NARAYANA TEMPLE

KULIMA, PATAN

HISTORIC STRUCTURE REPORT

KATHMANDU VALLEY PRESERVATION TRUST
MARCH, 1998

A Model Project
sponsored by Studiosus-Reisen, Munich / Germany
implemented by the
Kathmandu Valley Preservation Trust
in collaboration with
His Majesty's Government of Nepal - Department of Archaeology and Patan municipality

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KULIMA TOL - PATAN

Existing Condition: November 1996

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Delineation line

Patan Durbar Square- Monument Zone
(Properties outside but adjacent to
the boundary line are included)

Kulima Narayan Mandir

KULIMA TOL - PATAN

PATAN : CITY MAP

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

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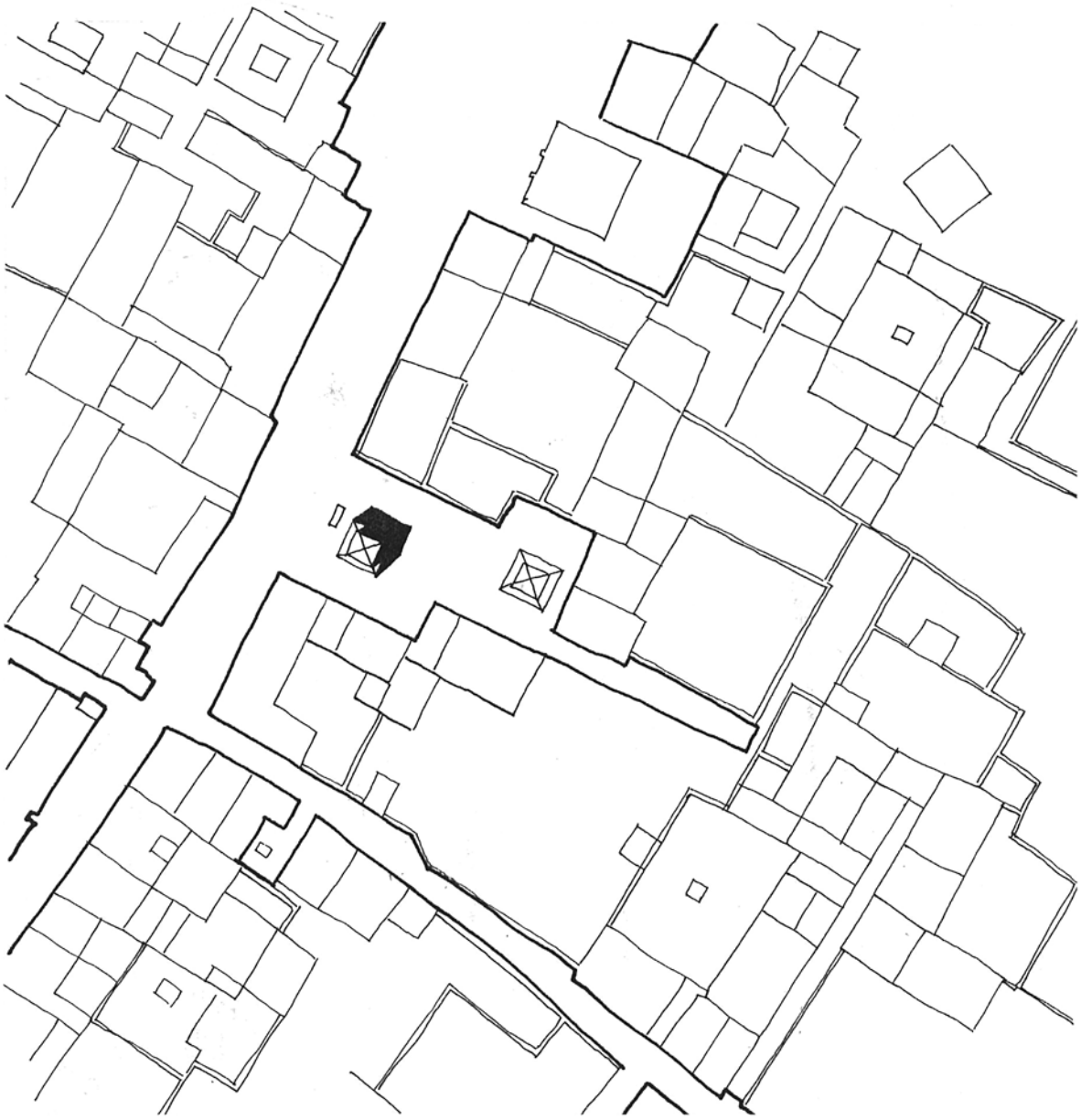


Kulima Narayan Mandir

KULIMA TOL - PATAN

KULIMA TOL : SQUARE AND ENVIRONS

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

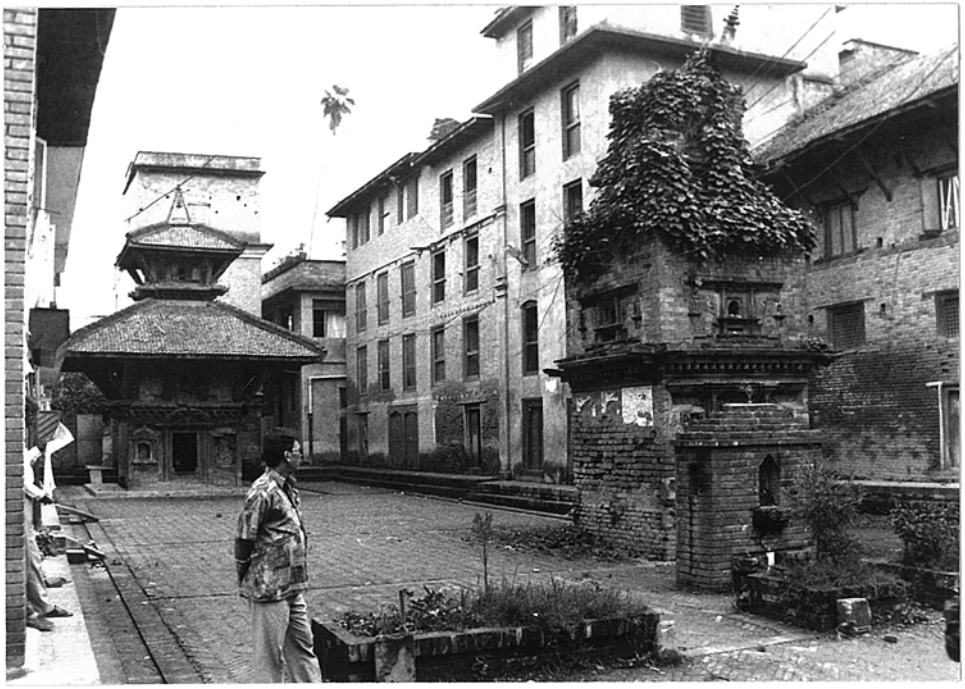
0 10' 50' 150'

1.0 INTRODUCTION

The Kulima Narayan Mandir, a fine example of a well proportioned, double-tiered brick and timber temple of the later Malla Period, was built in the 17th-18th centuries according to architectural formulas which span a milennium in this country. Freestanding, the pagoda as such temples are called (in Newari: *degah*), was the focus of the small square at Kulima situated one block north of the Patan Darbar World Heritage Site. The structure's siting along an important urban ritual path to Sankamul, north at the river, and its former religious significance (worshipped locally until the icon to Lord Vishnu was stolen) made it a vital element in the urban environment of Patan before its deterioration.

The temples roofs collapsed in 1976, the result of minor damage to the tile roof cover accelerated by the annual monsoon. Both roof levels deteriorated subsequently and are now lost, the wall structure having survived with amazingly little damage from the rains. The artistic importance of this temple is evident in the intact and intricate timber carvings around door and window openings--whose sculptural quality, depth, and composition represent the highest achievements of the 17th-18th centuries.

The "adoption" of this temple restoration project by a foreign travel agency (Studiosus Reisen, Germany) can be viewed as a critical precedent for the Nepal, the first time an international corporation funds such an effort.



Kulima Narayan Mandir. View from north west, Summer 1997.

Four of the remaining roof struts.
Documentation of four of the total 13 struts in possession by the local *guthi.* Five struts (Newari: *bilampau)* from the upper roof and four from the lower roof survive in sound condition. Another four are structurally damaged by wet rot. These pictured above are from middle locations, i.e. not at the corners where formulaic animal forms are found (Newari: *kusala* or corner horses). These above belong to a well known iconographic convention, the Dasavatar or 10 emanations of Lord Visnu, a common theme for struts on Vishnu temples. Here he is seen with his characteristic Garuda mount in the lower register and with foliage above, the mount and foliage are typical conventions of roof struts in Nepal 12th-20th centuries.

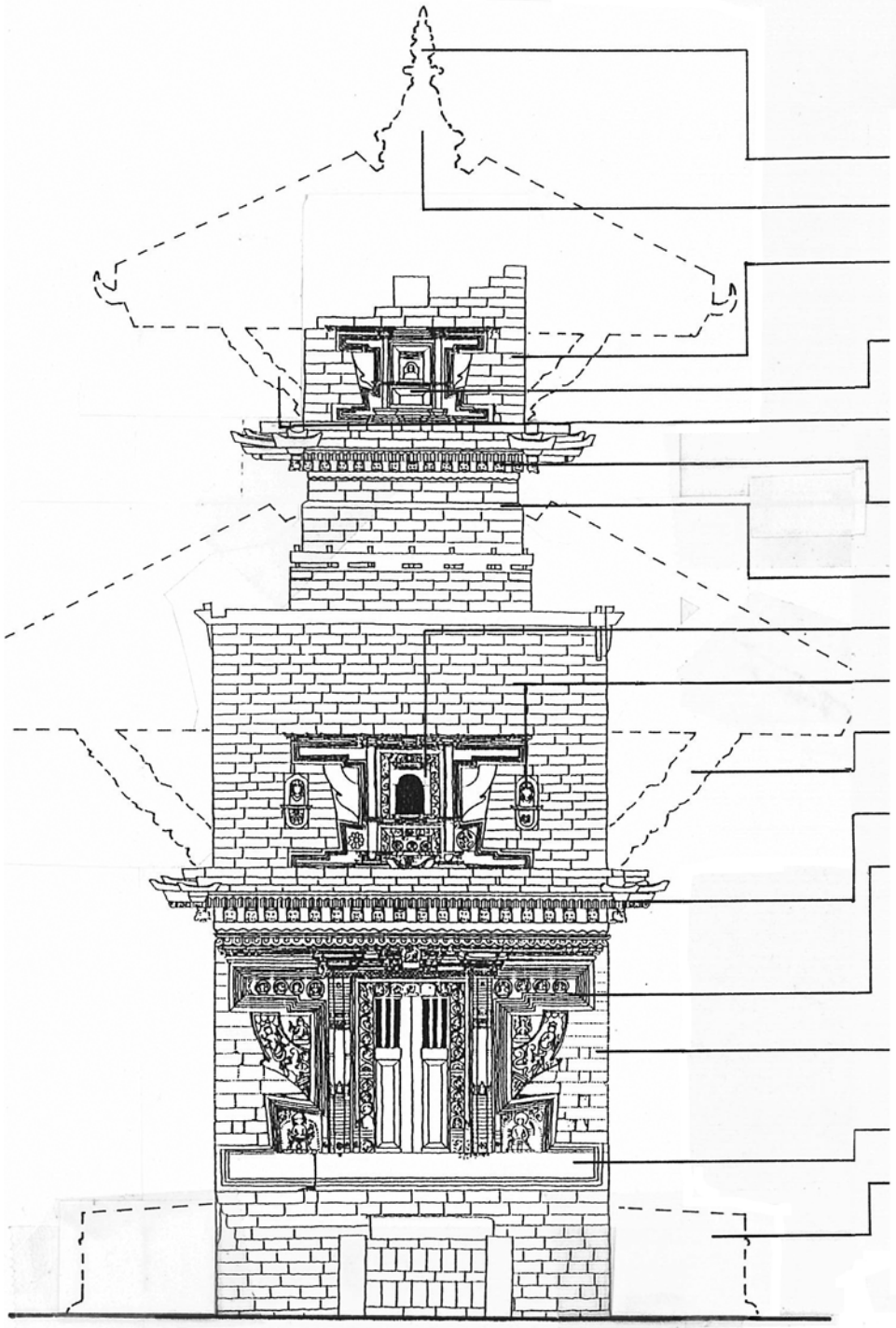
2.0 CONSTRUCTION HISTORY

Due to the near lack of documentary evidence indicating any construction or renovation dates (manuscripts, local records, inscriptions) a close study of the building's structure and fabric has been made. The annotated elevation drawing on the following page displays the estimated dates of small and major alterations.

The attribution of the temple's foundation to the 17th-18th centuries is based on a stylistic assessment of the surviving carvings by art historian Mary Slusser who inspected the temple with us. The iconographic formula of door surrounds and full treatment of figures, for example, are typical of the Newar canoon of this period, also the height of building activity in Patan under King Narasimha (late 17th century). This was the time when many of the pagoda temples of the nearby royal square were consecrated.

In general the building's two-tiered form and surviving woodcarvings (some *in situ* as well as struts in storage) all appear to be from the original construction. This is rare in the Kathmandu Valley where hasty repairs after earthquakes and less than rigorous maintenance practices often mix elements from different buildings and periods on a structure.

The replacement of the panel door and *dachi apa* with a larger size *ma-apa* at ground floor level is the only indication of rebuilding or major repairs. The King Mahendra Renovation Trust Booklet of 1959, the only published mention of the temple, notes that minor repairs, such as the refacing of masonry, were made in 1958. After an interview with a local elder we also know that the temple suffered little or no major damage in the great earthquake which ravaged Kathmandu Valley in 1934. The minor tilt of the ground floor may be the result of seismic forces for that earthquake. We can Certain timber members embedded in the masonry wall probably date from 1958 as they are machine sawn and not adze finished. Thus, the temple appears to maintain its overall form with minor masonry repairs from 20 years ago.



Terra-cotta pinnacle: 1958

Pinnacle base/ kingpost: original

Upper wall in *dachi-apa* and *ma-apa* in 1958

Carved windows: original, north window lost.

Upper roof struts: 19th cen. (?)
6 surviving, 6 lost.

Timber cornice original
Wall between cornices. 19th cen.?

Dachi-apa veneer brick: original.

Carved windows: original.

Carved flanking niches: original.

Lower roof struts: 19th cen.
8 surviving, 4 lost.

Timber cornice: original.

Door frame and brackets: original/ *Bhairabhs*

Door shutter: 1958.

Deity stolen in 1983.

Wall rebuilt in oversized *ma-apa* brick: 1958.

Stone threshold original.

Plinth lost: since 1974

Foundation original?

Kulima Narayan Mandir

KULIMA TOL - PATAN

CONSTRUCTION HISTORY: WEST (PRINCIPLE) FACADE

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0' 1' 5' 15'

3.0 ARCHITECTURAL DESCRIPTION

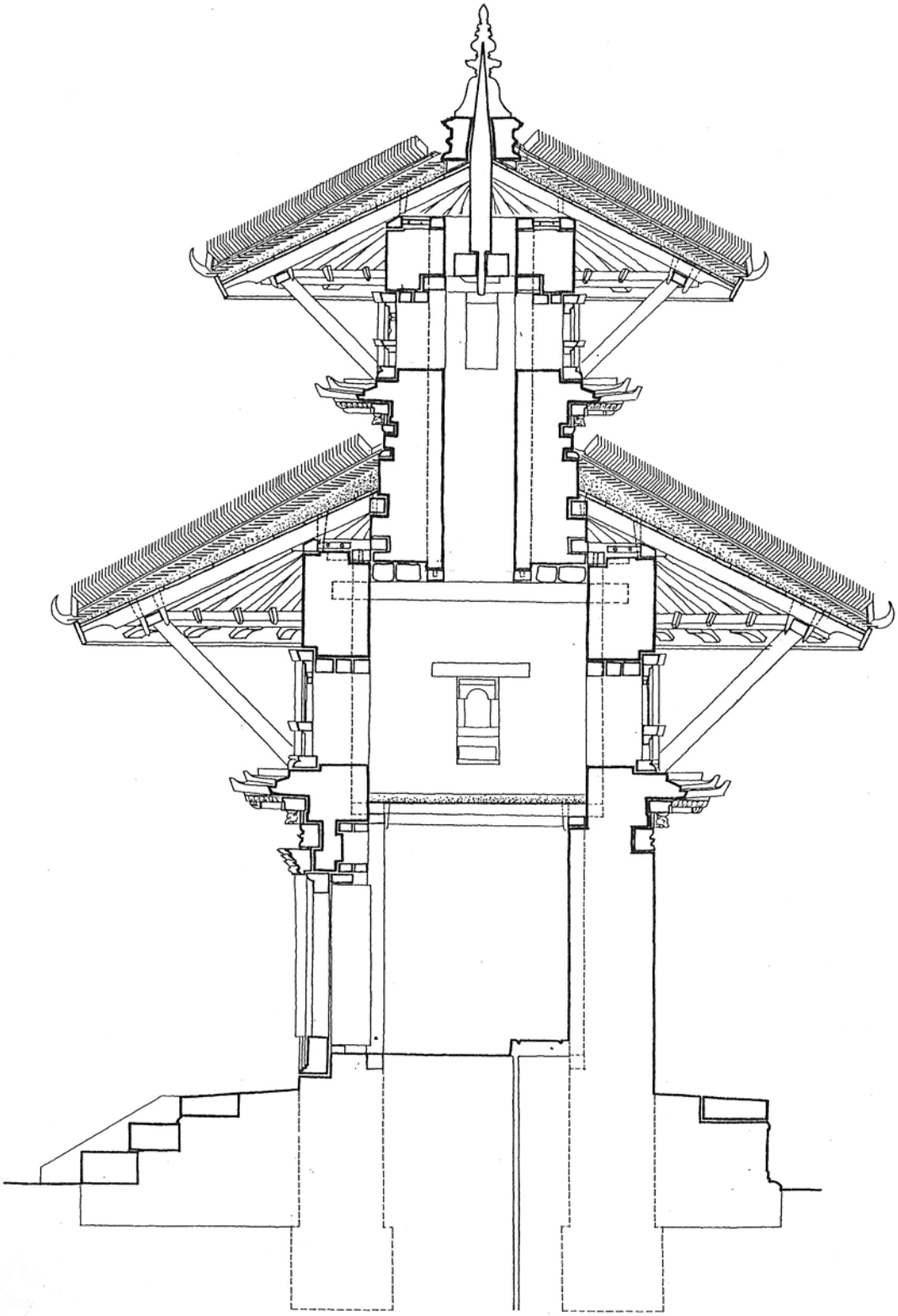
The ground floor of the temple consists of a square brick masonry cella measuring 7'2" x 7'2". The eastern elevation is marked by a single timber door opening on the religious icons of the sanctuary, the whole atop a double tiered brick and stone faced plinth. The plinth which was lost 12 years ago but traces are visible. The principal religious icon rested on a large stone pedestal within the sanctuary and faced the door. It was stolen some 10 years ago.

Above the ground floor,which is demarcated by a continuous composite timber and brick cornice, is found a superstorey below the lower of the two roofs. This superstorey is articulated with a single window opening on each side. Twelve massive roof struts support the deeply overhanging roof and access is via an opening in the timber joists above the sanctuary. There are no interior levels above this.

The cella forms a masonry structural core of walls 26" thick. The temple continues above this with the upper temple level, or upper cella, measuring 4'2" x 4'2" and is supported by beams within the base cella .

The visual dominant timber framed roofs consist of four-sided pent roofs at two levels with considerable overhangs (6' and 4'5" at lower and upper levels) which are supported by purlins on inclined timber struts. The timber struts rest on the continuous timber and carved brick cornices which protrude from the wall structure. The entire roof structure culminates in the pinnacle: in this case an oversized piece of terracotta replacing the original gilt pinnacle lost in the 1934 earthquake.

At ground level the other elevations are blank apart from a dedicatory inscription on the south side, now illegible. At superstorey and upper levels the configuration of timber framed openings is identical on all four sides with the windows placed axially on each elevation. These openings diminish in size as they go up the temple. The roof struts are located to suggest flanking elements around these windows. The brick surfaces are punctuated by the continuous cornices of timber and brick construction which support the roof struts and create prominent (12" tall) horizontal registers.



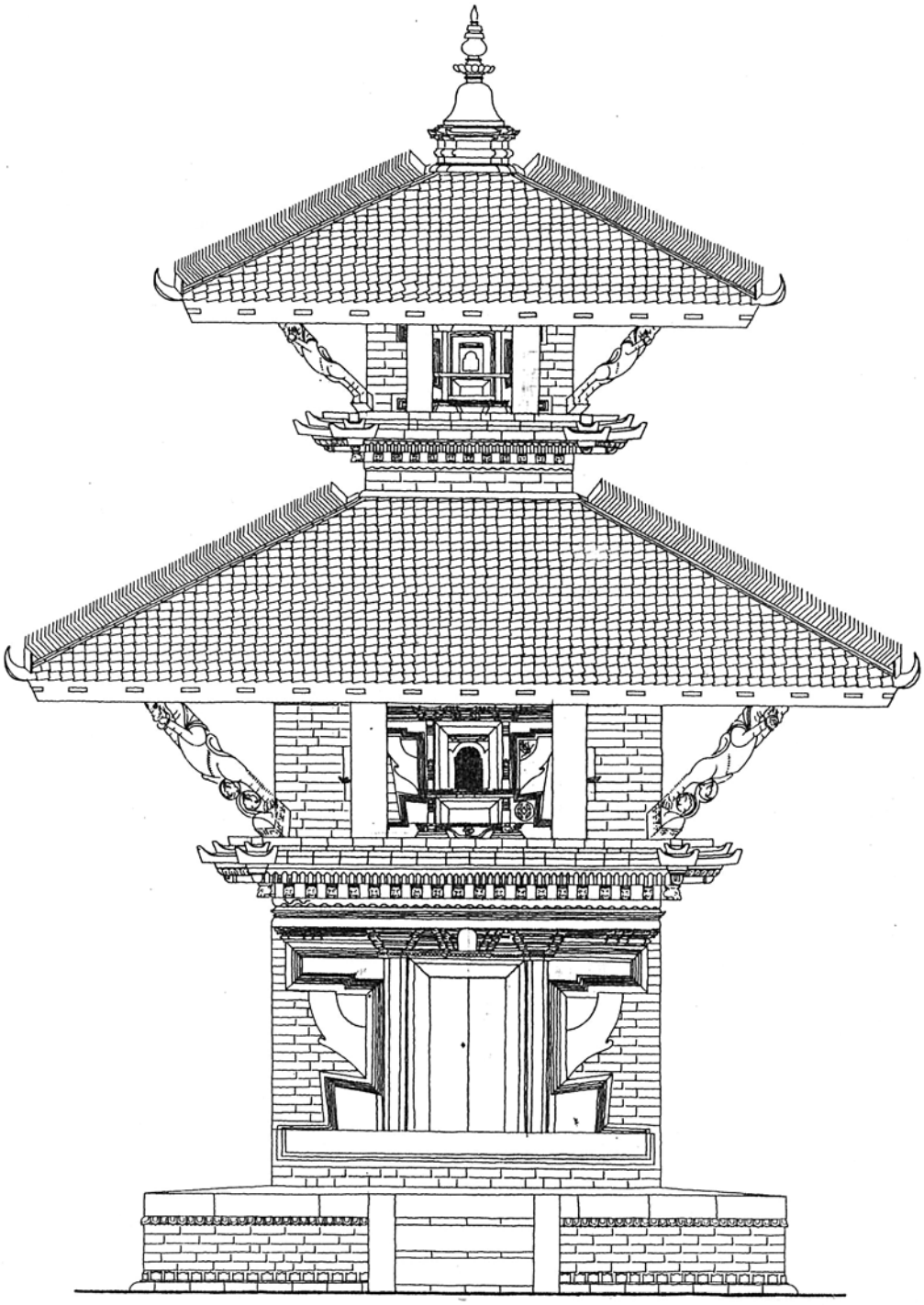
Kulima Narayan Mandir

KULIMA TOL - PATAN

SECTION EAST-WEST : RESTORATION

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'



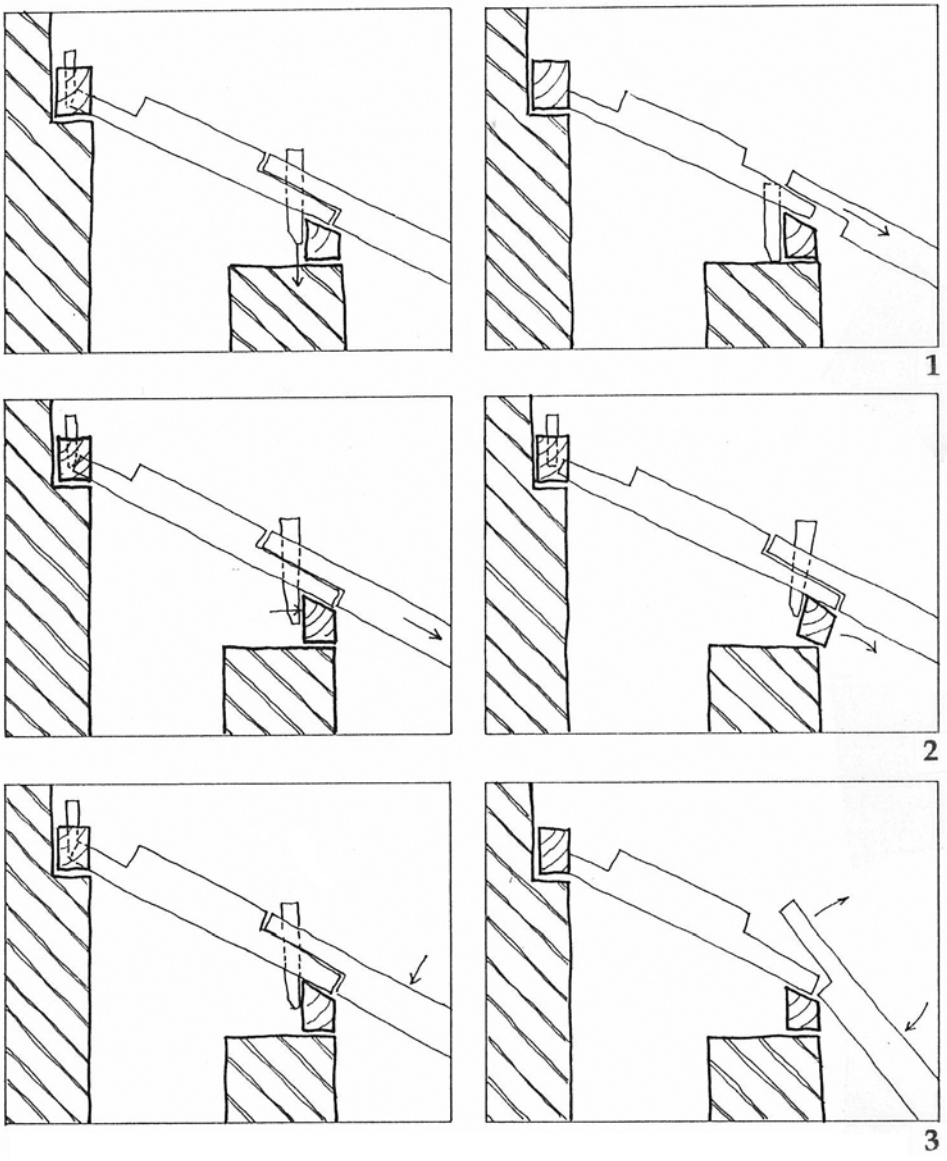
Kulima Narayan Mandir

KULIMA TOL - PATAN

PRINCIPAL EAST ELEVATION : RESTORATION

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'



Timber joinery: improper joinery which leads to structural failure

1. Moisture damages the wood around the peg which results in the hole become larger and weaker around the peg. This in turn causes the lower rafter to slip away.
2. If the timber peg which joins the rafter to the wall plate is not secure the rafter will have a tendency to slide. This will ultimately force the outer wall plate from its bearing on top of the outer wall.
3. The lap joint is improperly reversed where the lower rafter is held only by a smaller timber peg. The result is that the upper rafter is not sharing any of the load as it would usually when correctly lapped above the lower.

4.0 EXISTING CONDITIONS

The following numbered outline is used to organize descriptive material about the existing conditions of the temple and is repeated in the following section for proposed repair and restoration work. Thus, for example, proposed restoration work under section 5.04 relates and refers directly to existing conditions described under 4.04. etc.

4.01 Foundation/ wall structure
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 and wall structure

The foundation of the structure has not been excavated to check for structural deterioration as there has been no visible settlement of the masonry core of the structure. Rising damp is also not noticeable on the masonry structure. The lower and upper walls which have been exposed for over a decade to the elements are in good condition structurally despite the loss of the protective plinth.

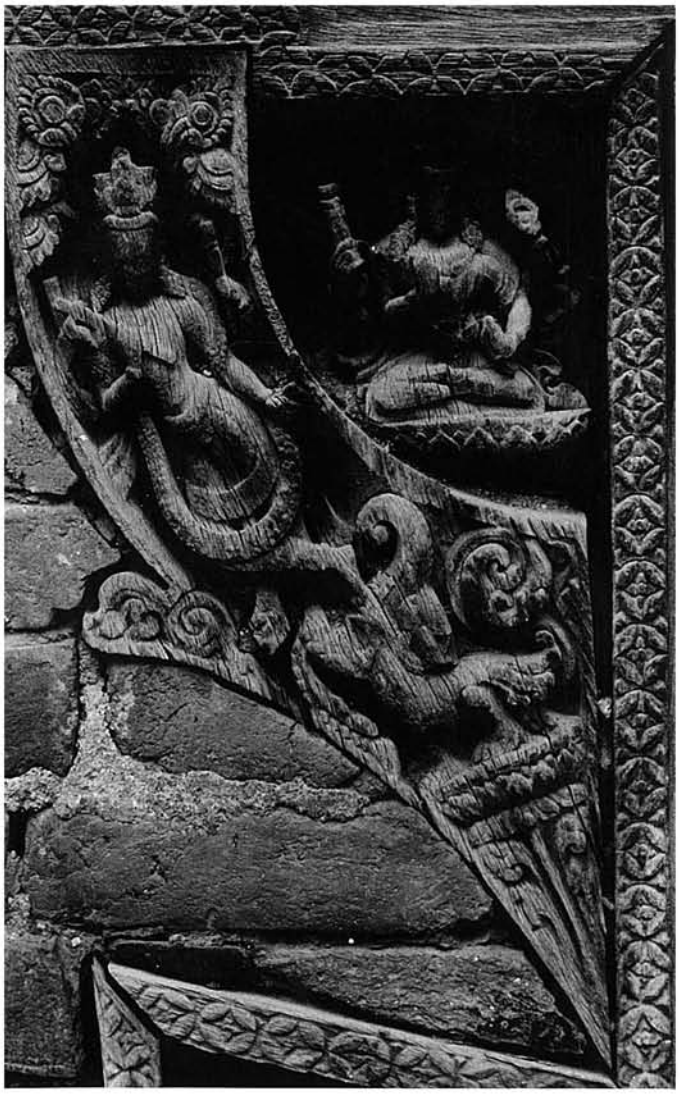
4.02 Wall Fabric

Ground level

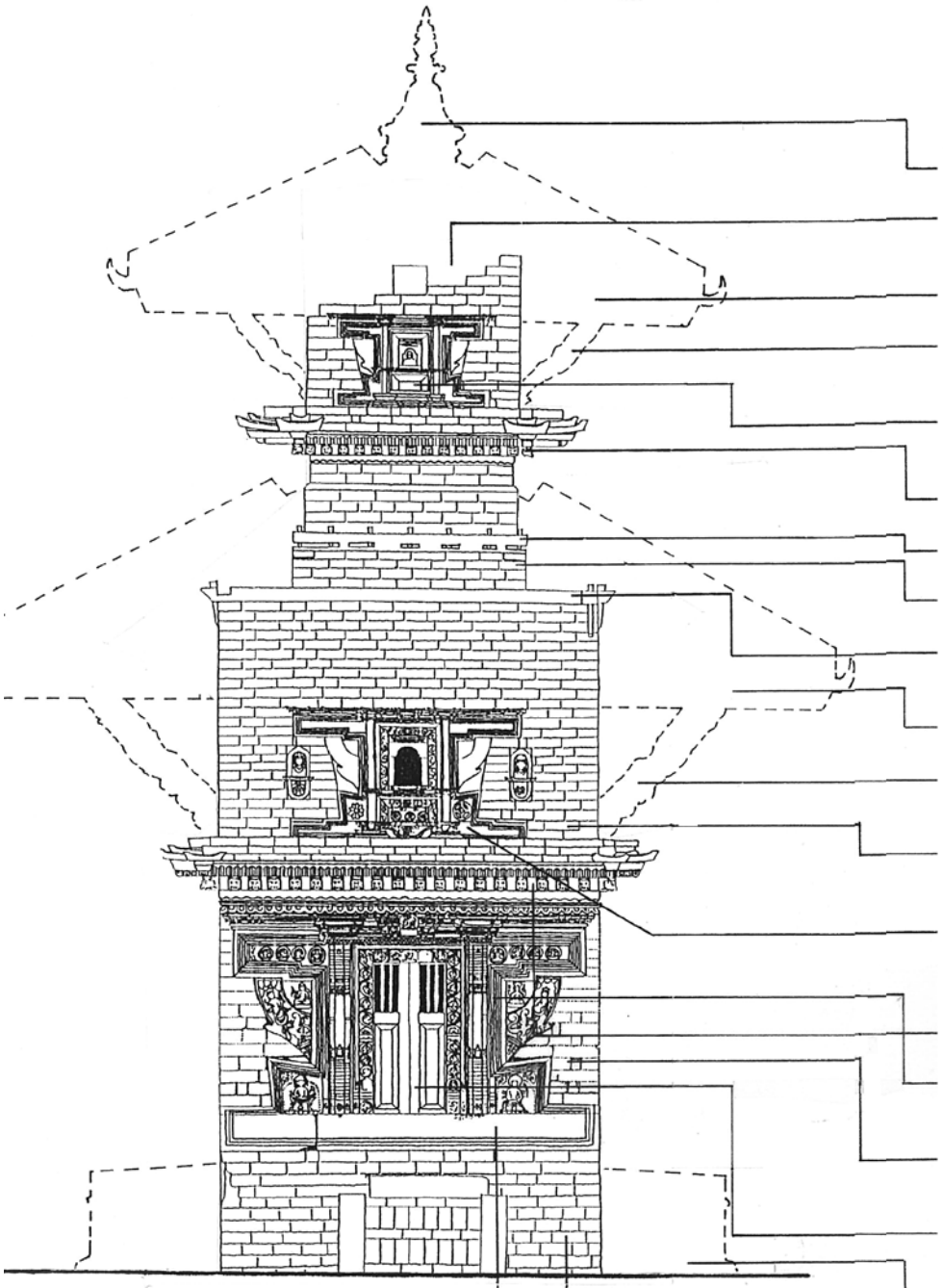
85% of the historical veneer brick has been replaced with a larger common brick, *ma apa* (3" x 9") laid in cement and lime *surkhi* mortar. Almost all fof these replacement bricks have spalled as a result of the bad quality and salts of the cement mortar. Tis is typical of all repairs since the 1950's in Nepal. In 1958 the ground floor wall fabric was refaced on each side and between this time and 1994 an approximate area of 3' x 3' of wall fabric has been sloppily 'patched' up. Approximately 30% of the wall area is in an advanced state of erosion.

Upper ground level

In good condition, the original veneer brick or *dachi apa* wall is intact except at the upper three courses damaged by rain water. Despite the onslaught of vegetation that comes after every monsoon the wall structure has survived. Approximately 20% of the bricks have salt stain from damp.



Bhairav, a protective deity, inset in the temple doorsill (left) and the curved salabhanjika (tree goddess) above framing the temple entrance. The formula for placement of these protective deities is largely standardized in Nepal during the 17th-19th c.



Pinnacle base platform: missing.

Upper six courses of the wall damaged and western facade restored using *ma-apa.*

Upper roof lost 12 years ago.

Struts: 1 corner and 4 side struts kept in local house.

Carved window damaged: some elements also lost in the north window.

Timber cornice damaged by water.

Upper wall plates in good condition.

Ma-apa base wall in good condition.

Lower wall plates and inner timber frame damaged by water pentration.

Lower roof lost 12 years ago.

Struts: 3 corner and 5 side struts kept in local house.

Dachi-apa wall in good condition: some parts (north mostly) damaged by salt stain.

Windows and niches are in good condition. Small portion is damaged by water in the east and west facade.

Timber Sal wood cornice in good condition

Front door in ecellent condition with all timber elements remaining.

Ground floor wall reconstructed using larger size *ma-apa.*

Door shutters in good condition.

Stone threshold in good condition. No sign of settlement visable.

Stone base for timber doorway post lost.

Plinth wall in good condition

Base (peti) of temple lost.

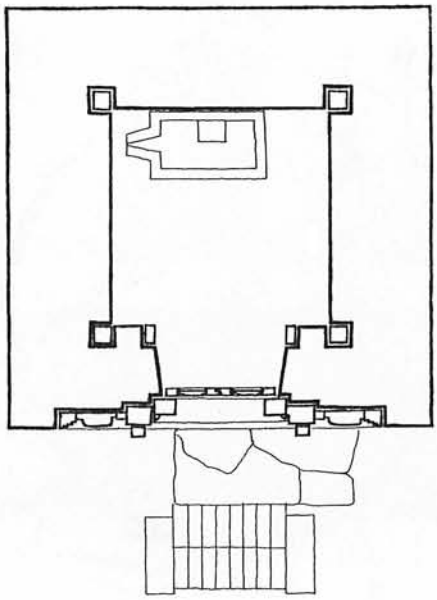
Kulima Narayan Mandir

KULIMA TOL - PATAN

EXISTING CONDITION: WEST (PRINCIPLE) FACADE

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'



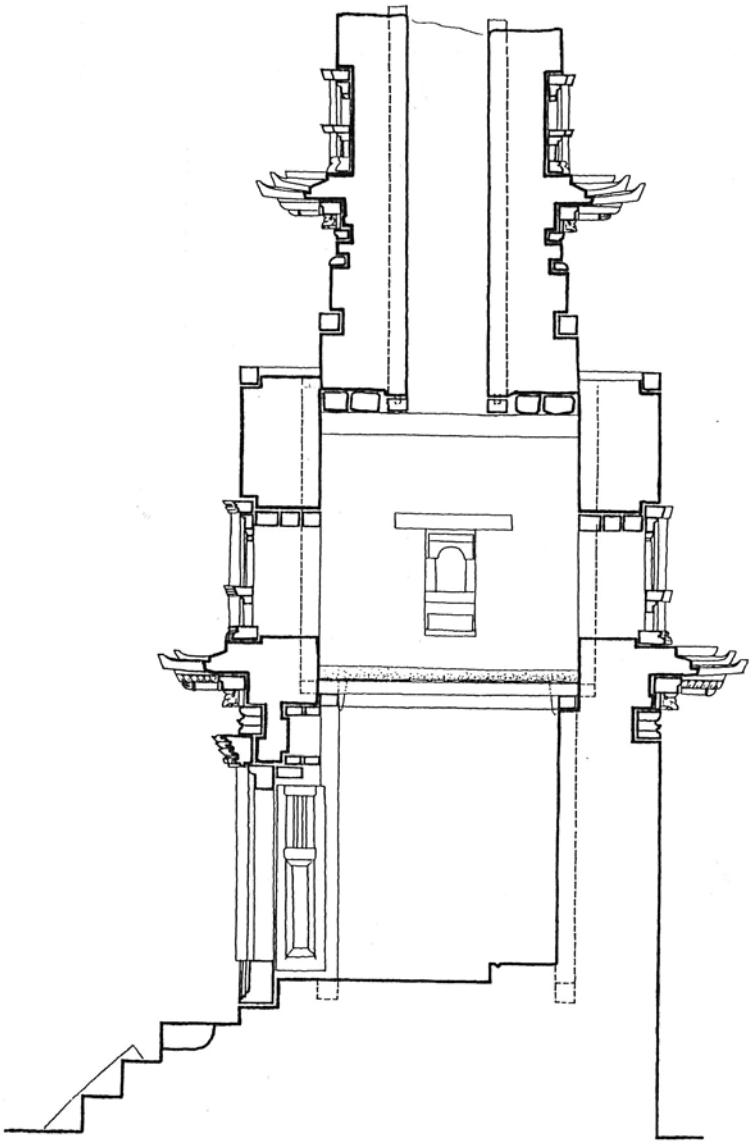
Kulima Narayan Mandir

KULIMA TOL - PATAN

GROUND FLOOR PLAN : EXISTING CONDITION

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'



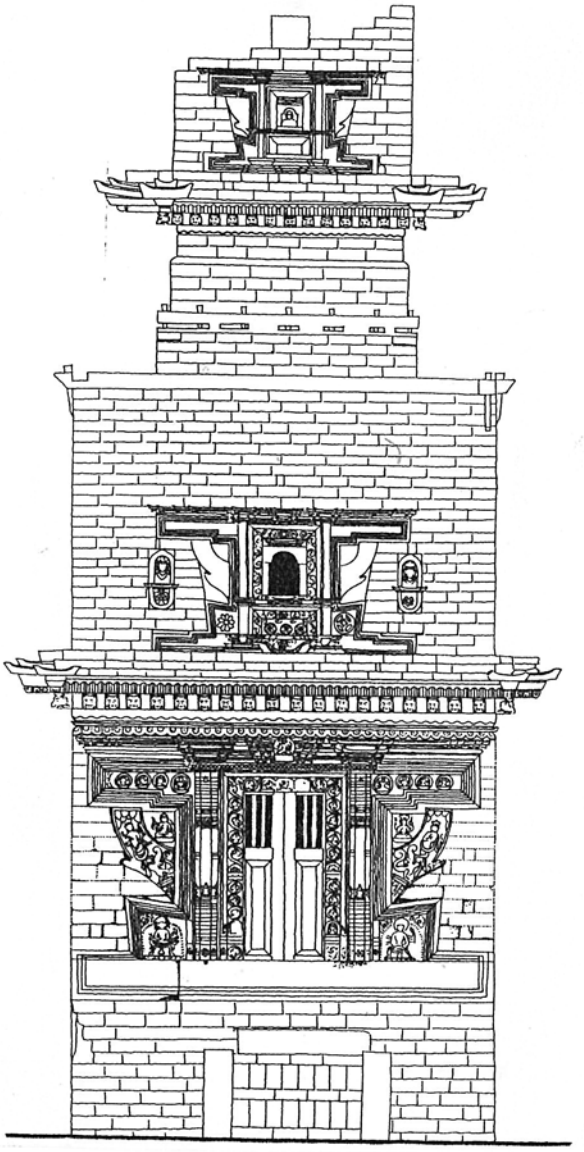
Kulima Narayan Mandir

KULIMA TOL - PATAN

SECTION EAST - WEST : EXISTING CONDITION

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'



Kulima Narayan Mandir

KULIMA TOL - PATAN

PRINCIPAL EAST ELEVATION : EXISTING CONDITION

KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

0' 1' 5' 15'

Top level (above lower roof)

During renovation in 1958 this level was reconstructed using mixed *dachi apa* (veneer brick) and *ma apa* (common brick). The top level has suffered considerable damage. The top three courses of brick masonry have collapsed as a result of water penetration. The southern face was repaired using *ma apa* in the 1958 restoration. The water has penetrated the mud mortar between the structural and veneer wall layers (inner and outer leaf layers, respectively) and has caused the wall to pull apart brick by brick. Water penetration has also caused the northern and eastern wall to bulge by 3" and the southern and western walls by 2".

4.03 Walls: openings and decorative elements

As usual with Nepalese historic buildings all timber and brick interfaces have suffered deformation. This movement is most evident in the joints of the timber door frames and masonry wall where there has been deformation of between 1/2" and 1". This is a consequence of the practice of using unseasoned timber and generally does not present structural problems.

The carved timber wall elements: door, windows, blinds, decorative panels and lower columns are all in good condition and exhibit no signs of rot, fungal decay, or insect infestation. The upper cornice is approximately 30-40% rotten as are three of the *niches* (two upper south and one lower north) which has surface wet rot to a depth of approximately 1/2"-3/4".

4.04 Roof structure and struts

Both roof levels have been completely lost without a single rafter remaining. The surviving sal wood wall plates have been completely damaged by water penetration, as have the timber posts inside the wall. Of the twenty four original struts thirteen survive (*see diagram on following page*), one *kusala* (corner strut) and four side struts have survived from the upper floor and three *kusala* and five side struts have survived in the lower.

4.05 Roof cover and decorative elements

The copper *gajura* was replaced in 1958 by a terracotta substitute and survives although cracked through the middle.

4.06 Interior

Some of the brick surfaces (approximately 20 bricks) have spalled due to rising damp. 50% of the floor tiles have been lost; those that remain are largely broken.

The floor above the sanctuary is a mud floor laid on timber lathe. All the timber joists and planks are rotten.

5.0 RECOMMENDED WORK

5.01 Foundation/ wall structure
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

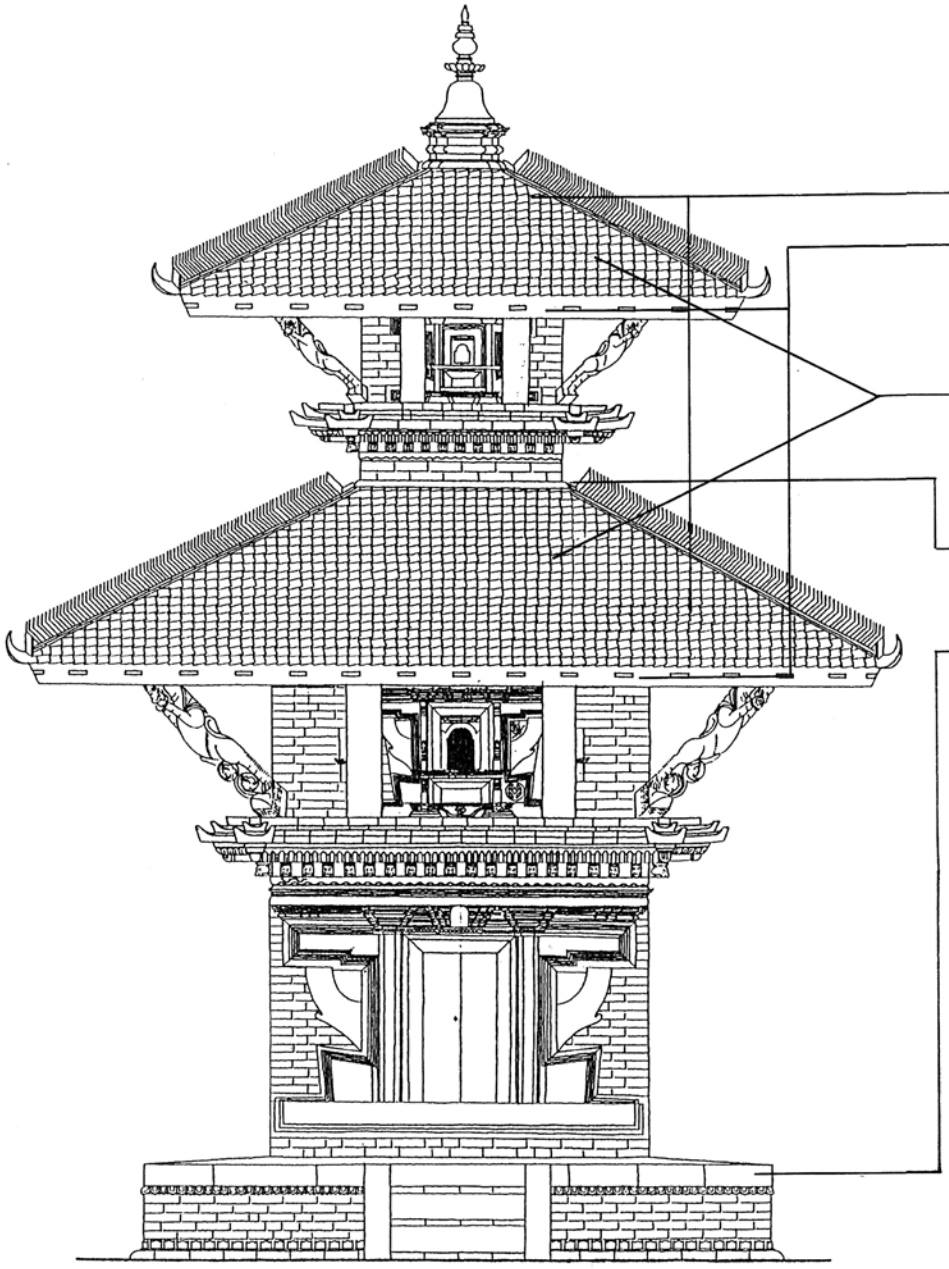
General seismic reinforcement issues.

Given the structural activity of Nepal, any restoration project must consider both the reinforcement of existing structure and the introduction of new structural members to withstand earthquakes. This is balanced against the desire to maximize historical fabric and configuration. Based on our experience with other pagoda structures and given the very small scale of this structure, it was decided that major interventions were not necessary. The building's centre of gravity is quite low (compare three tiered pagoodas) and its wall thickness (26") massive with respect to the overall height. The building is 20% smaller than Uma Maheswar Temple, restored in 1992.

We thus used as a model the KVPT reinforcement of Uma Maheswar Temple which was designed together with engineers Manohar Rajbhandari and Prayag Joshi in 1992. Interventions were limited to numerous small scale reinforcement measures in the timber roof structure to help the historical timber frame to act as a brace for the overall structure. These recommended reinforcements also grow out of our experience repairing five similar structures and are described below in detail.

Mortar

The maintenance of mud mortar construction greatly increases the performance of the building in an earthquake situation due to its damping effect. The mud is able to absorb the shock waves of the earthquake without fracturing adjacent bricks and other wall areas.



Concealed bolting on every third rafter to improve the structural stability of the roof frame.

Connection between the innerwall and outerwall plate is to incorporate the addition of a steel plate to increase the strength at the corner junction.

Concealed steel bolts inserted in every second rafter to improve the connection to the purlins and increase rigidity.

New hole made in the original post and pin inserted to join the wall plate.

Steel plate added at the 'weak' corner joint. Plate aligned in the same angle as the purlins.

Mud mortar used in the construction of the plinth wall to improve the seismic performance.

Kulima Narayan Mandir

KULIMA TOL - PATAN

RESTORED SECTION EAST - WEST : SEISMIC IMPROVEMENT

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Plinth/foundation

In addition, the necessary rebuilding of the lost plinth was identified as an opportunity to buttress the exising foundation. This plinth reinforcement was suggested by visiting structural engineer Dr. Walther Mann and is also explained below.

Strengthening of timber structural connections

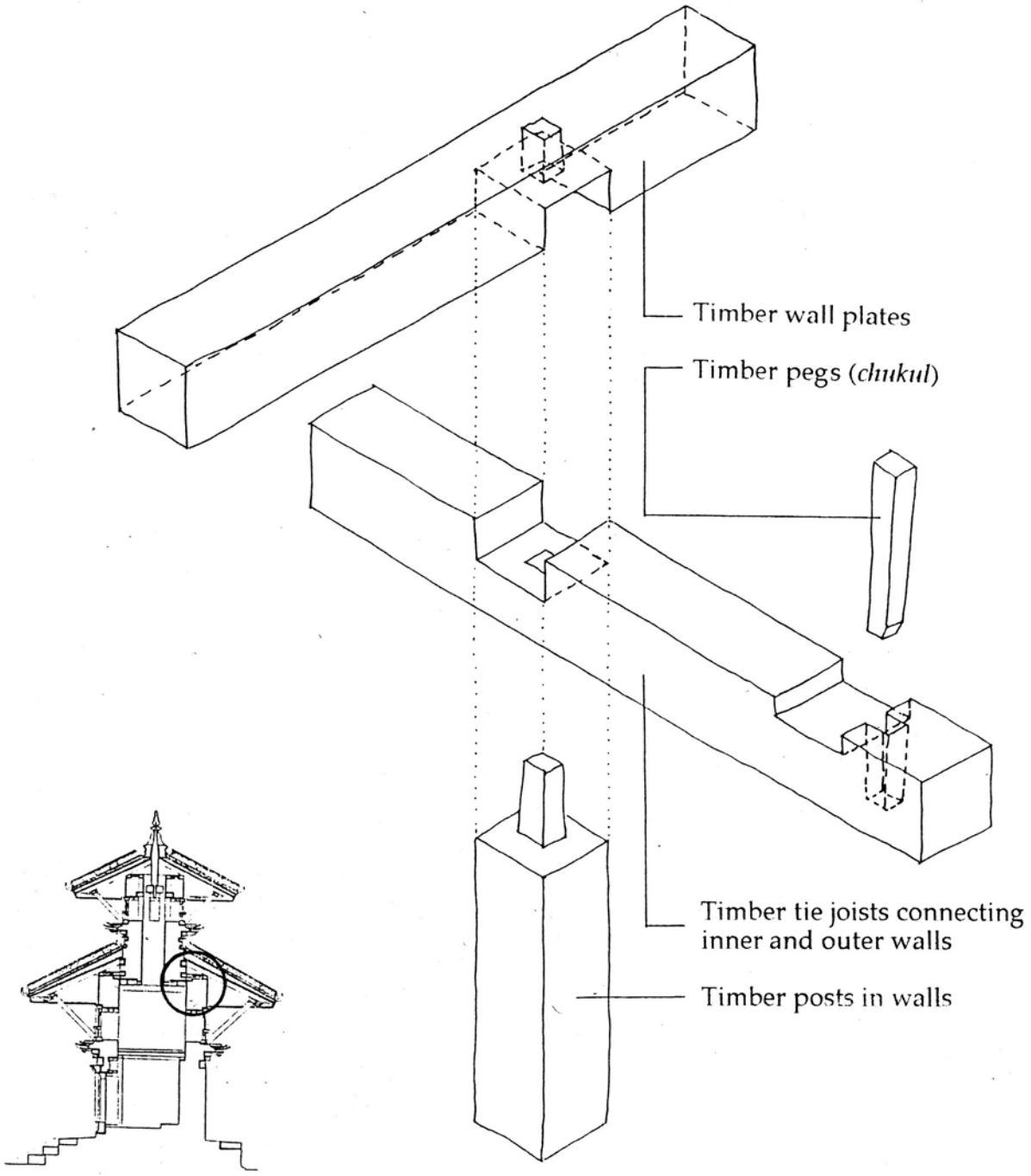
Connection between rafters and wall plates. In traditional structures the rafters are not notched to the wall plates and are simply held by timber pegs. Concealed bolting on every third rafter is proposed to improve the structural stability of the roof frame and wall plate connections. This can be considered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

Connection between innerwall plate and outerwall plate. The traditional configuration of double wall plates makes it easy to develop a timber horizontal ring beam of sorts by careful 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 replacement, the corner joints will be made with the traditional lap joinery but will also incorporate 3/8" thick steel "L" 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 experience 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.)

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

Connection between inner wall post and wall plate. This is a difficult joint to achieve if rebuilding is not necessary. In this case the wall is in a fair condition and does not need rebuilding. The existing tenon at the top of the post has decayed and is rotten due to water penetration but the rest of the post is in good condition. It is therefore proposed to drill a hole in the post to insert new timber to make a joint between the vertical and horizontal members.



Kulima Narayan Mandir
KULIMA TOL - PATAN

TYPICAL TRADITIONAL JOINERY
(CONNECTION BETWEEN TIMBER POST AND INNER WALL PLATE)
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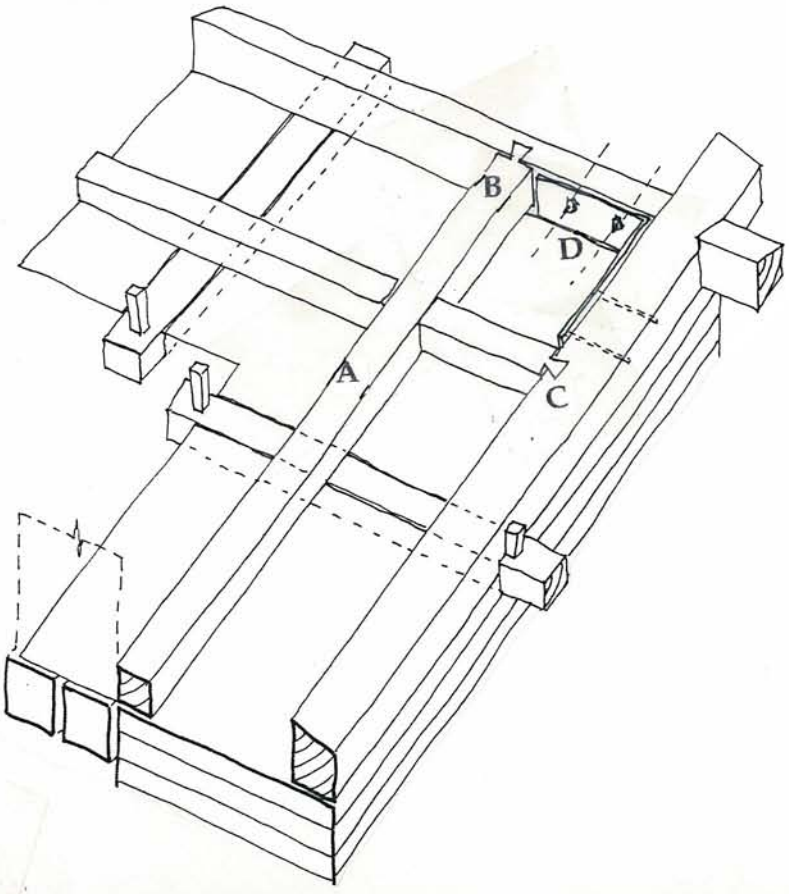

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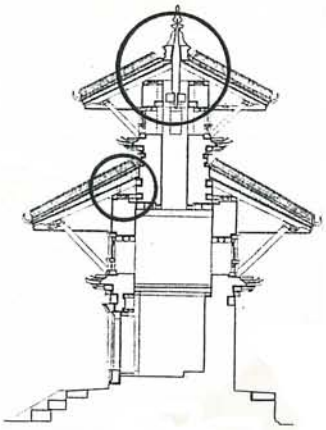

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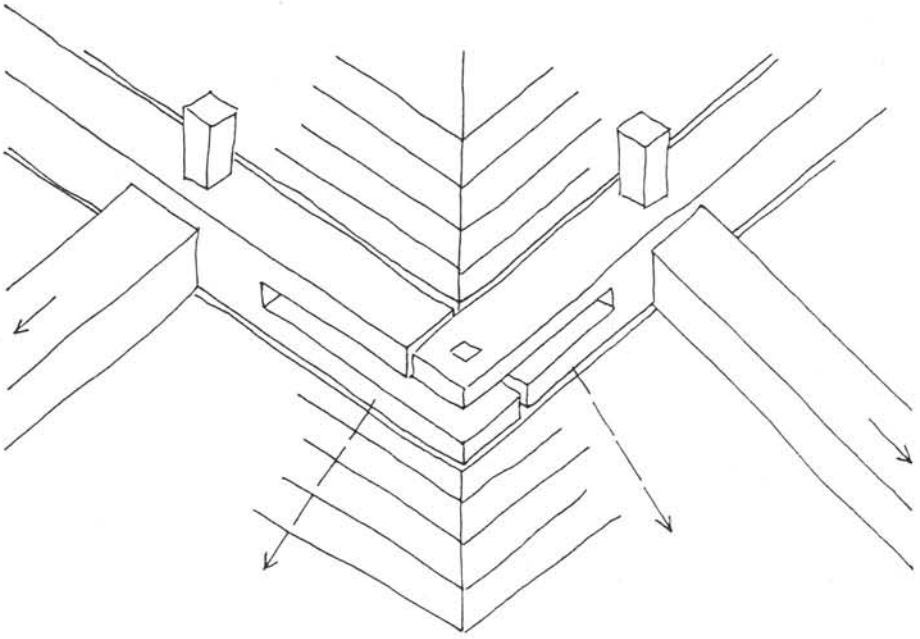
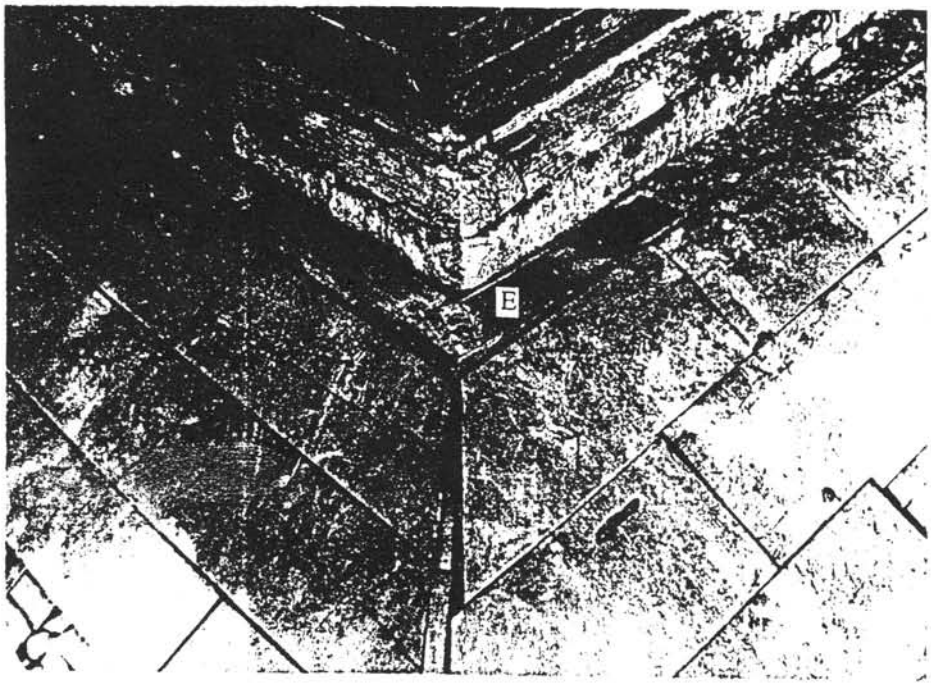
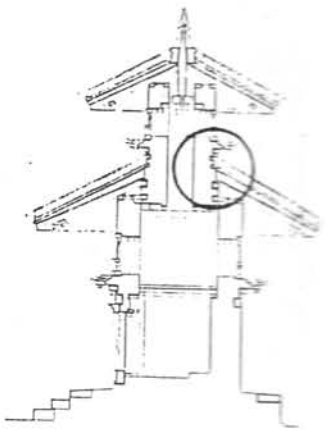
3

Tie between wall plates.

1. The diagram shows the location of the wall plates.
2. At present the inner and outer wall plates are not connected with each other.The proposed arrangement will act a one horizontal unit. With (a) the introduction of the inner wall plate, the subsequent linking with the outer wall plate (b) using dovetailed joints (c) and steel collars (d) at the corner.
3. Photo august 1997: This technique increases the seismic strength of the temple by acting as a ring beam which ties the walls together.







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.

Connection between purlin lap joints in the corners. 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 add a steel plate 2" wide and 3/16" thick in the same angle as the purlins to strengthen this connection.

Plinth wall. The plinth will be restored incorporating a solid construction f bricks to increase the efficacy of the walls' foundations in resisting earthquakes. The traditional plinth is a madee of mixed fill and rubble. This improvement in detailing was suggested by Dr. Walther Mann, seismic engineer while inspecting the monument. It is recommended that 36" be excavated from within the temple and built up with solid brick work laid in mud mortar, complemented by the solid brick plinth construction on the outside. The effective foundation is thus an 11'x11' base of 4' height.

5.02 Wall fabric

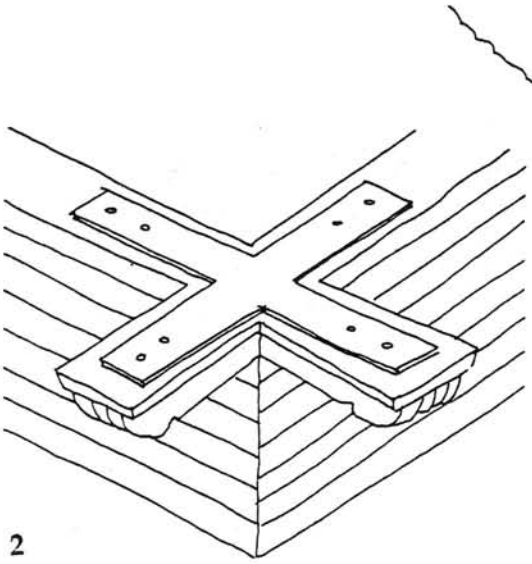
The inappropriate *ma apa.* brick shall be replaced with traditional *dachi apa* using yellow mud moortar matched to that of the upper level. All *dachi -apa* will be custom ordered to make them the same size as in the upper level of the temple.

At first floor level the three upper brick courses will be repaired using *dachi apa.* Bricks displaying salt stain shall be cleaned with water and soft brushes.

Several bricks within the sanctuary have suffered damage, these shall be replaced individually by "piecing in" without dismantling the wall. This work must be carefully supervised as masons yend to rebuild large areas whenever left to their own.

5.03 Wall opening and decorative elements

All the wall openings and decorative elements such as timber cornice, *lah kah, blind* window, windows and main doorway shall be cleaned with plain water and soft toothbrushes. No structural work is required for any of the decorative elements. Two of the four timber *lah kah* (decorative corner brackets) are missing, these shall be recarved as per the remaining two. They are identical on all corners.



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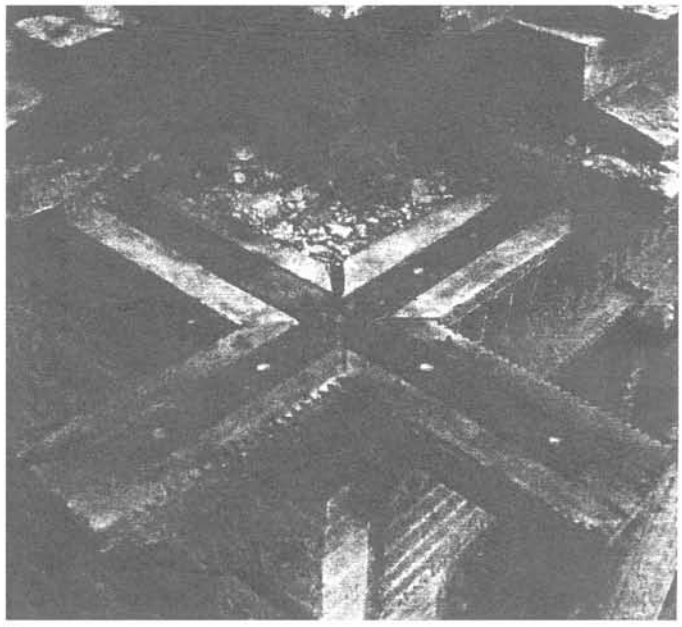

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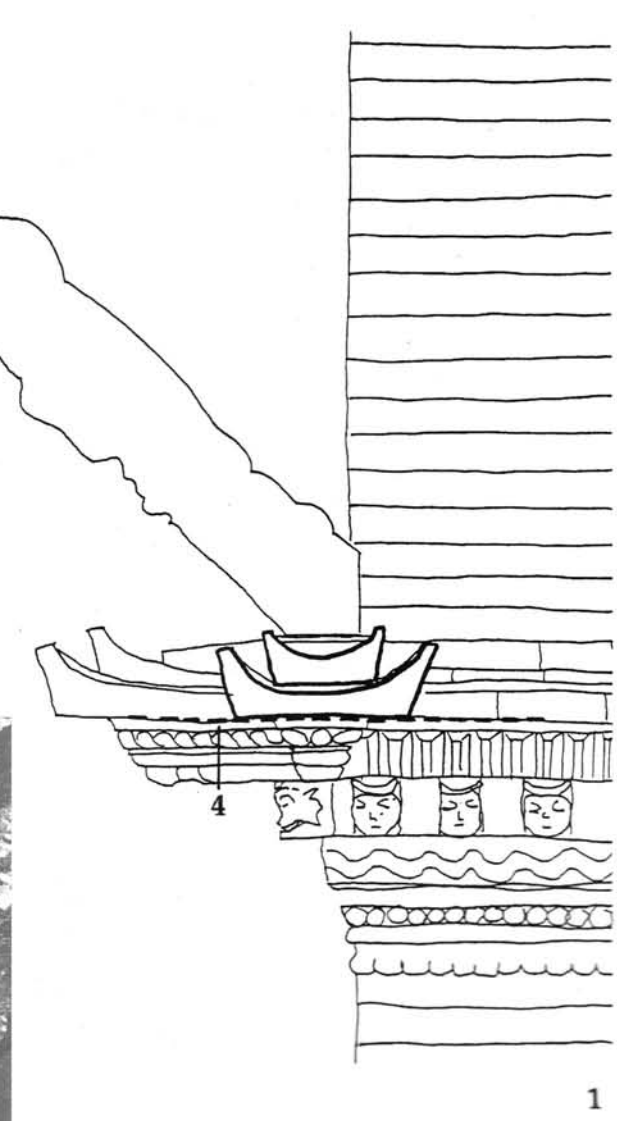


4

1

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 localized strength.
3. Location of proposed cross piece which is inserted between the timber and terra-cotta *lah-kah*.
4. The steel member is countersunk into the timber *lah-kah* thus keep the original proportions and configuration.

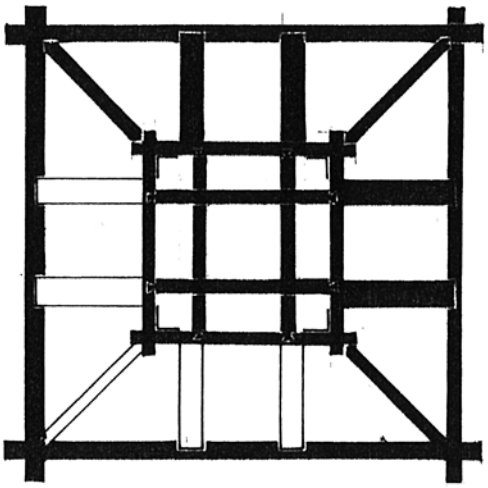
It can be noted that the treatment of sal timber elements with preservatives such as Wykamol is undertaken by KVPT only under special circumstances. Tests by the Trust in 1992 determined that penetration was minimal (up to 1/8") in the sal wood and that it is highly resistant to moisture when ventilated. Protecting historical timbers from roof leaks is thus a more effective conservation measure than such chemical applications. Our experience shows that Wykamol also permanently darkens the wood considerably despite manufacturers' claims to the contrary.

5.04 Timber roof structure and struts

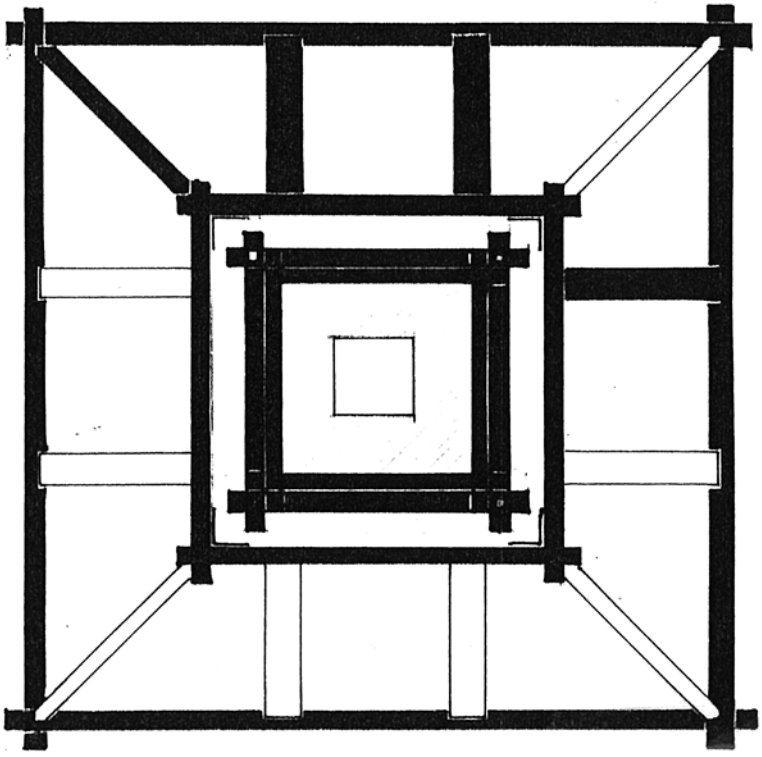
The entire roof structure shall be restored using the historical configuration and materials. The surviving struts and masonry core allow the section to be accurately reconstructed. The new roof frame, in pine, shall be matched in size and spacing to traditional temples of comparative size and configuration. The rafter size will measure a minimum of 4" x 5" in keeping with historical precedents and will be adze finished. It can be mentioned that most existing pagoda roofs have lost their historical rafter spacing in the course of economics-minded rebuildings over the years. Thus, historical spacings of 9" o.c. (evident from notches in old eavesboards) are generally rebuilt with spacing of 12"-15" o.c.

The use of pine was consistent in historical roofs. Only recently, have modern repair projects substituted sal timber for pine with the strategy that the more moisture resistant timber will increase the life of the building. The sal, however, is much heavier than the pine and thus has the disadvantage of reducing performance in earthquake, i.e. the building becomes more top heavy. Moreover, if roofs are not repaired in a timely manner, even the sal will deteriorate quite rapidly. Thus Trust projects have consistently employed pine for roof rebuilding and repairs.

The traditional joinery techniques for the fixing of rafters are limited to the use of pegs. 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 bolts will be stainless steel imported from India or steel pre-painted with anti-corrosive paint.



Upper tier



Lower tier

Kulima Narayan Mandir

KULIMA TOL - PATAN

ROOF PLAN : SHOWING SURVIVING STRUTS
(SURVIVING STRUTS SHOWN IN WHITE)
KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

Roof struts

The four missing corner struts (*kunsuru*) will be replaced as exact copies of those that survive. This process counts on the abilities of carvers like Radhe Shyam Silpakar, master carver. Lost corner horse struts can be easily recarved based on the surviving examples as these members are largely formulaic. One of the upper corner struts is in a critical condition and will require further study to determine the necessity for reinforcement.

The other missing struts (Newari:*bilampau*) will be replaced by plain members as no precise historical evidence survives. These plain members will, however, be sized to allow future votive offering of carving.

The decision to carve new iconographic members is a philosophical question deserving of ongoing debate. There is a contemporary woodcarving tradition in Nepal whose masters are able to develop new and appropriate solutions. At the same time, one must decide what interventions either complete, complement, or detract from the surviving historical fabric. While this project carves only where the formulaic corner horse struts are lost, another parallel project at Sulima develops new carved elements.

5.05 Roof cover and decorative elements

Gajura

The historical *gajura* or pinnacle will be reinstalled with concealed patching of the cracks in lime-surkhi plaster.

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 as 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 aviform 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 soaked in the 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.

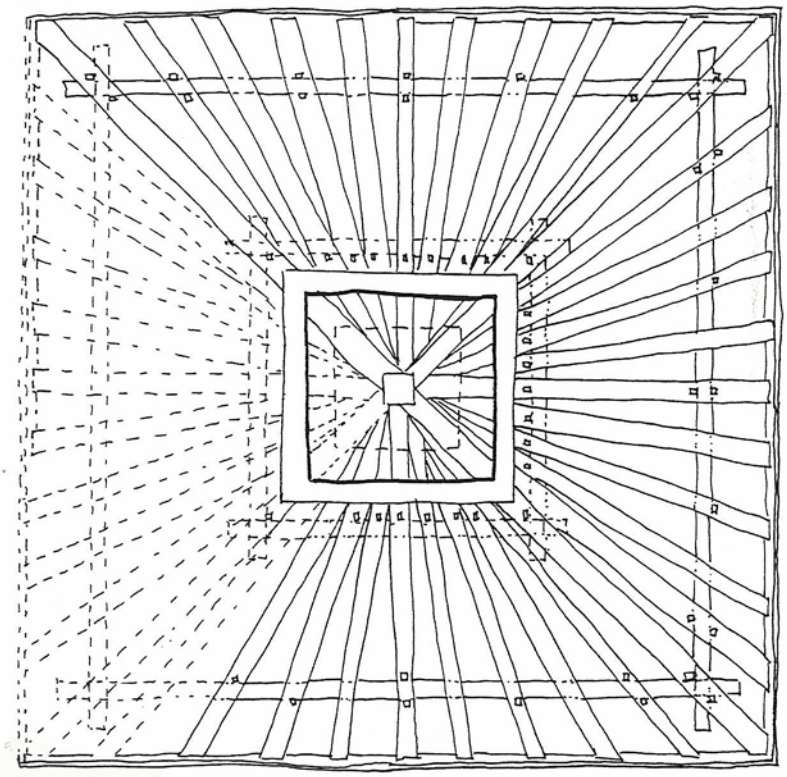
One detail developed in the 1992 Radha Krishna restoration project shall be repeated here. The bottom-most layer of tiles (above the eavesboard) are pre-drilled and attached to the planking below using nails whose heads have been removed, this enables the replacement of broken tiles, at a later date,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

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 projects 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, and sealed with bitumen on top. This use of tarfelt as a waterproof membrane is, however, a potential weak link in the rebuilt roof cover. The study of previous



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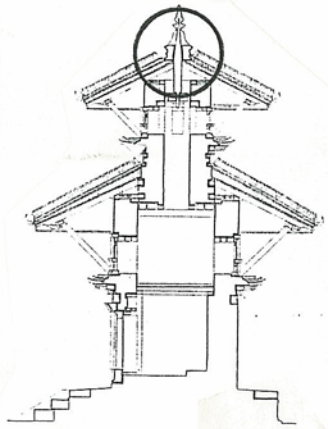
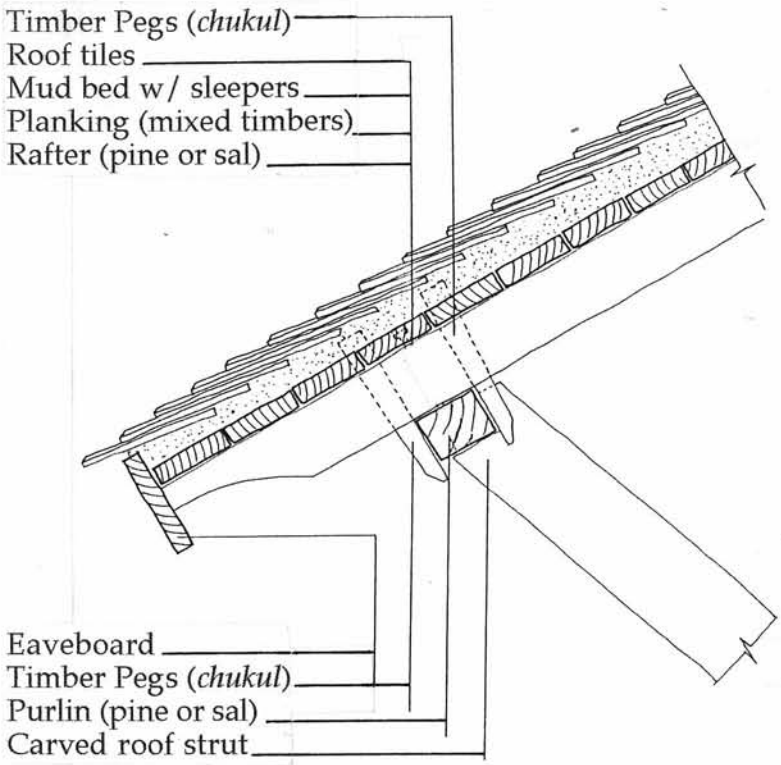


1

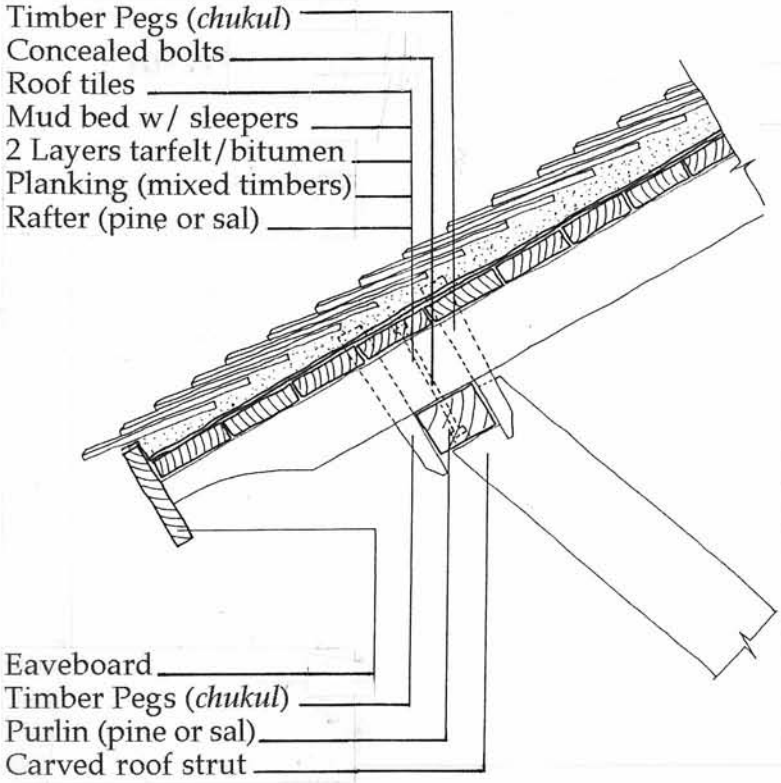
3

Reinforcement in the upper roof.

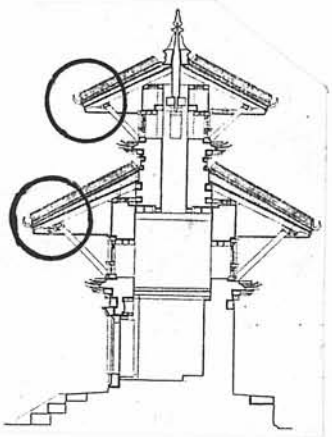
1. Diagram showing the position of reinforcement within the temple.
2. Upper roof plan showing the position of the steel belt above the rafters.
3. The steel plate is screwed to the top of the rafters. This allows the roof structure to act as a single unit.



As traditionally detailed.



Improved detailing.



Kulima Narayan Mandir
KULIMA TOL - PATAN

THE KEY PROBLEM
KATHMANDU VALLEY PRESERVATION TRUST - NOVEMBER 1998

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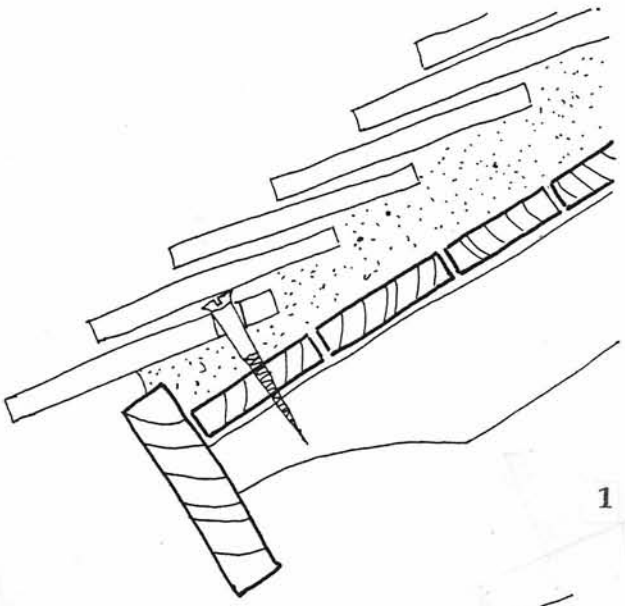

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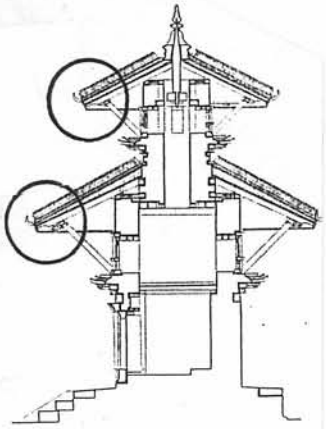
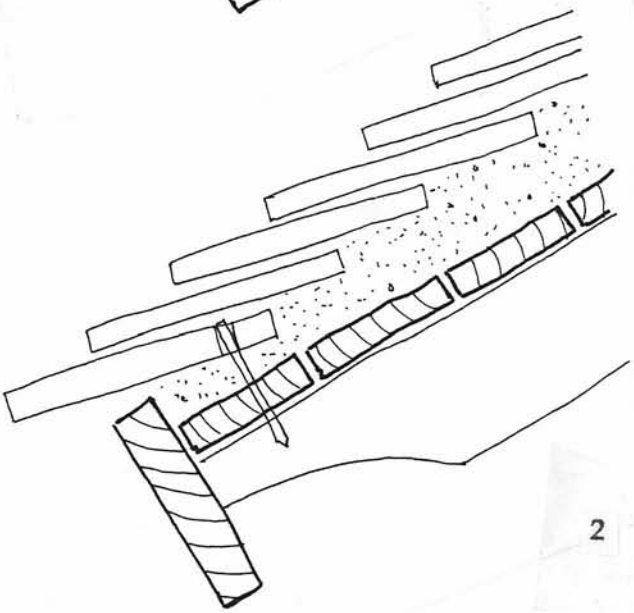
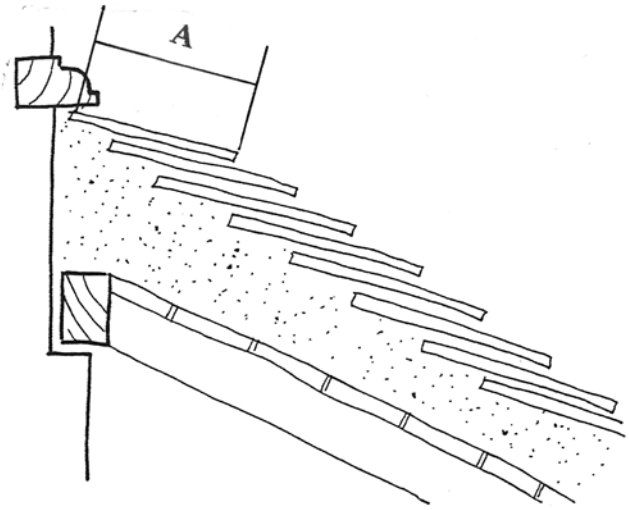


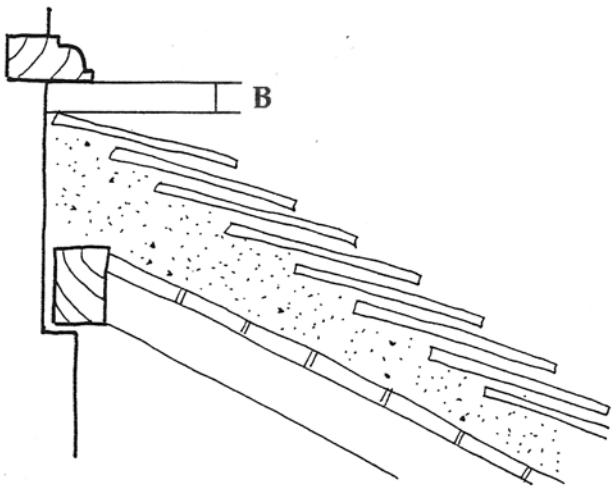


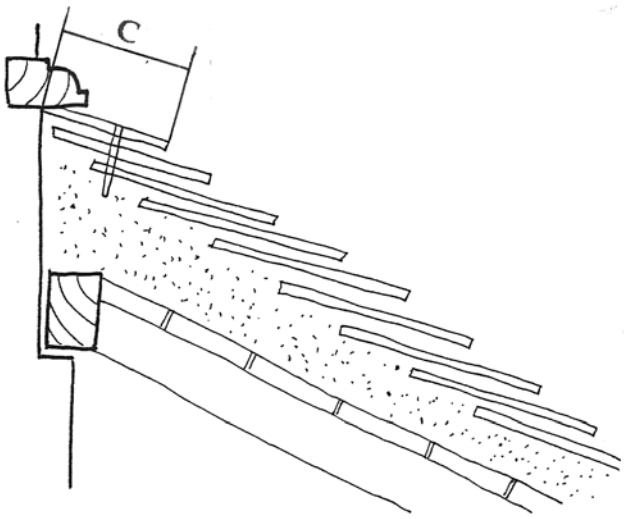
2

Nailing the first row of *Jhingati*.

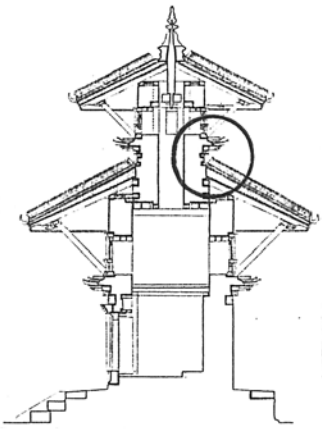
1. This solution of screwing the first row of *jhingati* was developed during the Hanuman Dhoka project. This solution does not allow easy access if one needs replacing at a later date.
2. The solution proposed consists of using a nail whose head has been removed. This allows easy access in the event that a *Jhingati* should need to be replaced at a later date.
3. It is possible to move the tiles after using a headless nail but when screwed their movement is made much harder.







A. Full tile
B. Space after settlement
C. Half tile



Tile reinforcement.

1. The upper most row of the tiles are just laid below the timber cornice. During any external movements the upper row of tiles starts to slide down, this in turn the adjacent row, causing them to slide down as well.
2. All the lower tiles are always overlapped with only app. 1/4 of the total length showing. The upper most tiles are totally visible, except those which are overlapped by the timber cornice on the wall.
3. When these tiles are laid on the thick mud bed the tiles settle slightly after the mud has dried. This creates a space between the cornice and the tiles and makes it easier for the upper most tile to slide down the roof as result of external movements such as perching birds.
4. After the few days of laying of the *jhingati* the mud dries and makes a small space between the timber cornice and the tiles. A 3/4 *jhingati* is inserted in this newly created gap with a single nail. This ensures that tiles will not slide down and also that the lower rows of tiles are only visible by less than half a tile, this solves the problem of authenticity.

projects has shown the maximum life span for Indian tarfelt to be only fifteen years.

Proposed for the Kulima project as a more longlasting membrane is the imported "Plasfal" (see specification in Appendix D) new to the Kathmandu Valley. A synthetic elephant skin, it has 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, 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 inimize 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 activity.All planks will be 1" thick sal wood in random widths and lengths, fixed to the rafters with galvanized nails.

5.06 Interior

New telia tiles (6"x 6") shall replace those which have been lost or damaged within the temple.

The local community has agreed to commission and reinstall a new deity upon completion of the restoration of the temple.

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 Archeology, although in practice government authorities are not even able to control demolition of historic structures in the World Heritage Site, let alone specify maintenance practices. Thus, the first job of the conservation architect in Nepal is to build not only the Department's technical resources, 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.

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APPENDIX A

Documentation of the temple renovation in 1958.

कोवहालस्थ-नारायण-मन्दिर तथा भगवन्मन्दिर

यो स्थान पाटन मङ्गलबजारबाट केही उत्तर राजमार्गमै पर्दछ । मन्दिर मध्यमल्लकालीन हो भन्ने अनुमान हुन्छ जसको अथोटमा शिलापत्रादिको यस स्थानमा अभाव भएको बुझिएबाट शंकै छ ।

यस स्थितिमा पूर्वकालीन श्रद्धालु भक्तगणहरूले निर्माण गरेका स्थानहरूमा र उहाँहरूको पवित्र कीर्तिमा चिर-स्थायित्व भर्ने अभिप्रायले हाम्रा नेपालनरेश श्री ५ महाराजाधिराज महेन्द्रवीरविक्रम शाहदेवले आफ्नो निजी कोषबाट पर्याप्त आर्थिक सहायता दिई उक्त नारायणमन्दिर र नजिकैको भगवन्मन्दिर पनि साथसाथै जीर्णोद्धार गराई बक्सिएको हो । मन्दिरहरूको स्थिति उपरितन चित्रले देखाइरहेको छ ।

Nrayan Temple and Bhagwan temple at Kobahl

This locaction is situated just north of Patan Mangal Bazar, beside the road to Sankhamul. It is hard to say that this temple is of mid Malla period since there is a lack of stone inscription to tell us the exact date.
In this situation the area which is constructed by the devotees was restored by His Majesty King Mahendra Bir Bikram Shah Dev by giving sufficient financial support from his own personal funding Trust to have condolence on their pure eternal artwork. At the same time Narayan and near by Bhagwan temple was also restored by His Majesty. The condition of the temple is shown by the above picture.

APPENDIX B
Application for restoration

31/05/97

Dr. Saphalya Amatya
Director General
H.M.G Dep. of Archaeology

Dear Dr. Amatya

In anticipation of the important conservation risk at Kulima Narayan temple, we have put forward a steering committee for the supervision of the construction works.

For our regular meetings, we will request a representative from the Dep. of Archaeology and KVPT.

Steering committee:

Kulima Narayan Restoration Project.

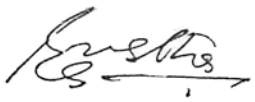
1. Mr. Shambhu Man Shrestha, chairman.
2. Mr. Sushil Shrestha, representative of local committee.
3. Representative of Dep. of Archaeology.
4. Representative of KVPT.

(additional members can be called if required for technical and implementation problems).

We hope that work will commence before the monsoon. So we request your support in this project in the form of a letter of permission to begin the construction work.

Thank you for your time.

Yours Sincerely



Shambu Man Shrestha

List of commitee members

1. Mr. Shambhu Man Shrestha.
2. Mr. Umesh Mangal Toshi.
3. Mr. Sushil Prasad Shrestha.
4. Mr. Harinar Mangal Toshi.
5. Mr. Devendrea Shrestha.

31/06/97

The Director
Kathmandu Valley Preservation Trust
Kathmandu

Dear Sir,

We are in the effort of conserving the architectural heritage of Nepal. So we cordially request for your technical and financial assistance for the renovation of Narayan Temple which is situated in ward No. 9, Kullima Tole, Lalitput, sub-metropolitan city.

We look forward for your concern in this regard to this.

Thank you for your time.

Yours Sincerely

Shambu Man Shrestha

c.c Dr. Saphalya Amatya
Director General
H.M.G

APPENDIX C
Conservation notes.

KATHMANDU VALLEY PRESERVATION TRUST
POST BOX 294 KATHMANDU, NEPAL
TEL: 248747, 522556 FAX: INT'L + (9771) 522556
E MAIL: THEOPHIL@KVPT.MOS.COM.NP

Conservation Notes

submitted to HMG Department of Archaeology
April, 1997

for the proposed restoration of

Kulima Narayan Temple

Kulima Tole, Patan

1.0 Introduction

The restoration of this temple using funds from a foreign travel organization is a critical precedent for the Kathmandu Valley, encouraging foreign businesses to "adopt" temple restoration projects. Moreover, the 18th century temple is a fine example of the neighborhood scale Newar pagoda with extremely fine carvings, an important urban centerpiece as well to the small square at Kulima. The area contributes to the environmental quality of the Darbar Square as well, lying one block north of the World Heritage Site delineation.

The project continues the Kathmandu Valley Preservation Trust's emphasis on the repair of small scale monuments on the verge of being lost in and around the Patan World Heritage area. To date the Trust has saved some seven monuments in Patan. This repair project and related fundraising has evolved in response to a request from the Honorable Mr. Bekha Ratna Sakya, Mayor of Patan.

2.0 Proposed work description/ conservation specifications

Timber roof structure

The whole timber roof structure collapsed 7-8 years back, not a single piece of plain timber roof members were left. So the roof structure will be restored based upon the proportion of the temple itself and historical photographs.

Timber carvings

After the collapsed of the both roof 14 carved struts from the 24 struts were kept by the local people. Detail research will be carried out before the installation of those struts. The struts will be carefully cleaned with mild soap (liquid soap - extran) and water using soft brushes. Two badly damaged corner struts (*ku-sa*) from upper roof structure will be reinforced at the back of the struts with steel angles, which will be not visible from outside. One missing corner strut from the lower roof and two from the upper roof will be

reproduced as they are typical carved corner struts, but other lost carved struts with deities (4 from lower roof and 3 from upper) will be left plain, as no documentation or evidence of their configuration exists.

All the extant carved timber elements in the temple will be carefully cleaned *in situ*, also using mild soap using soft brushes.

Earthquake strengthening

The diminutative size of the temple does not necessitate a major intervention for earthquake strengthening: during the restoration of the temple the historical timber structure will be strengthened/reinforced to improve performance in an earthquake. These measures include:

a. concealed bolting of every third rafter to the wall plate and purlin,
b. concealed metal corner plates bolting in the corner lap joint of the wall plates, which is one of the weakest point of the roof structure,
c. improve jointings and doubling up of the timber wall plates connecting each other to act as a ring beam (as executied in Uma Maheswar Temple, 1993)
d. metal collar plate on the upper roof rafters for securing the rafters to each other

Roof cover

The general standard in the Kathmandu Valley for roof protection consists of a concealed layer of tarfelt with bitumen were installed under the mud bed for *jhinagti* roof to protect from the leakage from the roof. Tarfelt, which is locally available, has a life of 15-20 years. This project will introduce for the first time in a restoration project a new water proofing membrane called "plastfalt", which is much more durable than tarfelt with an estimated life. Mud will be treated with anti vegetation chemical "Karmex". And as in KVPT past projects, the upper and lower most layers of the *jhingati* will be nailed with headless nails to protect from movements and headless nails allows to replaced damaged jhingati without moving other *jhingatis* besides damaged one.

Super structure

Even after years of exposure to the monsoon rain, the wall structure is still relatively sound, although the plinth is lost. A new plinth will be restored on the basis of the historical photographs and interviews with the local community.

APPENDIX D
Product information.

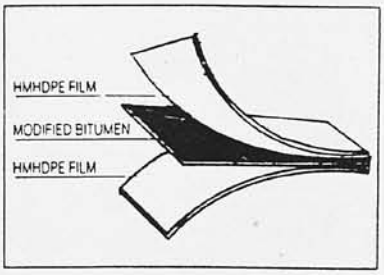
DATA SHEET

Integrated
Waterproofings Limited
(A Joint Sector Undertaking with TIDCO)

PLASFAL STANDARD
1 Kg / Sqm

Product Description

Plasfal Standard 1 Kg/Sqm is a Modified Bituminous waterproofing membrane manufactured to highest technical standards. It is a three layer membrane consisting of a layer of high quality modified asphaltic mix with properties of high penetration, high heat resistance and high softening point to make it ideal for waterproofing purposes. It also achieves high bonding strength with substrate and a strong adhesion between overlaps. The Modified Asphaltic mix is protected on both sides with HMHDPE. This reinforces the non permeable quality of the entire membrane. The resultant membrane has elongation exceeding 200% to adapt to contours.



Supply

Plasfal Standard 1 Kg/Sqm is supplied in rolls as follows:

Grades	Width in Meres	Length in Meres
Plasfal Standard 1 Kg/Sqm	1	20

Application Process

Application of Plasfal Standard 1 Kg is fast and easy. Smooth surface with minimum slope of 1:75 is required to apply the membrane. Therefore surface is first cleaned completely to eliminate all sharp projections. After cleaning, Multiplas Cold Sticker/Multiplas Blown Bitumen 85/25 or 90/15 is coated on the surface. (for more details refer relevant data sheet of Multiplas Cold Sticker/Multiplas Blown Bitumen).

Plasfal Standard 1 Kg is unrolled over the coated surface (with overlaps of 10 cm) and bonded completely to the substrate. The overlaps are then sealed by flame or blown bitumen. Special care is taken at singularities such as drains, expansion joints,etc.

Plasfal Standard 1 Kg is topped with a second layer of Multiplas Blown Bitumen @ 1.2 Kg/Sqm and finally finished with Multiplas Bituminous Aluminium Paint. If necessary, for additional security and life, Plasfal may be applied in two or even three layers with intervening layer of Multiplas Blown Bitumen.

PLASFAL

Tender Schedule Wording

Plasfal Standard 1 Kg: 'Supplying and providing waterproofing treatment with Modified Bituminous Plasfal Standard Waterproofing membrane of 1 kg/sq M (Plasfal or approved equivalent) including first coating the surface with Multiplas Blown Bitumen 85/25 or 90/15 @ 1.2 kg/sqm. Then applying Plasfal Standard 1 Kg membrane with 10 cm overlaps completely adhered to Multiplas Blown Bitumen and covered with a layer of Multiplas Blown Bitumen 85/25 or 90/15 @ 1.2 kg/sqm and finally finished with Multiplas Bituminous Aluminium Paint at 100 g/sqm.

Uses

Plasfal Standard can be used for following applications:

★ Roof Waterproofing ★ Toilet Waterproofing ★ Lining of Reservoirs

Specifications:

Characteristics of Polymeric Bitumen	STANDARD	PLASFAL STANDARD (1 Kg/sqm)
SOFTENTING POINT	ASTM D - 36	In excess of 70°C
PENETRATION AT 25°C 100g 5 sec	ASTM D - 5	24 tenths of mm ± 5
PLIABILITY	DIN - 52123	+15°C does not break +10°C does not break
TENSILE STRENGTH Break load of the membrane Elongation at break	DIN - 52123 Crosswise Lengthwise	 65 N/5 cm 50 N/5 cm Minimum 200%

*The data stated refers to standards effective on the printing date.
IWL has the right to modify them without any prior notice.

Distributed by :

Manufactured by:

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