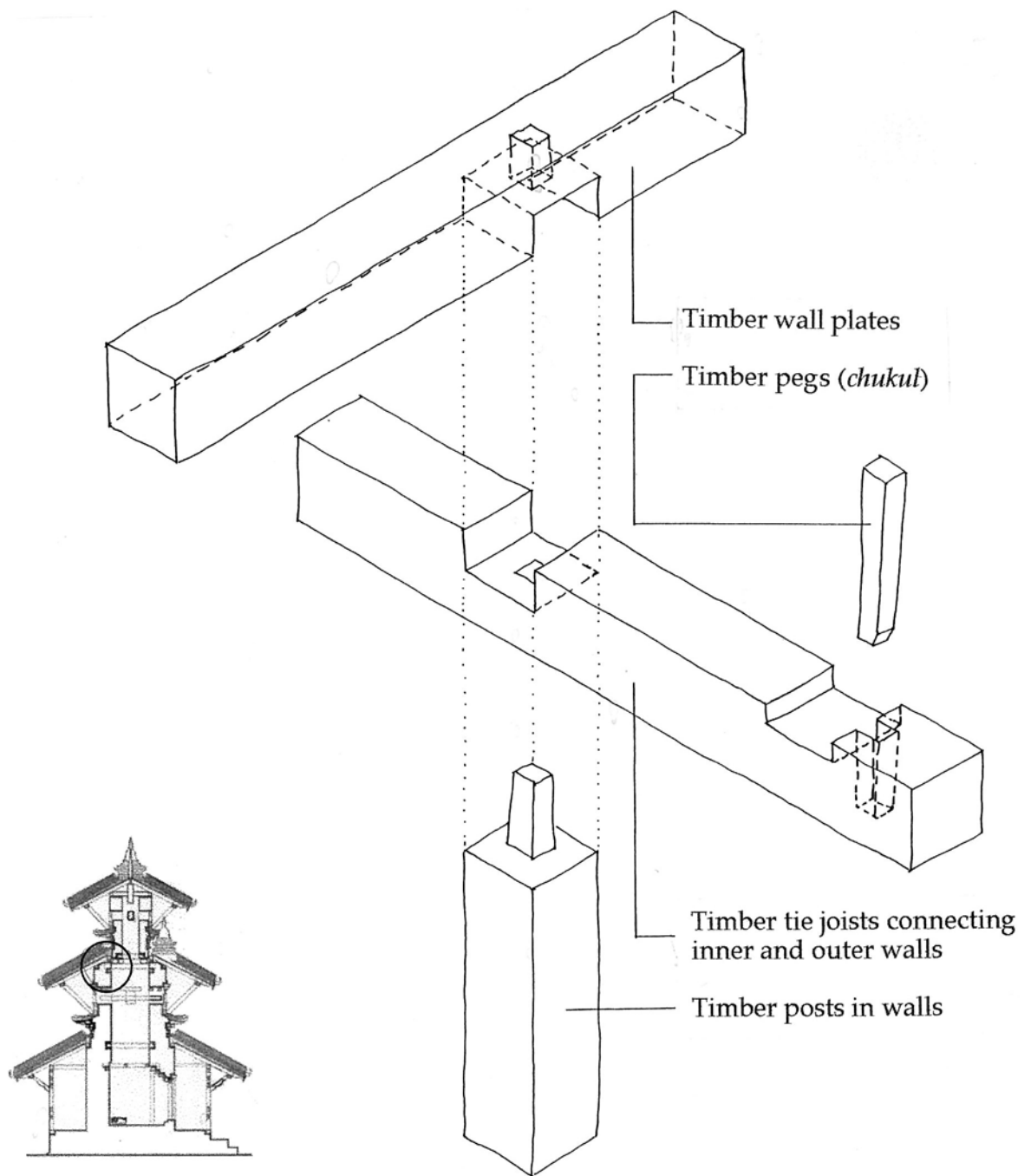
Connection between rafters and wall plates. In traditional structures the rafters are not notched to the wall plates and are simply held by timber pegs. Concealed bolting on every third rafter is proposed to improve the structural stability of the roof frame and wall plate connections. This can be considered a general strategy for seismic reinforcement.

Connection between inner wall plate and outer wall plate. The traditional configuration of double wall plates makes it easy to develop a timber horizontal ring beam of sorts by carefully sizing and joinery at the corners. In this temple there was no connection between the inner and outer wall plates, because these members were already damaged. During rebuilding the corner joints will be made with the traditional lap joinery but will also incorporate 3/8" thick steel plates to reinforce this corner. These plates will be made of iron painted with three coats of anti-corrosive paint. The additional joints between inner and outer wall plates use dovetailed joinery.

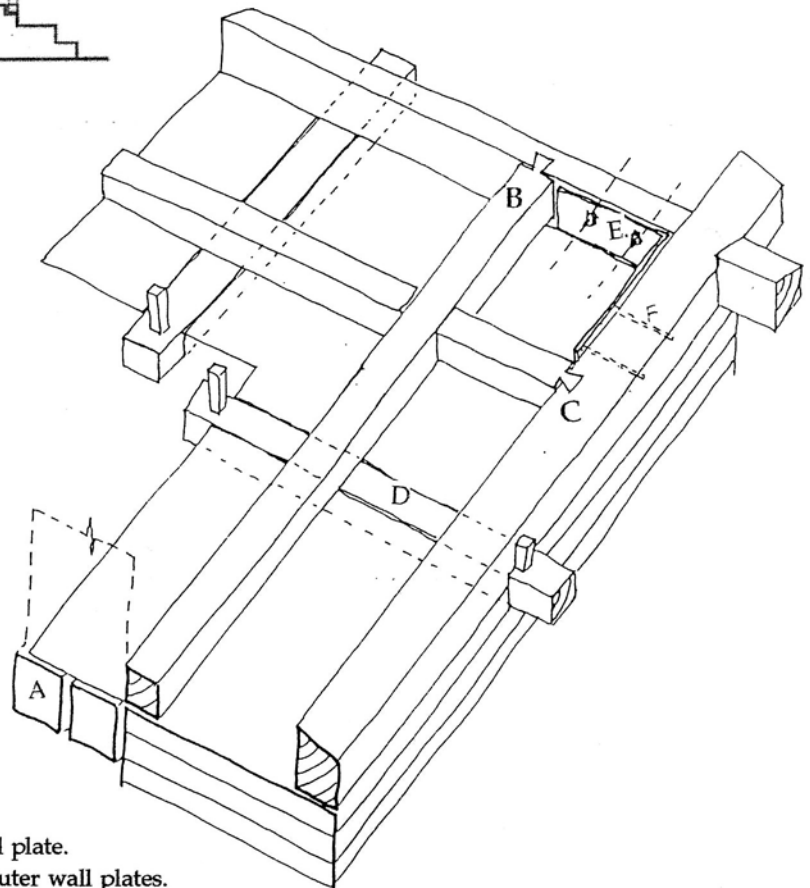
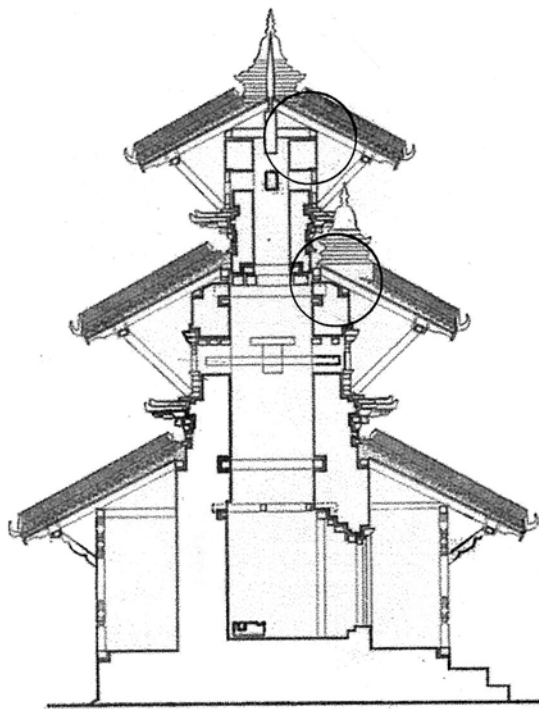
(Stainless steel components are not available in Nepal. Past experiences with imported stainless steel from India has caused delays of up to six months, while the risk of corrosion seems minor if the roof cover is properly maintained. Technical experts have concerns about the effectiveness of the anti-corrosion paint. We are therefore trying to solve the problem with zinc plating)

Connection between the rafter and purlin. The joint between rafter and purlin is a loose joint linked by timber pegs to prevent diagonal sliding. It is proposed to incorporate steel bolts in every second rafter to overcome vertical moment and improve overall rigidity.

Connection between purlin lap joints in the corner. This joint is much weaker than the wall plate joints and they have to bear extra load from the struts as well. It is proposed to

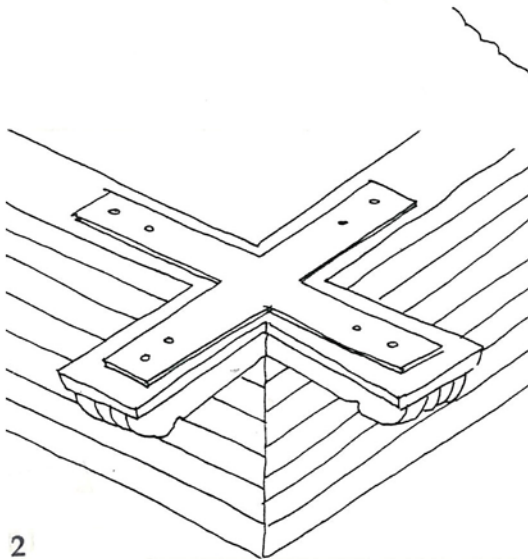


Typical traditional joinery: connection between timber post and inner wall plate



- A. Existing principal timber beam.
- B. Existing inner wall plate.
- C. Existing outer wall plate.
- D. Timber joining inner and outer wall plate.
- E. Steel collars tying together timber outer wall plates.
- F. Concealed bolting with outer wall plate and steel collar.

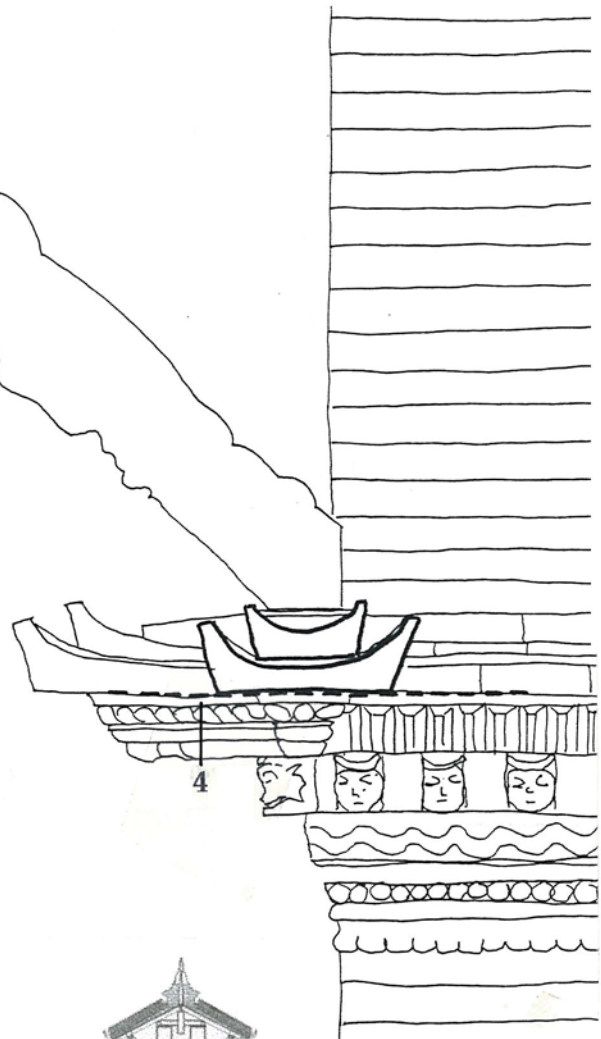
Reinforcement of wall plates: Axonometric view at wall plate level below the roof rafters. Metal collar connection in between the outer wall plates to improve the weak corner of a half-lap joint, which must carry the thrust of the rafters.



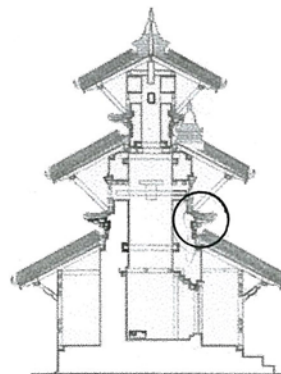
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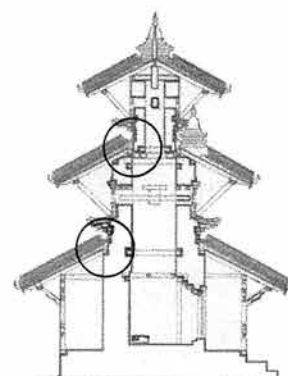
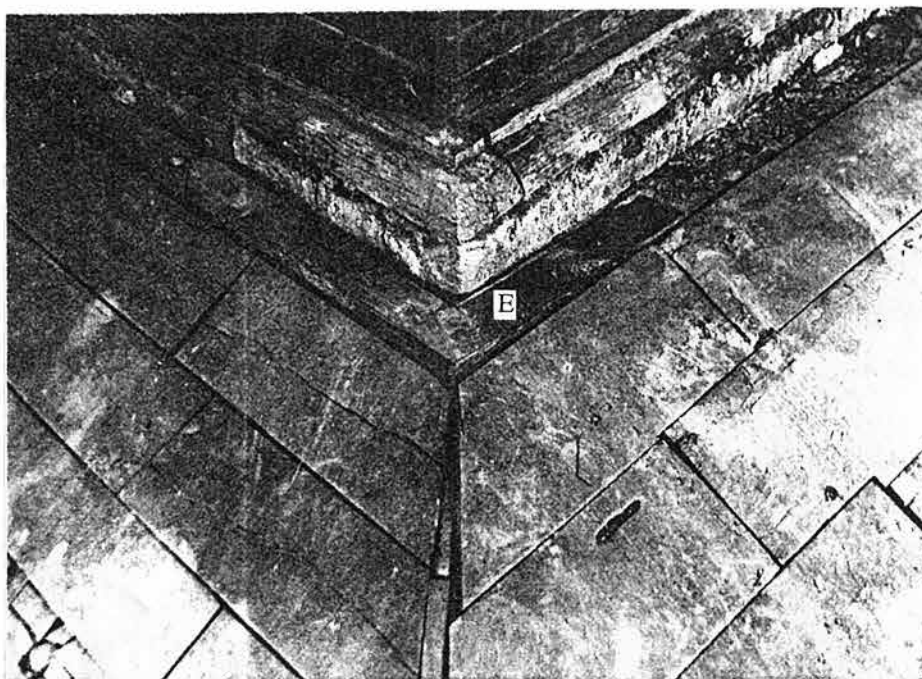
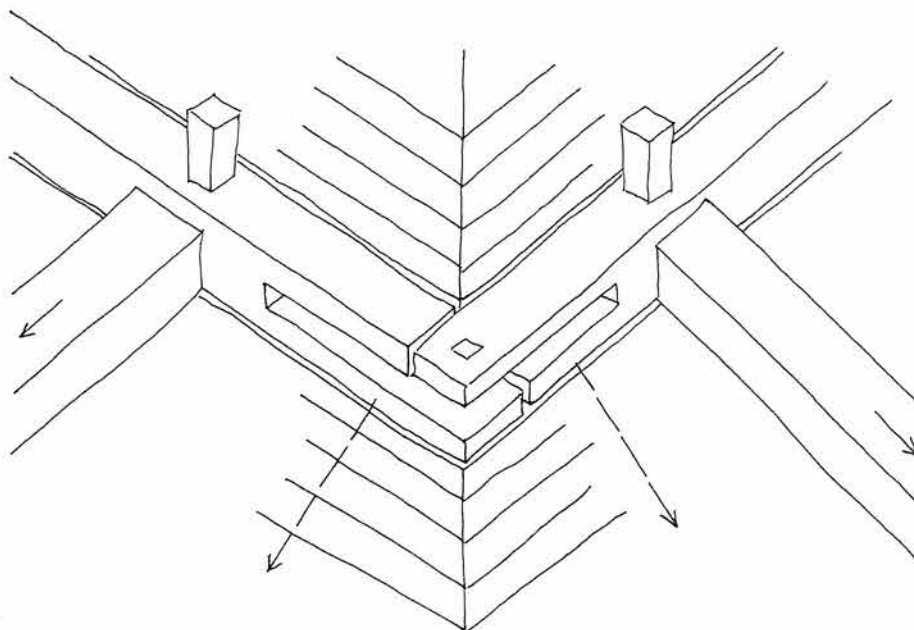
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Reinforcement of *Lah-Kah*.

Reinforcement of Lah-Kah

1. The corner strut rests at a point where considerable loads converge upon all three layers of the *lah-kah*. The lower and upper layer of the *lah-kah* are carved from wood. These sandwich a terra-cotta layer.
2. This shows the location of the proposed cross piece which will tie both pieces of the *lah-kah* together and , hence, increase the localised strength.
3. Location of proposed cross piece which is inserted between the timber and terracotta *lah-kah*.
4. The steel member is countersunk into the timber *lah-kah* thus keep the original proportions and configuration.



Reinforcement of the corner lap joint

1. The corner lap joint timber section is not sufficient to bear the load of the corner strut. If the corner strut is off center it is highly probable that the protruding timber end will break off easily.
2. To prevent this kind of failure a metal cross piece is attached to the joint. This improves the strength and allows the even distribution of local forces.

add a steel plate 2" wide and 3/16" thick in the same angle as the purlins to strengthen this connection.

Timber colonnade

The timber colonnade was rebuilt using the surviving four columns in good condition. Twelve new columns were created copying the existing examples and employed at the corners where structural loads are greatest. The weaker surviving columns were placed at the middle positions and contrast with the newer examples.

At the ambulatory level where the post meets the beam holding the lower roof there are sizable loads especially at the corners. The joint above the timber pillars of the arcade was identified as the weakest point by Robert Silman. A metal cross plate 2.1/2" wide & 3/16" thick at these weak corners ties them together creating a ring beam. Although the measures to create reinforced ring beams are desirable in terms of seismic consolidation, Silman has identified an "Achilles' heel" at the historical timber peg connection at the corners. There is still vulnerability to lateral forces of seismic event "kicking out" the timber column and shearing off the timber peg threatening the collapse of the lower of roof. Seismic strengthening of the historic pagoda temple configuration is an issue that deserves continued attention and experimentation in future projects of the Trust.

5.02 Wall Fabric

On the plinth wall the inappropriate *ma apa* brick and cement patches as well as mismatched rubble fill will be replaced with traditional *dachi-apa* using yellow mud mortar. The two missing base stone for timber posts (Newari: *iloh*) will be made and replaced. At upper levels the multiple layers of damaged brick corners will be repaired using *ma-apa* and yellow mud mortar. Several bricks at the ground level corners that are damaged were replaced individually by "piecing-in" without dismantling the wall. Particularly at the middle and upper levels where missing *dachi-apa* shall be replaced and rebuilt back to the historical configuration. Where rebuilding of the wall occurs, the brick will be laid interlocking in yellow mud mortar from the outer face to the inner wall face. The most rebuilding occurred at the middle roof portion where a tree had taken root and the entire root system was removed.

At the corners of the brick wall some of the missing and damaged *lah-kah*, or extended terra cotta cornices will be replaced and repaired. As in the case of the decorative carved windows, the *lah-kah* are identical and therefore able to be copied and recreated based on surviving examples. Sandwiched between the *lah-kah* and the timber cornice are steel plates bolted to both and reinforcing the traditional timber cornice that acts as a ring beam. Such interventions that embrace traditional elements in seismic performance deserve ongoing investigations and experimentation by the Trust.

5.03 Wall opening and decorative elements

Strut Repairs

Prior to installation of the four surviving struts, they shall be cleaned with plain water and soft toothbrushes. Since there is no documentary evidence of the location of the two surviving struts from the middle level it was decided to place them at the south-west corner. This is the most visible location on the temple and will contrast in appearance with the newer adjacent struts.

At the upper roof the location of the two recovered struts is documented. And shall be installed in their historic positions after cleaning.

Lost struts and new carving

In past projects of the Kathmandu Valley Preservation Trust the question of whether and how to carve replacement roof struts constitutes the principal design/restoration challenge of the project. The decision to carve new iconographic members is a philosophical question deserving ongoing debate and experimentation. In Tum Baha Narayan the opportunity to copy existing decorative elements as well as to design/carve new struts based on surviving examples was presented.

In the case of the decorative carved window (Newari: *ga-jhyah*) evidence existed that allowed for new replacement carving. The four *ga-jhyah* facing the cardinal directions were identical in design. Lost fragments of one window were identified in the other allowing for accurate copying.

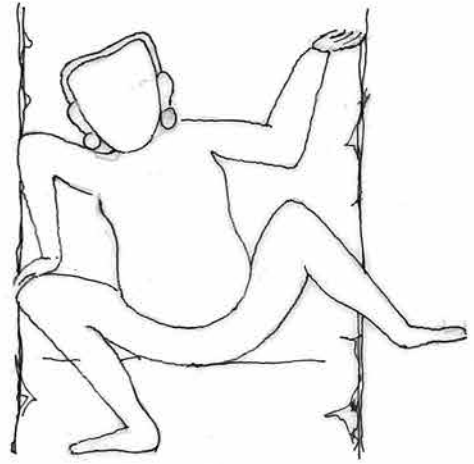
The lost and stolen struts will be replaced by new carved struts, which followed the design of the surviving examples. There is no other documentation of the original, although the iconographic program of the struts is determinable. As at nearly all Narayan temples, the 10 incarnations of Vishnu are represented as the cycle of struts. This exercise is undertaken as a means to support the local craftsmen. The new struts will be dated in verso by the carvers and installed together with the repaired historical members.

The opportunity to develop support of contemporary craftsmanship was identified at Tum Baha Narayan. We encouraged the craftsman and documentation team to design new variations within the iconographic and compositional formula of the surviving examples.

The generated options concentrated upon the figures at the lower portion of the strut. The upper figure, various incarnations of Vishnu are documented and reproducible. Thus the exercise addressed the portion of the strut where the artisans are traditionally given artistic license.



Above: examples of different variations created by Kathmandu Valley Preservation Trust with Master woodcarver Indra Kaji to fill the lower portion of the strut of indeterminate design.



Above: examples of different variations created by Kathmandu Valley Preservation Trust with Master woodcarver Indra Kaji to fill the lower portion of the strut of indeterminate design.



Above: examples of different variations created by Kathmandu Valley Preservation Trust with Master woodcarver Indra Kaji to fill the lower portion of the strut of indeterminate design.

5.04 Roof structure and struts

The entire roof structure shall be restored to the historical configuration. Although the majority of the roofs had collapsed, there was enough surviving historical members on the middle level to determine the roof length on one side. Because the pagoda roof is symmetrical, the complete roof can be reconstructed.

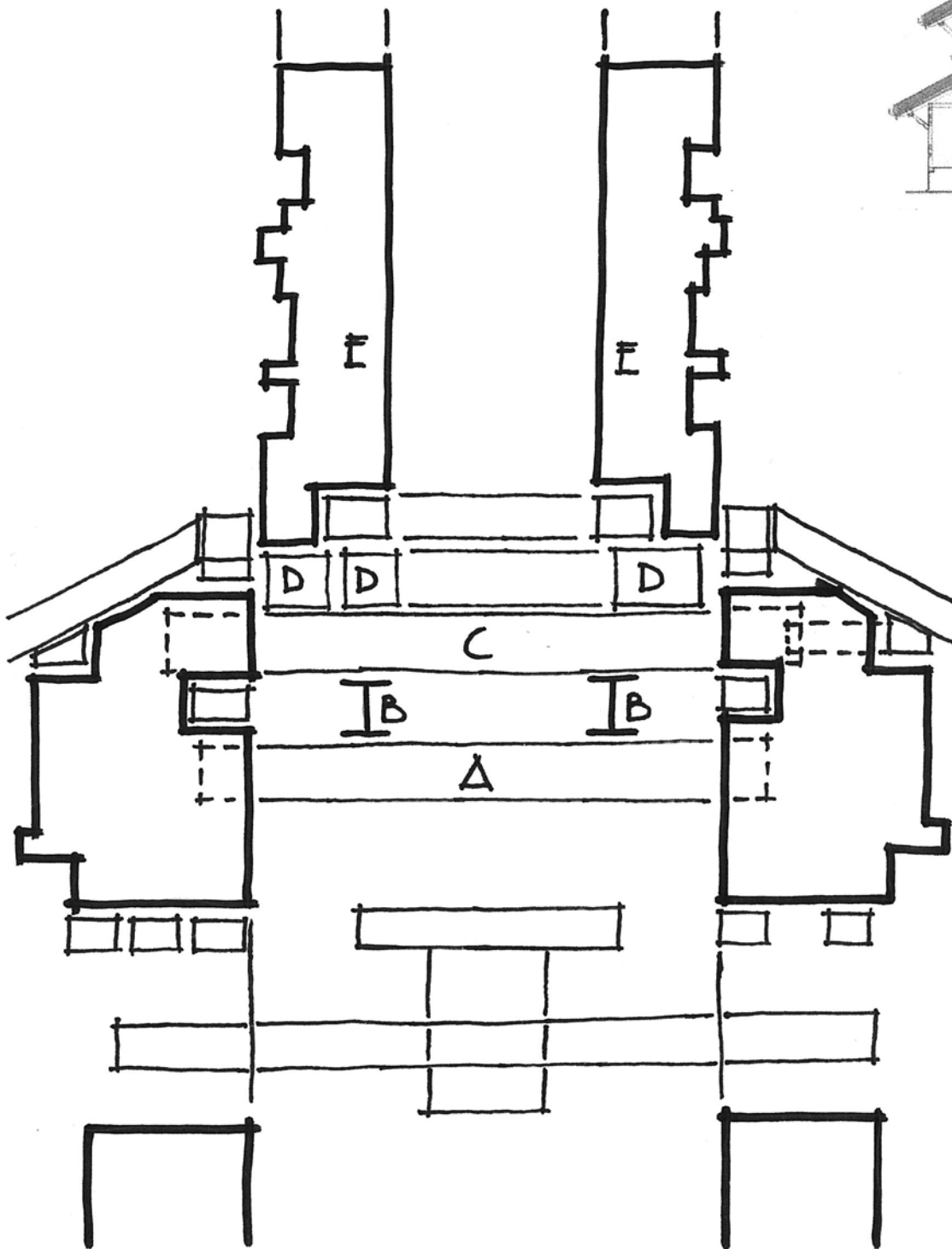
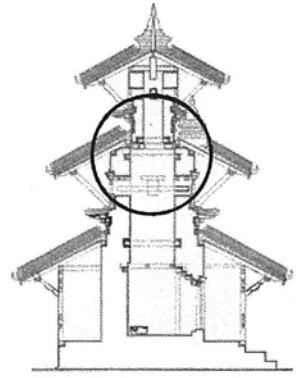
The roof rafters will be made of pine timber as was consistent in historical roofs. Whenever possible the Trust employs sal timber because of its proven resistance to termites and fungal growth, however in this case the substitution of pine with sal would be inappropriate.

The traditional joinery techniques for the fixing of rafters are limited to the use of pegs. Seismic consultant Robert Silman identified the strengthening of the weak points at the joints as critical for seismic consolidation. To improve the structural integrity of the roof frame, which must carry loads of up to 300 kg/sq. m., every third rafter shall be fixed to the wall plate using a concealed bolt, and every corner wall plate shall be joined with a steel plate to increase the strength of the lap joint. The sizing of the metal angles are based upon the structural calculations made by Manohar Rajbhandari. The bolts will be stainless steel imported from India or steel pre-painted with anti corrosive paint.

A metal collar tying all the rafters together at the upper roof was successfully implemented. Interventions using metal to reinforce the historical timber configuration at Tum Baha Narayan are modeled after previous projects by the trust. This as well as the creation of a metal reinforced ring beam at the wall plates at the lower roof evolved from experiments at Uma Maheswara Temple.

Iron I sections at the middle roof were used to carry the load of the tower in the event of historical timber beam failure. This technique is desirable because it reinforces the existing historical timber without replacing it. The restoration design of Radha Krishna also provided model details for securing the upper roof from collapse. In both the cases the temples have similar three roof configurations. Where exposure to elements due to lack of roof had weakened the existing timber beam supporting the tower requiring this solution saving existing historical material.

The struts were screwed into place both at the top where they meet the purlin and on the bottom where they meet the base timber plate. This further reinforces the historic connection providing for better seismic performance and also a deterrent to theft.



- A. Iron I-section to carry the load of the tower
in case of weakened historic timber beam failure
- B. New steel beams to carry top level walls/roof
- C. Existing principal timber beams
- D. Existing secondary timber beams
- E. Uppermost temple level walls

Reinforcement below upper temple level: Section detail at wall plate level below middle roof rafters.

5.05 Roof cover and decorative elements

Gajuras

The two new decorative traditional bell-shaped pinnacles, were recreated based on documentations, including pre-roof collapse photos and drawings made by the Trust and the surviving *gajura*. The terra-cotta decorative surrounds were recreated and restored to their original positions. The *gajura* from the middle roof was recreated in terracotta like the original. The *gajura* from the upper roof was recreated in copper as is traditional for such a temple. Even with the benefit of photo and drawing documentation, many judgment and design decisions were determined after much discussion among the artisans and the architects. The international preservation community should recognize that attempts to "scientifically" reconstruct a three-dimensional structure based upon two-dimensional documentation inevitably results in artistic judgment by those involved.

Roof cover

The formula for roof cover has been developed over the years by various international projects. The general principle is well understood--introduction of a waterproof membrane under the mud bed to extend the life of the roof. Our experience shows that the careful supervision of the various work components (mud treatment, Batten installation, etc.) is the most critical determinant of the roof's life.

Roof tiles/*jhingati*

Experience gained from past projects has shown that the quality of new tiles is inferior to that of old. It is thus worth the effort and expense to find and clean old *jhingati* for use in the restoration of the roof. When suitable tiles have been found they are first soaked in water then cleaned using wire brushes. Given their present age and durability there is no need for chemical treatment, an appropriate measure for new tiles to reduce their absorption.

Specialty tiles (stacking ridge tiles and corner oviform tiles) shall be custom ordered due to the unavailability of historic pieces. The shorter life span and tolerance to moss growth can be increased with siltrate treatment. Each tile is to be slaked in siltrate solution (1:9 ratio) for 2 hours and then allowed to dry. The stacking tiles (which run the length of the ridge, down to the corner) are susceptible to slipping. A concealed copper wire and nail shall be used to prevent this movement.

The bottom-most layer of tiles (above the eaves board) are pre-drilled and attached to the planking below using nails whose heads have been removed, this enables the replacement of broken tiles, at a later date, without the need to remove any of the upper tiles. This detail was developed in the 1992 RadhaKrishna restoration project shall be repeated here.

Mud bed

The supervision in the digging of the yellow mud and its subsequent treatment with Karmex herbicide will be critical in the efforts to control vegetal growth. The removal of mud at a depth greater than three feet ensures the absence of vegetal particles within the mud. the treatment with Karmex should follow the manufacturers instructions diligently. The Karmex available today, an Indian product, has been found inferior to the French Karmex used in the UNESCO Hanuman Dhoka project (1972–76). in previous restoration project the use of Indian Karmex has resulted in vegetation growing especially on the less sunny North side.

Moisture barrier

Since the Hanuman Dhoka restoration project (1976), the employment of Indian tarfelt as a waterproof membrane has been standard. The heated bitumen is coated on the planking, between the two layers of tarfelt as a waterproof membrane is, however, a potential weak link in the rebuilt roof cover. The study of previous projects has shown the maximum life span for Indian tarfelt to be only fifteen years.

First proposed for the Sulima Ratnesvara project and to be employed on this project as a more long-lasting membrane is the imported "Plasfal" new to the Kathmandu Valley. A synthetic elephant skin, it had the advantage of being easier to install on the planking (it is more flexible and not temperature sensitive). It is supplied with its own waterproof glue. Its life is projected at a minimum of 20 years and may reach 30 years or twice that of the tar felt.

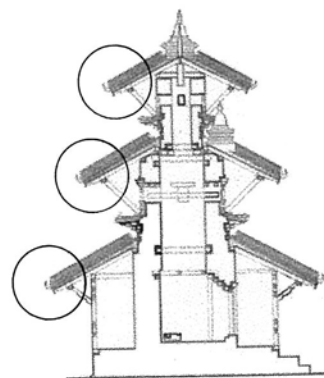
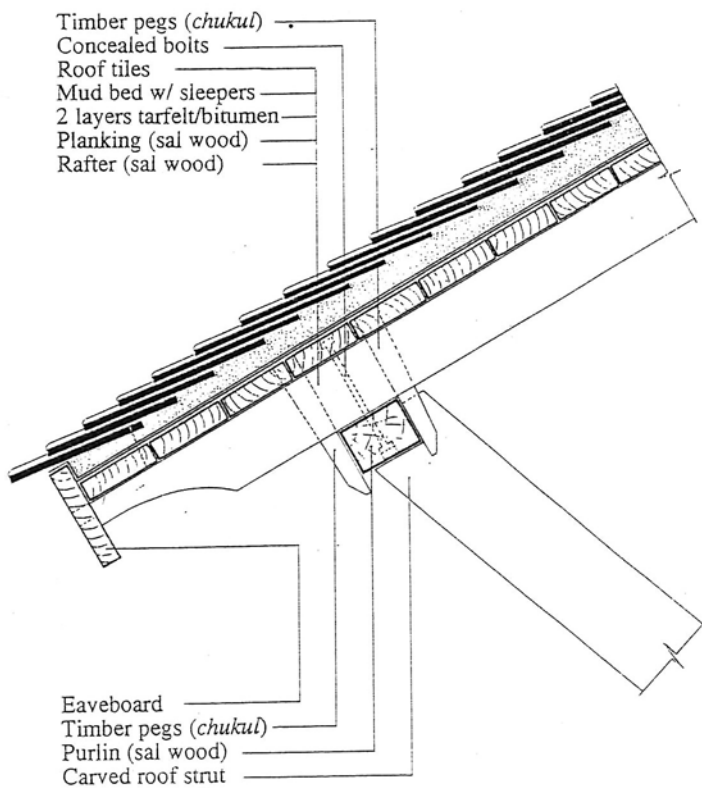
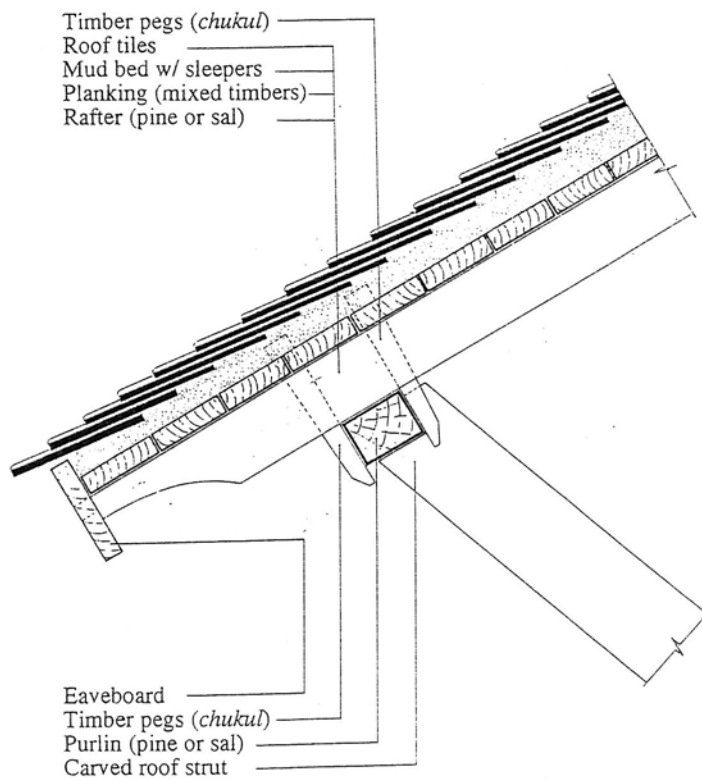
Above the membrane, the battens will be provided (a traditional key to grab the mud bed above). They shall be painted with the multiplast glue to protect them from water damage and minimize seepage through nail holes. The battens must be laid in a diagonal sloping pattern to allow water to flow off.

Planking

The typical solution of restoration projects in the last two decades substitutes planking for traditional lath of scraps and bamboo ends. Although ahistorical, the planking is more moisture resistant and contributes to the rigidity of the roof structure, a critical issue in light of seismic strengthening. All planks will be 1" thick sal wood in random widths and lengths, fixed to the rafters with galvanized nails.

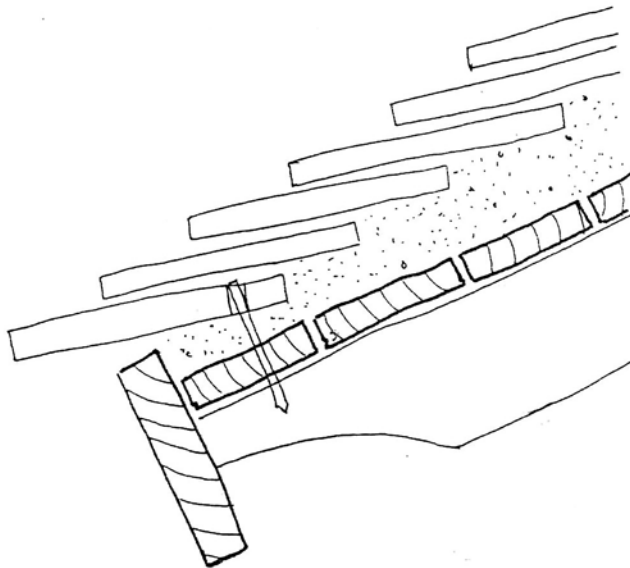
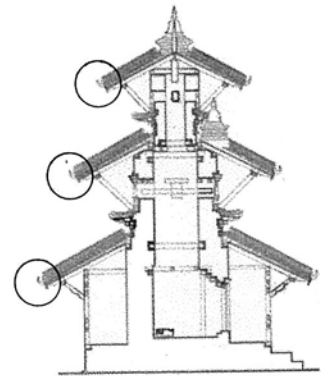
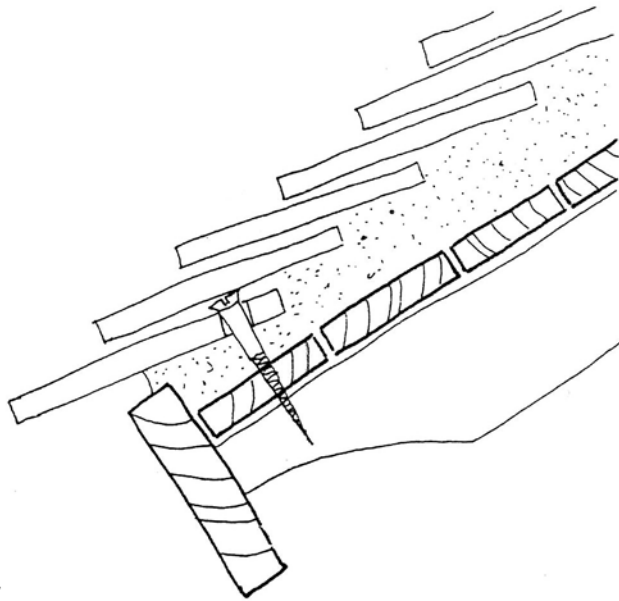
5.06 Interior

Traditional telia tiles (6"x 6") shall be installed as a new appropriate flooring installed with proper slope and a repaired drain.



The KEY Problem.

Section at roof overhang: traditional and improved detail.



Improved detail for fixing the first row of jhingati (roof tiles) on the roof

Top: Typical detail with half of the jhingati in the first row overhang the eaves board. Once the first row falls away further loss continues above. In the Hanuman Dhoka Restoration Project the first row of jhingati were screwed into place to prevent loss. After some years many jhingati were lost. Replacement, however, was difficult, due to the screw heads which must be removed before jhingati replacement can be undertaken. Bottom: Improved detail with the first row of jhingati fixed with headless nails. If it becomes necessary to replace jhingati one simply lifts the second row of jhingati to insert replacement onto headless nail

6.0 RECOMMENDED MAINTENANCE

Maintenance in Nepal is a challenging question with no easy answers. Theoretically any future work on this temple will have to be approved by the Department of Archaeology, although in practice government authorities are not even able to control demolition of historic structures in the World Heritage Site, let alone specific maintenance practices. Thus, the first job of the conservation architect in Nepal is to build not only the Department's technical resource, but also the public awareness that old buildings need care and professional expertise.

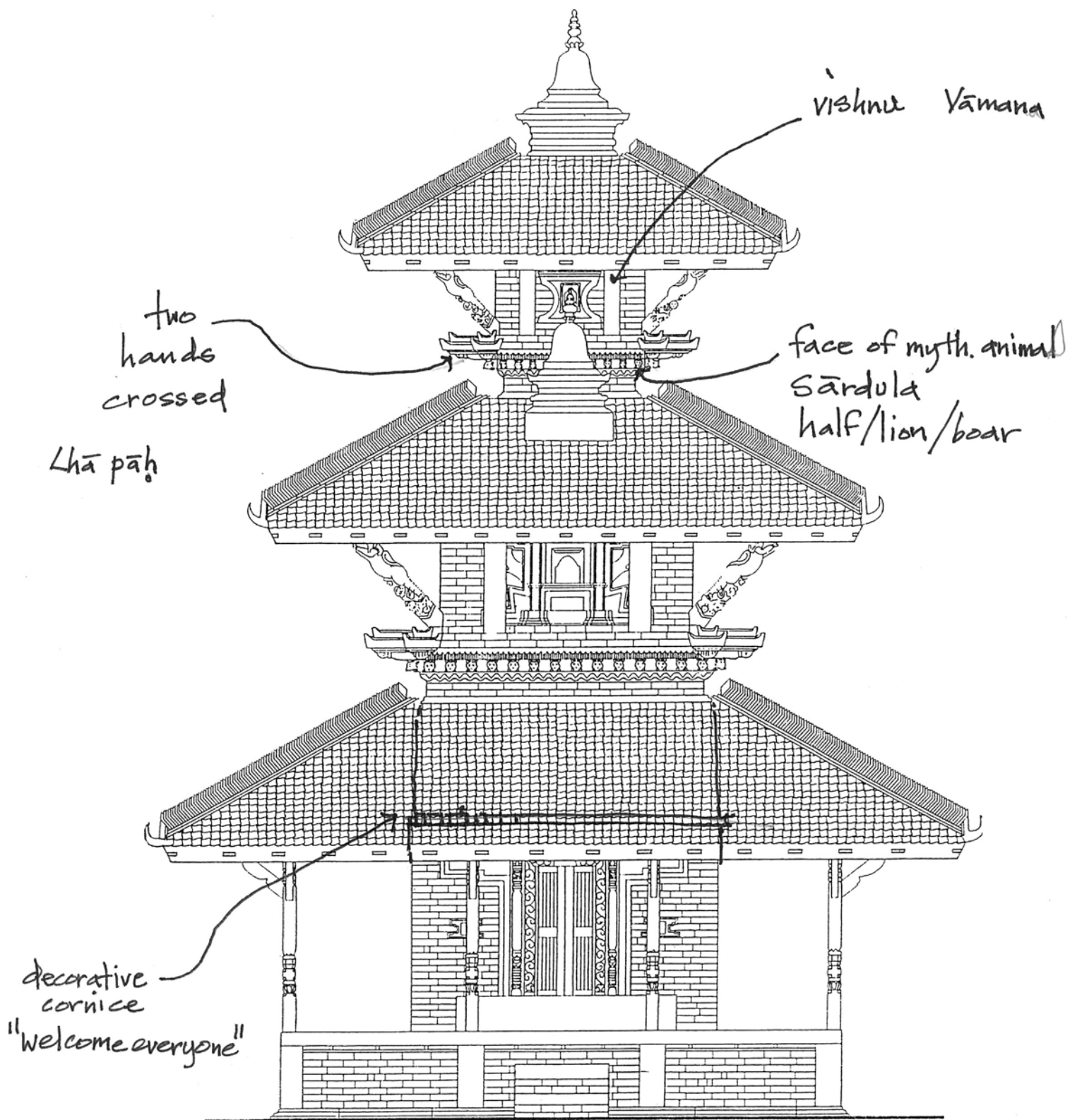
The following is an outline of what recommendations the Department could issue to persons wishing to maintain an historical building:

- i. Roof maintenance. Roof damage must be corrected as soon as possible to prevent related timber and structural damage. During repairs of the traditional tile roofs, great care must be taken not to damage other tiles. We recommend that only tile layers (Newari – *awah*) be used for any work on the roof – even the removal of vegetation – as they only have the sensitivity to realize when a tile has been broken when stepped on. And they have the skills to be able to repair it on the spot.
- ii. Timber carved elements. No paint, varnish, or treatments other than the traditional linseed oil. Current fashion is to paint everything black.
- iii. Wall repairs. No cement mortar anywhere. The problem with cement or *surkhi* mortars is that they are largely irreversible, i.e. while removing them bricks or stones are generally broken. The salt content of cement mortar reduces the life of these traditional building materials. Despite these facts, cement mortar is the norm.
- iv. Brick walls. No paint, mud wash or lime wash. Clean with soft bristled brushes.

APPENDIX

A. Iconographic field notes

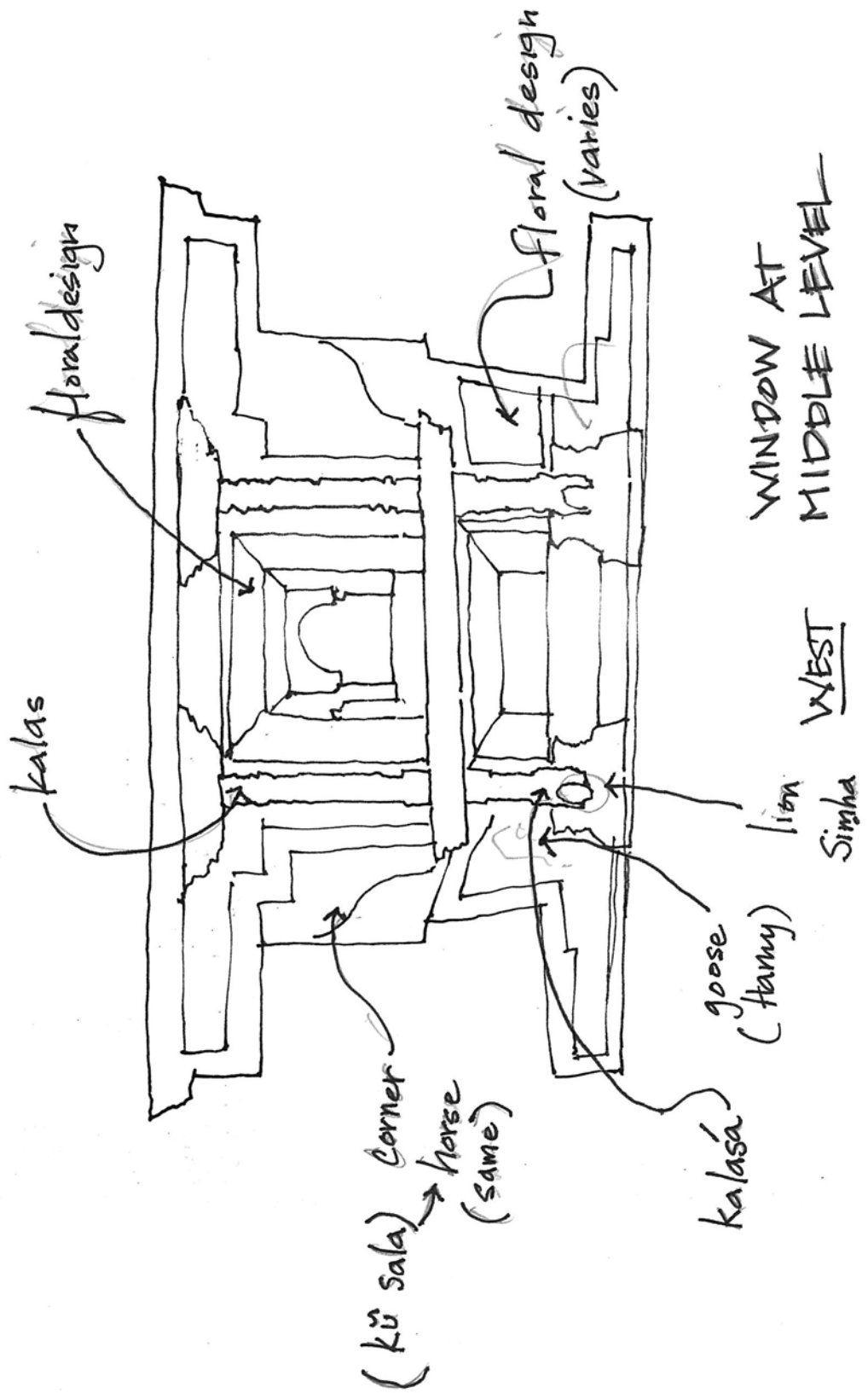
Martin Lee and Nutan Sharma

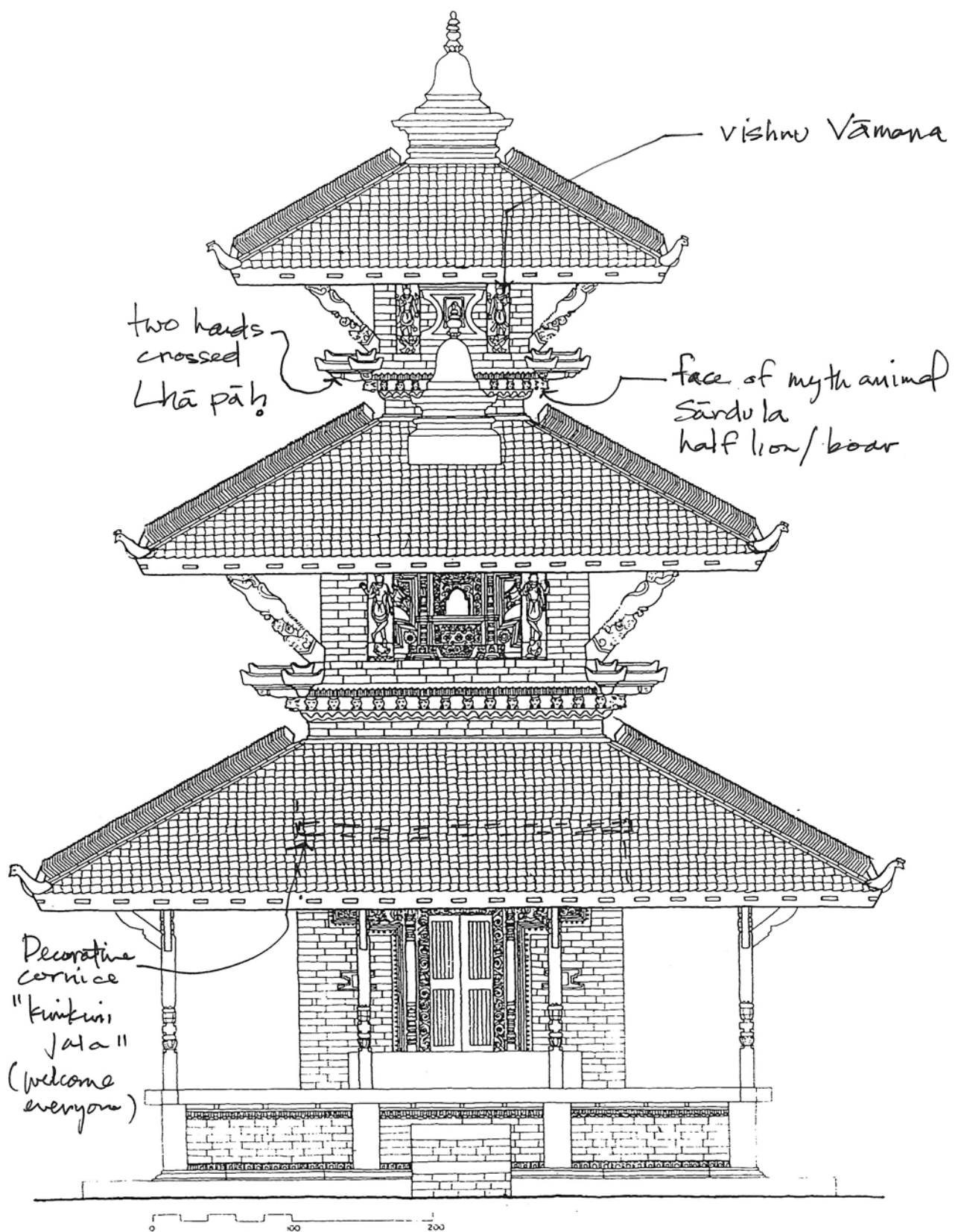


Kimkini jāla

0 100 200

TUM BAHANARAYAN



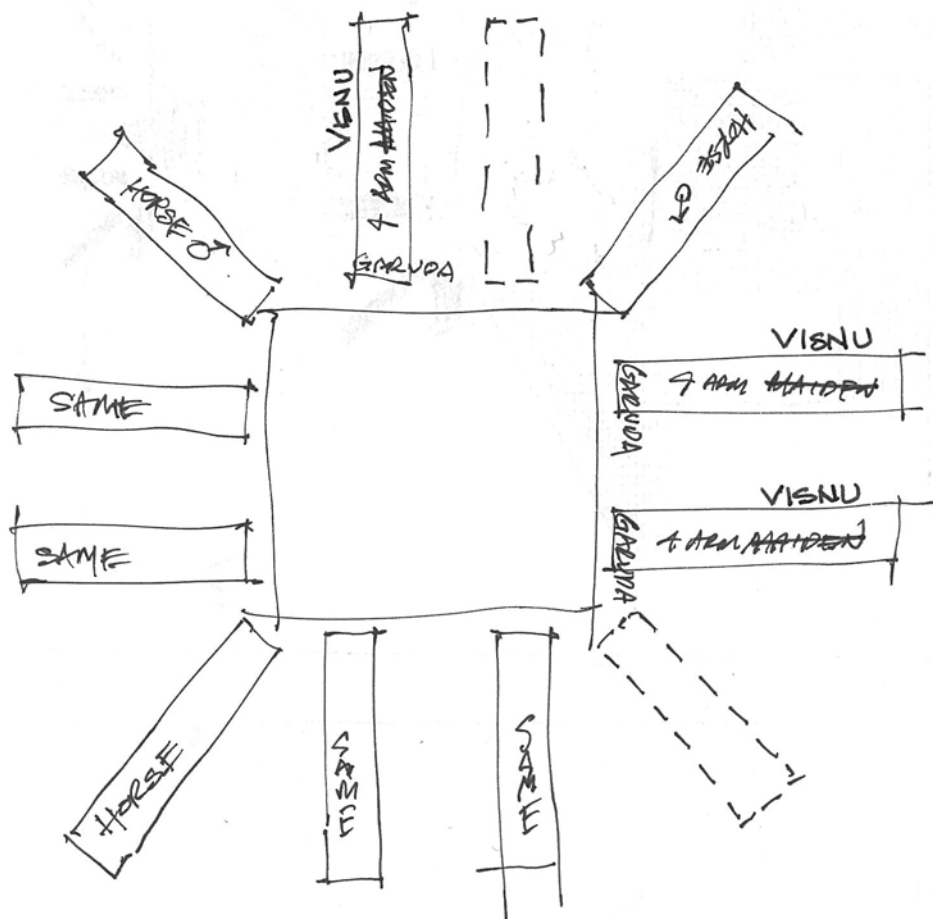


TUM BAHANARAYAN

PROPOSED: PRINCIPAL ELEVATION

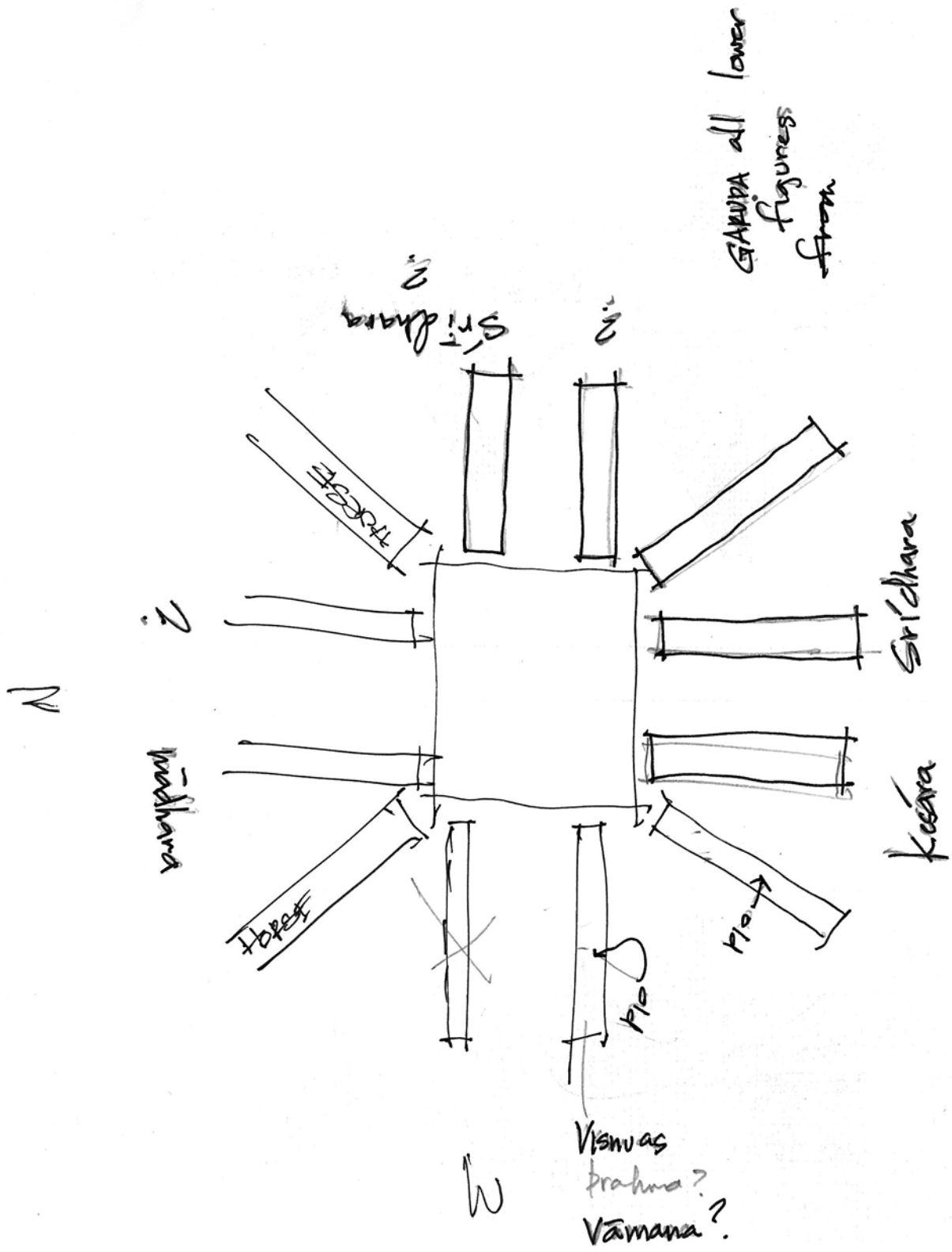
PATAN DARBAR WORLD HERITAGE SITE
KATHMANDU VALLEY PRESERVATION TRUST

N



N

UPPER ROOF



2nd level

Nutan Sharma
27.07.2000

Provisional Translation of Sanskrit text:

Obeisance to venerable Vāsudeva (an incarnation of Vishnu). Obeisance to Nārāyaṇa (Vishnu) [who] saves from the hellish sea (Navakāṇava).

Who is spread over the three worlds (heaven, earth and hell)... .. O' Madhusudana (Vishnu), protect us please .

Established on Wednesday, the bright half of the lunar month of Vaiśākha , [Nepal] Saṃvat 696 (A. D. 1575).

Translation of Newari text:

Since his son Deva Bhāro died in a landslide, Luṃg Bhāro of Tvaṃ Vahāra (Tuṃbahā) established in the name of the [his] dead [son] the icon of Umāmaheśvara against the wall of Siddheśvarī [temple] after consecrating fine-sacrifice in Vārāṇasī (Benaras).

After coming back on the 13th day of the bright half of the lunar month of Vaiśākha, Wednesday when [occured] the constellation called Hasta and conjunction called Harsana, on this day, in Tvaṃbu (Tuṃbahā) square, the three storied temple was built in the name of Late Deva Bhāro, the golden (gilt) pinnacle was offered and [the icon of] Vishnu was established. While digging for the foundation of this God(temple) a well was found. [Thus] After the renovation of the well, after the floor was leveled, the temple was erected. In order to worship this God of the temple, to offer a charity to a priest in the name of the dead person (*Nisrāva*), to offer lamps, the income of the field called Ādibū is kept. The priest is honorable, Brahmana Phyākadeva of Maṇichē (Mangal Bazaar), the instructor is honorable Devasiṃha of Vakhanimha (Balima Tol of South-western part of Patan). The astrologer (Daivajña) is Jiva Saṃkha Bhāro. The Ācārya (literally 'master' –acts as an assitant to the priest) is Chukala Hāku Bhāro, [his] son Lumgu Bhādro [and] Hāku Bhāro who are the Pātravaṃśarābuta (nobles) of Tvaṃbahār (Tuṃbahā). May the grandson Deva Bhāro reach in heaven (Vaikuṇṭha) through [these] different types of virtues. The carpenter (*karami* kahmi) of the god's work (construction of the temple) is Lugudu Bhāro. This task was completed during the reign of Śrī Jyeṣṭhavihāla Yaṃkuli; Śrī Jaya Narasiṃha Deva Thākura (the King of the then Patan). May all be well.

Document (on the Gajendramokṣa Nārāyaṇa temple of Tumbahā) # 1 Stone Inscription¹

- १ ॐ नमोभगवते वासुदेवाय ॥ नारायण नमस्तेस्तु नर
- २ काराणवतारण । त्रैलोक्य व्यापिता***त्राहिमां मधुमूदन ॥
- ३ स्वादुतन्द्रस वर्षे वेशापे*****॥ शुक्लपद्मे च ह
- ४ स्तयर्क्षे स्थापनं बुधवासरे ॥ ॥ श्रेयोऽस्तु ॥ सम्बन् ६६६
- ५ पौषकृष्ण ॥ नवमिकुन्द, वाराणसीस, सिद्धेश्वरीया, अंड
- ६ स लिधनकं, उमामहेश्वर प्रतिमा थंडाव, यज्ञयाचकं त्वं
- ७ बाहार लुंगु भारोनं काय देवभारो चंलन****नक याव
- ८ मोकयातं नामनं थापना याङ ताथरतो ॥ लिहावयाव वै
- ९ शाप शुक्ल ॥ त्रयोदशी ॥ हस्तनक्षत्र ॥ हर्षनयोग ॥ बुधवा
- १० र ॥ अवकुन्दु त्वं वु लाछेस, सएव देवभारोयात नामनं
- ११ स्वत पोलोल देवल दयकं, लुंगजुडिझास्यं, विष्णुमथा
- १२ पनयाडादिनजुरो ॥ अवदेवतया निहङ्गुल, तुथिलुया-
- १३ व, तुं थिदयकं वंळ्याडन देवलदंडाजुरो ॥ अवदेवल
- १४ यातं देवपूजा, निश्राव, मतयात आदिवु आय दुंतया
- १५ जुरो ॥ पुरोहित मडिछे द्विजवर श्रीफयाकदेवजु, उप
- १६ देस्तावखनिह्मा श्री देवसिंहजु । दैवज्ञ यो यका—जि
- १७ व संख भारो, आचार्य लु क ल हाकुभारो ॥ यजमान
- १८ त्वंवाहार पात्रवंशरावुत दोयभारो, पुत्र लुंगुभारो
- १९ हाकुभारो ॥ अनेन पुन्येन पौत्र देवभारो—वैकुण्ठ
- २० प्राप्तिरस्तु ॥ देवज्यायाक क्रमि लुगु डुभारो ॥
- २१ अवतेकर्मयाडा श्री ज्येष्ठविहाल यंकुलि श्रीज
- २२ य नरसिंह देवठाकुरस प्रज्याया जुरो ॥ शुभ ॥

¹ D. R. Regmi, *Medieval Nepal*, part IV (Patna: The Author, 1966), pp. 32-33.



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