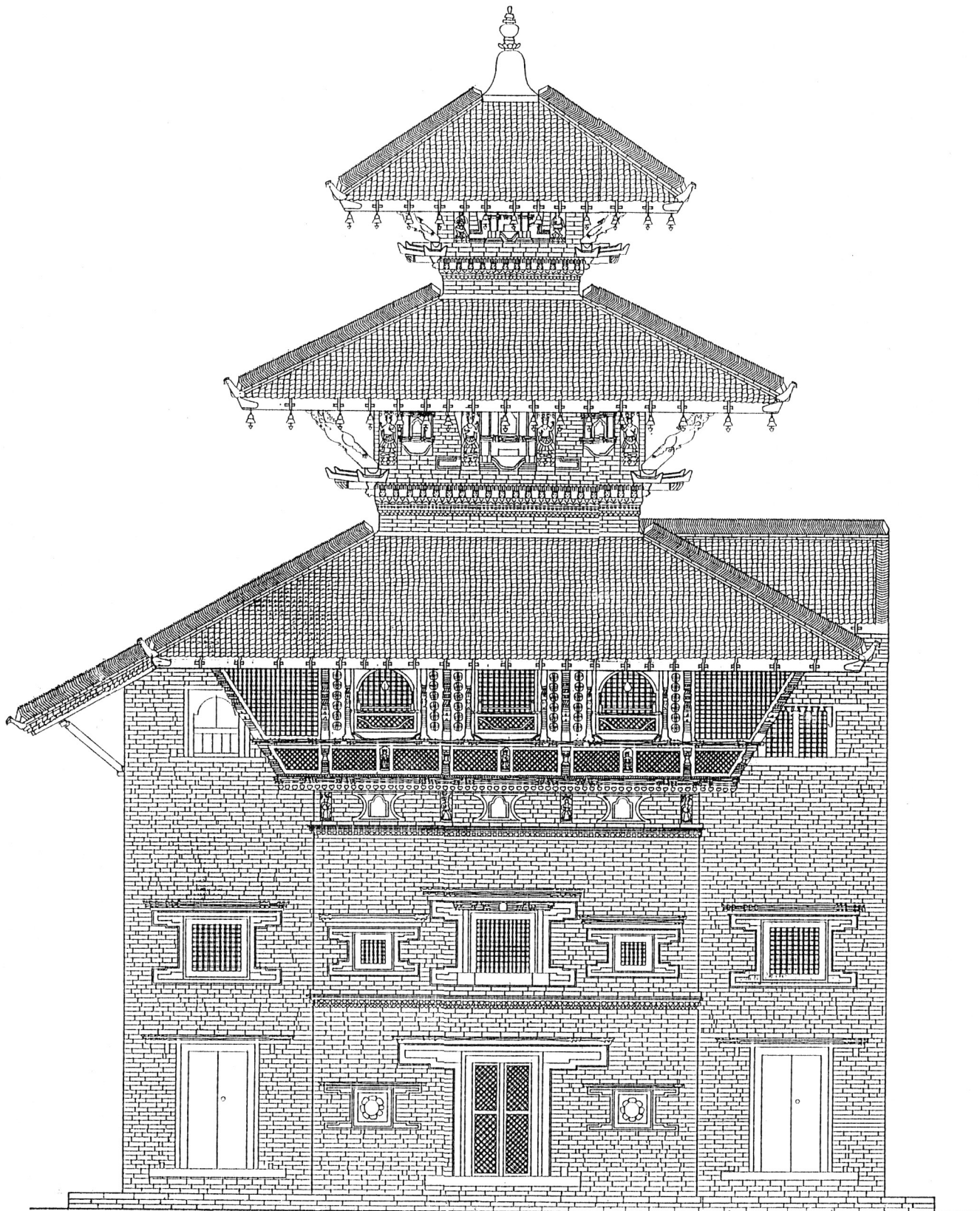




RESTORATION OF THE PATUKVA AGAM,

A 17TH CENTURY ESOTERIC SHRINE BUILDING
PATAN DARBAR WORLD HERITAGE SITE

FINAL REPORT

KATHMANDU VALLEY PRESERVATION TRUST
ERICH THEOPHILE AND ROHIT RANJITKAR , DECEMBER, 1998

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Acknowledgements

The project was made possible through the generosity of the following organizations and individuals:

British Overseas Development Administration
UNESCO World Heritage Centre
Patukva Guthi
Mr. and Mrs. Himalaya B. Pande,
Mr. Watson B. Dickerman III
Patan Programme (German Technical Cooperation)
Charlene Engehardt Foundation
Peter Goldfarb Foundation

Fundraising events were organized by Gautam S.J.B. Rana, Rajni Malla Fistolera, Patrick Lyons, and Erich Theophile.

This project would not have been possible without the kind assistance of Dr. Eduard F. Sekler, Michael Doyle, Patan Municipality, HMG Department of Archaeology, Sir Bernard Feilden, Dr. Niels Gutschow, Guy Nordenson, Mr. Timothy George, former British ambassador, Alfeo Tonelloto, Minja Yang, Rajni Malla Fistolera and members of the KVPT Board of Directors.

1.0 Introduction

The Patukva Agam restoration project gave back to the city of Patan and the world a rare architectural treasure, one of the handful of esoteric shrine buildings used by the royal priests, an architectural monument of international stature.

The building was ruinous in 1992 when the project was identified. Without this initiative the building would certainly have been lost, its advanced state of disrepair justifying the owners' application to rebuild in 1991. Instead, a long process of negotiation was initiated which proposed careful *in situ* repair and subsidized the local contribution of the owners to achieve an international standard of building repair. The building notably remains in the hands of the priestly family which first built the structure. Thus in its restored state it can be used again for the religious rituals of this priestly clan resident in the adjacent courtyards.

Conceptually, the project is an important precedent in preservation in Nepal for a number of reasons. First, owned by a religious confraternity or *guthi*, it is one of the first **semi-private monuments** to be restored with international assistance. Until now international attention has only concentrated on government owned or public buildings, ignoring the hundreds of threatened A-class monuments under semi-private (*guthi* or *sangha*) or private ownership. For this special case, the project developed a model tripartite agreement between the owners, KVPT and Department of Archaeology, a framework which both protected it in the future and allowed turn-key implementation by KVPT. Contributions and agreement stipulations also included a substantial local contribution of approximately \$5,000.

Secondly, the project, at the time of inception, stood on the outside of the delineated World Heritage Site. The rallying of funds for a structure which defined but stood outside the boundary line, i.e. **an unlisted monument**, was an important precedent for international attention to historical buildings which are key to the understanding of Nepalese heritage but are until now unprotected.

Thirdly, the **seismic strengthening** of this monument introduced a new approach to protecting the fragile masonry structures of Nepalese architecture. Instead of rebuilding the walls, the existing masonry structures were left untouched wherever possible and a new reinforcing, "back-up frame", somewhat like an interior scaffolding was introduced on the interior. Previously, all seismic strengthening measures in Nepal had introduced concrete ring beams into the existing wall fabric.

2.0 Chronology of work and documentation

Winter-spring 1993

Insulation of electrical high tension wires in front of the building.

Scaffolding constructed on both sides of the building; dismantling of the damaged roof structure at all three levels.

Repair of upper pagoda damaged walls at two levels.

Temporary waterproof covering installed for monsoon protection.

Fall 1993

Repair of wall plates; replacement of pinnacle base timber structure. in upper tower.

Installation of new rafters and pinnacle base in upper tower. Rafters treated with waterproofing chemicals provided by UNESCO. Installation of planking and eavesboard.

Installation of tarfelt as waterproofing membrane on upper tower roof. Mud bed and roof tiles installed upper tower level.

Winter-spring 1994

Repair of wall plates and installation of rafters at tower lower level.

Installation of new rafters at main roof level. Waterproofing chemical applied on all rafters

Planking and eavesboards installed at two levels: main roof + lower tower roof. Tarfelt waterproofing layer installed at both levels.

Cleaning of roof struts and decorative timber work in situ at upper tower level.

Install mud bed and roof tiles at lower tower level.

Custom fabrication of decorative terracotta elements and facade brick.

Protective cover on main roof for monsoon.

Fall, 1994

Install timber structural back-up frame on ground floor above new stone foundations.

Reconstruction of timber gallery on rear facade, two levels.

Fabrication of lost *san-jhyah* (bay window) components; repair in situ of intact elements of bay window; repair of other carved openings in principal facade.

Repair and replacement of floor joists above ground level.

Winter spring 1995

Masonry wall repair and reconstruction in lower 3 levels.

Replacement of damaged facade veneer bricks and decorative terra-cotta tiles.

Installation of planking and waterproof tarfelt layer on principal roof.

Construction stopped from February to July 1995 due to delays in funding.

Cleaning of struts and decorative woodwork in situ at lower tower level.

Repair and bracing of damaged struts, all levels.

Installation of upper three levels of timber structural back-up frame.

Fabrication of bronze bells for eaveboards.

Installation of mud bed and roof tiles on principal roof.

Fall, 1995

Fabrication and installation of replacement doors on principal facade.

Cleaning of brick and timber carved elements on main facade.

Installation of bronze bells at eavesboards.

Reconstruction of uppermost (third) level of the rear timber gallery including rafters.

Replacement/repair of floor joists at second floor.

Construction stopped from May to November , 1996 due to lack of funds.

Fall, winter 1996

Door and window shutter installation.

Mud plaster and lime interior plastering.

Fabrication/installation of new staircase and trapdoor.

Installation of diagonal floor planking (as seismic bracing) at two levels.

Installation of mud bed and roof tiles at back gallery. Installation of eaves bells at main roof.

Fabrication and installation of timber railings in rear gallery two levels. Timber floor planking installed in rear gallery.

Winter-spring 1997

Metal bracing installed on timber back-up frame.

Retiling of gallery roof; correction of leakage problems.

Pavement repair in courtyard, back gallery area, and deity room.

Courtyard clean-up including repair of plinth, drainage, and steps. Site clearance.

Inauguration March 25, 1997

3.0 Building fabric

3.1 Roof configuration

During the partial disassembly and repair of the main roof, evidence of a previous and symmetrical roof configuration was found. In this configuration the roof would have sloped down on all four sides around the upper pagoda.

A surviving wall plate on the north face of the upper pagoda wall (now covered by the reconfigured roof) reveals that the earlier roof rested here and sloped down to the north. The construction of the adjacent house which is taller than this main roof necessitated the reorientation of the roof to slope east-west. The latest possible date for this reconstruction would have been following the 1934 earthquake, the time from which the extant house dates, although this building may have replicated an earlier condition.

3.2 Maintaining historical fabric

Despite local requests to replace rather than repair, architect Rohit Ranjitkar successfully negotiated with them to maintain the historical tile pavement and the timber columns of the rear loggia as well as the facade veneer brick. These preserved elements, although specified as "to be saved" in the historic structure report are often difficult to save when local funders of the project protest. It is a huge time commitment to discuss these fine points of preservation with locals who feel that building new is the most appropriate way to venerate the gods.

4.0 Technical issues

4.1 Seismic strengthening

Engineer Guy Nordenson conceived and prepared a design as a contribution to the project for a timber back-up frame. In Sir Bernard Feilden's words, the solution is a "novel" solution to seismic reinforcement, deserving of further development. Based on Sir Bernard's concerns about the flexibility of this frame up against mud masonry walls, the decision was taken to build it in pine. Stone footings were designed and constructed below these pillars which were treated with a preservative paste form of Wykamol donated by UNESCO World Heritage Centre.

Mr. Nordenson's design included a timber back-up frame as well as diagonal timber floor planking added in two layers to create a rigid plate.

The timber back-up frame may have wide scope for application in Nepal because it is easy to build and effective for the reinforcement of small structures against earthquakes. Similar to the visible steel frame of the German-funded Cyasilin Mandap reconstruction project, it is the only contemporary example of a secondary structural frame in timber added to buttress a building.

This approach to reinforcement, the back-up frame, reduces invasive insertion of structure in the walls. It would be less costly and appropriate for larger buildings if executed in steel. I believe this may be a major positive direction for earthquake strengthening technology in Nepal.

- 4.2 Jhingati roof tiles
Project architect Ranjitkar developed a nailing solution to attach the roof tiles on lower roofs at the first row, i.e. where they spring from butting walls. This is the place where animals and birds tend to dislodge the tiles. This measure will increase the life of the roof.
- 4.3 Roof cover-protective membrane
In place of the waterproof layer of tarfelt for the roof cover, we attempted to substitute a longer-life elephant skin newly produced in India. Delivery time proved to be too long (2 yrs +), however, and tar felt + bitumen was used instead. The elephant skin will be an appropriate solution after supply routes are in place.

5.0 Operational issues

- 5.1 Project implementation schedule
The actual duration of construction work was as described in the historic structure report approximately two building seasons or 20 months. The fact that this was spread over three years resulted from two financing difficulties: the local guthi contribution and the inability of KVPT to secure funding to complete construction. The former donation of the Guthi in the amount of \$5,000 was held up because their payment depended on a government land sale--this condition was disclosed only well into the project. To expedite the government land sale the aid of the Department of Archaeology, the British Ambassador, the American Ambassador, and the Roads Department, the government agency responsible for such land deals were enlisted. Our expediting efforts, including not fewer than one hundred meetings, secured funding month later allowing the project to start up again.

Meanwhile in spring 1996, the KVPT chairman issued the directive that no further work should be taken up on the project because of insufficient funds. Thus from April 1996 until November 1996 no construction work took place. In November 1996 when funds from the Boston fundraiser organized by the author reached here, work started up again and was substantially finished in February, 1997. Additional minor work components such as the final coat of mud plaster and the installation of the diagonal steel bracing was completed in April, 1997.

Despite the delays caused by collection of the local contribution, the importance of financial participation of local partners cannot be underestimated--both critical to the longterm future of Nepal's heritage and as guarantee of their ongoing commitment to maintain the building.

6.0 Budget Summary

Income Summary

1.	British Embassy	126,500.00
2.	GTZ	500,000.00
3.	"Itihaas" Fashion show contribution	100,000.00
4.	Interest	108,109.78
5.	Jyoti Bhawan	30,000.00
6.	KVPT, Nepal	813,216.45
7.	KVPT, Boston	1,546,976.40
8.	Mrs. Carrol Long	25,000.00
9.	ODA	1,074,450.00
10.	Mr. Himalaya Pande	250,000.00
11.	Patuko Guthi	250,000.00
12.	UNESCO	150,000.00
	Total Income	<u>4,974,252.63</u>

Expense Summary

1.	Construction	
	Sub contractors	322,844.50
	Timber	923,393.10
	Conservation material	182,013.20
	Construction material	367,102.50
	Imported structural materials	16,000.00
	Tradesmen	406,704.00
	Local conveyance	93,028.50
	Capital investment	136,914.00
	Total	<u>2,447,999.80</u>
2.	Documentation/Research/ Training	
	Professional library	23,801.40
	Photographic documentation	48143.16
	Doc/HSR preparation	21,201.00
	Reprographics	59,073.00
	Total	<u>152,218.56</u>
3.	Implementation Team/Project office	
	Staff salaries	1,194,647.50
	Office supplies	130,549.00
	Training activities	32,190.00
	Office rent and utilities	78,850.00
	Total	<u>1,436,236.50</u>
4.	Miscellaneous Cost	
	Miscellaneous	43,403.39
	Fundraising expenses	314,526.00
	Visa expenses	63,642.00
	KVPT/Boston	249,672.00
	Bank ledger fee	950.00
	Communication	265,603.95
	Total	<u>937,797.77</u>

Grand total of expenses 1-4

= Nrs 4,974,252.63

7.0 Project notes

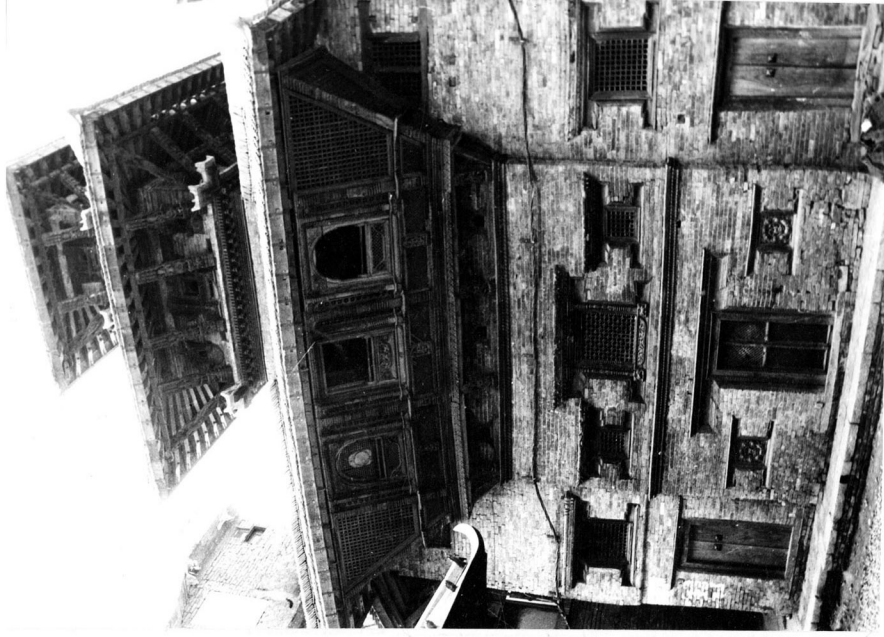
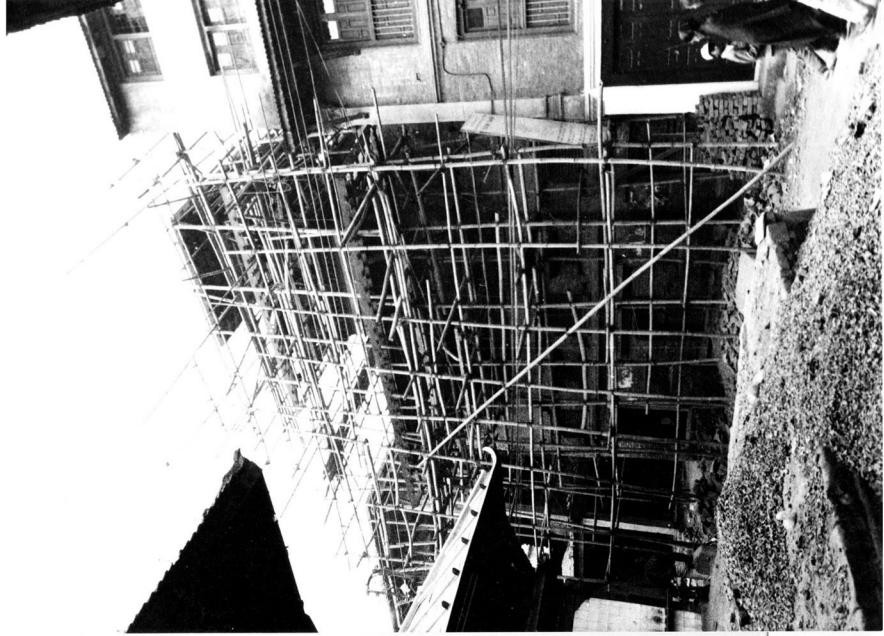
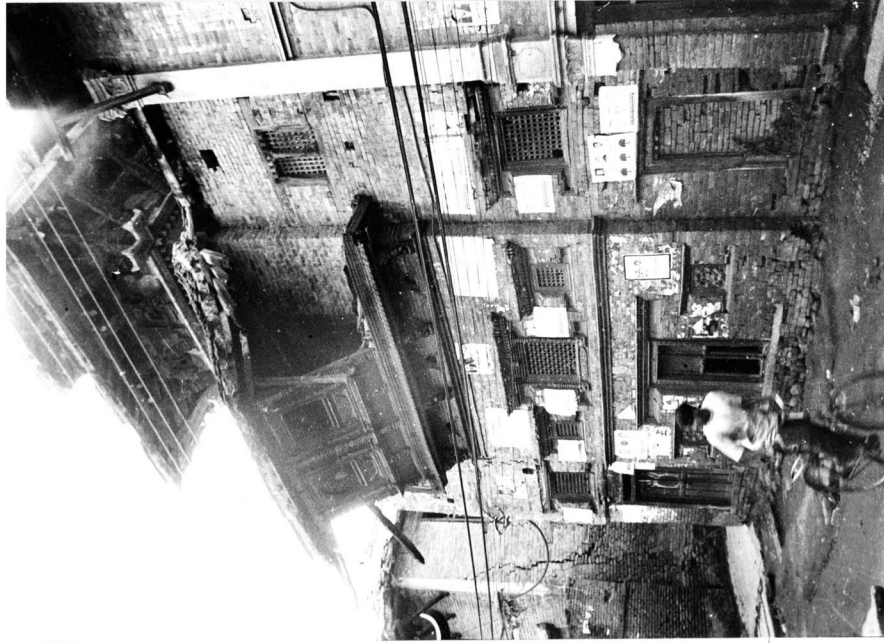
The completion of the Patukva Agam restoration project has been hailed as a success by visiting UNESCO experts on two occasions and was used as the cover page for the December, 1996 Nepal World Heritage Site Monitoring Report. The use of a timber back-up frame on the interior to strengthen the fragile tower-like building against earthquakes has been described as a useful model by Sir Bernard Feilden, who reviewed the project design in 1994.

Documentation prepared for the historic structure report included photographs of similar agam buildings in Kathmandu and Patan. This documentation by chance proved useful when the Joshi Agam, which defines the west side of Kathmandu Darbar Square, was partially dismantled and rebuilt with modern fenestration. Our photo remains the only record of the Joshi Agam historical facade and was provided to the Department of Archaeology and UNESCO World Heritage Centre. Unfortunately, neither of these authorities was able to enforce the rebuilding of the structure in the historical configuration.

During the repair of the Patukva Agam another agam structure in Patan, the Sulima Agam was partially dismantled, demonstrating how critical these interventions are. Despite UNESCO authorities decision not to place the Kathmandu Valley World Heritage Site on the endangered list, the destruction of monuments inside the World Heritage Sites continues. Fifty feet south of the Patukva Agam, an early Malla period Buddhist Agam structure (included in the redefined World Heritage Site boundaries) was fully dismantled 18 months ago.

The building has been shown to numerous visiting experts and v.i.p.'s including His Excellency the Ambassador to UNESCO Mr. Jha, Ms. Minja Yang (World Heritage Centre), Rick Englehardt, Regional Director of Culture for UNESCO (Asia-Pacific Region), His Excellency the British Ambassador Mr. Barney Smith, Kevin Brindt, First Secretary to the British Embassy/O.D.A. Director, the American Ambassador Mrs. Sandy Vogelgesang, Her Royal Highness Princess Jayante Rajya Laxmi Devi Shah, and, most recently, a tour of the American Woman's Organization of Nepal.

The project also built important experience in fundraising activities which included KVPT's first international fundraiser September 1996 at Club Karma, Boston and another major event, a fashion show "ITIHAAS" organized by Ms. Rajni Malla Fistolera in Kathmandu at the Hotel Mall in September, 1997.



Patukva Agam
view of principal facade and superstructure from Patukva Square
before restoration (1991), during (1993), and after (1997)



Pre-project activities
SE view after emergency tarpaulin cover on the roof to
protect from monsoon rain, 1992.

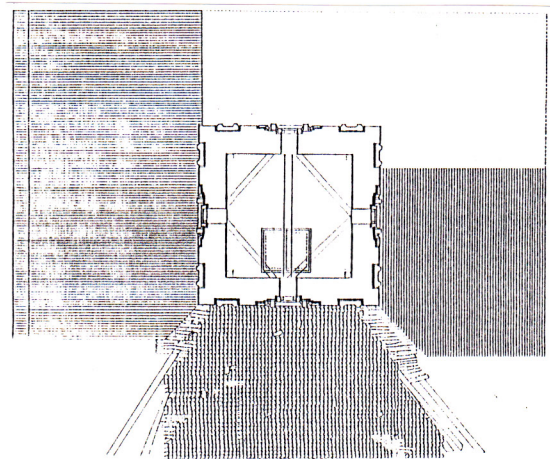
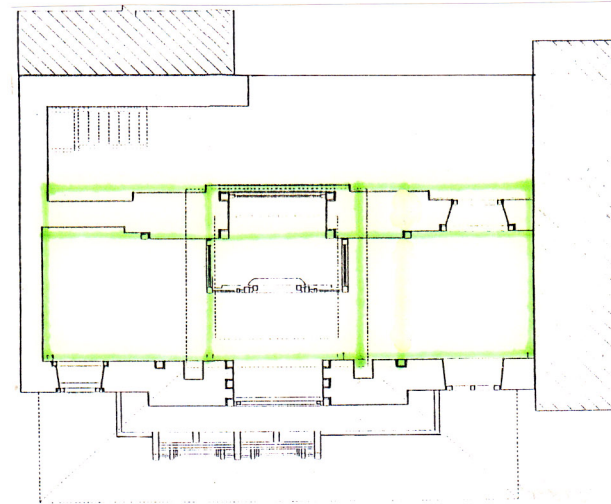
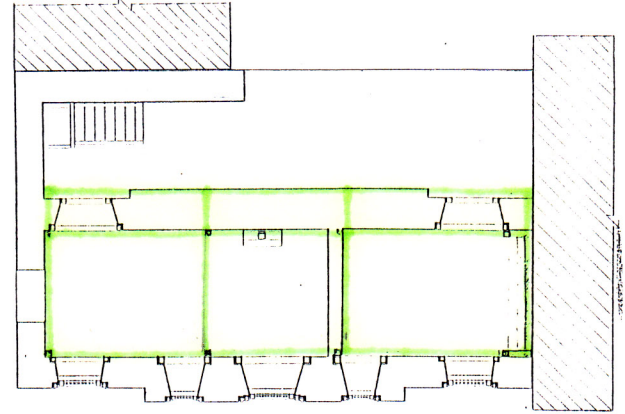
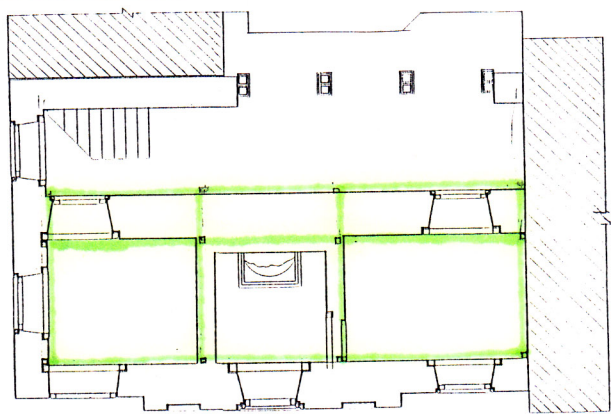
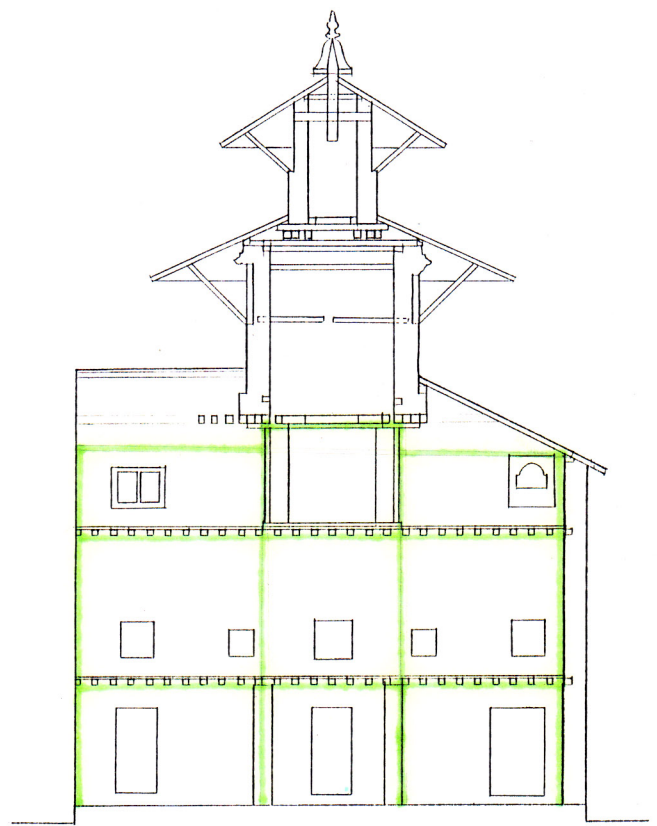
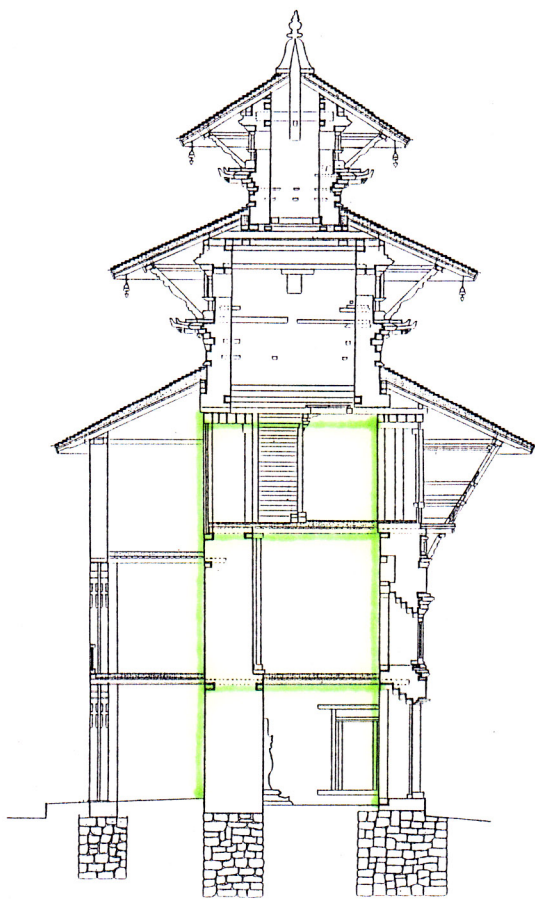


Courtyard elevation (west)
before and after restoration showing rebuilt gallery.



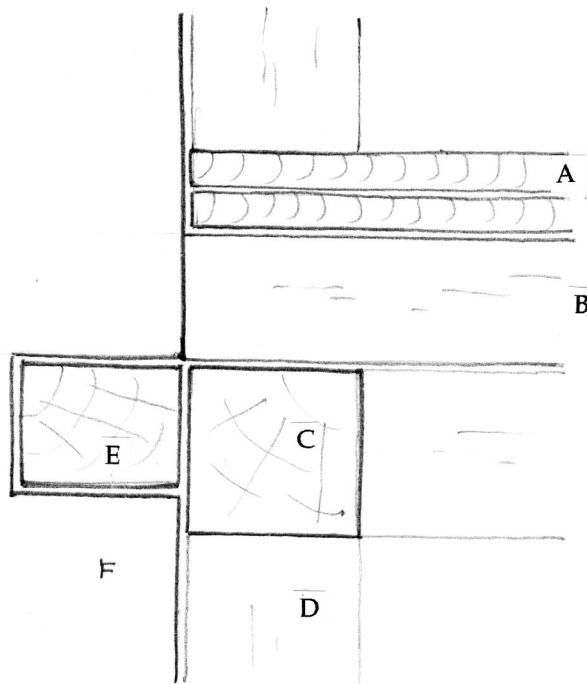
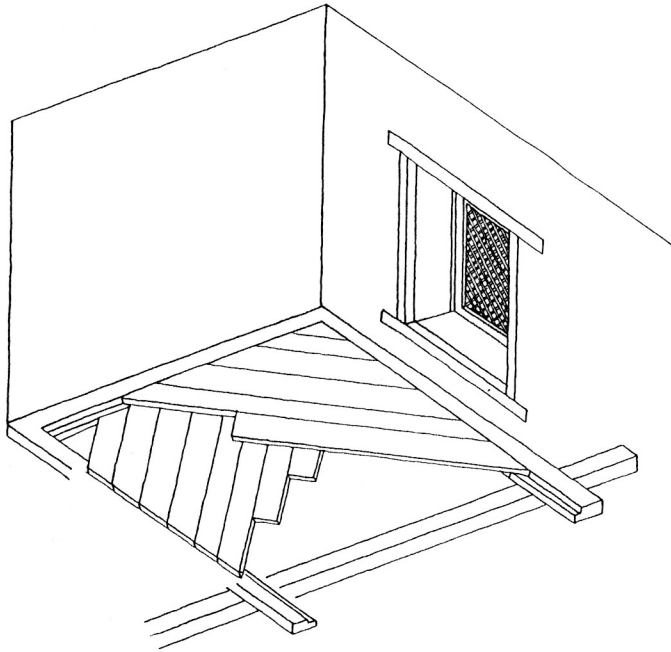
Seismic reinforcement

Top: New timber earthquake back-up frame inserted at three levels of the building. The middle four posts were located beneath the upper tower walls, so the frame works as reinforcement for the tower as well as backup frame to support floors in case of wall failure. Middle: New planking floors laid in double layers at 45 degrees and perpendicular to each other together with the floor joists, to create a three layered rigid plate. Bottom: A detail of connections in-between timber posts and beams secured with metal brackets.



Seismic reinforcement

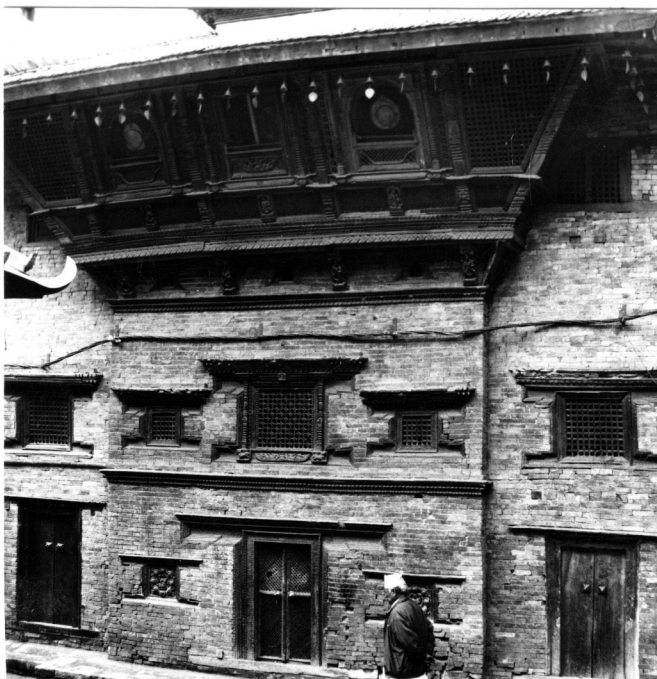
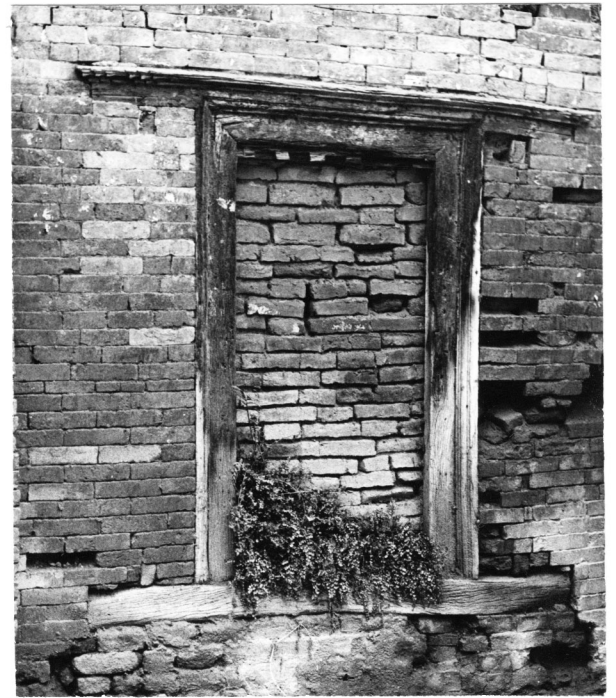
Reinforcement with timber frames as a backup frame which will carry loads if walls are damaged in the earthquake. Floor plans, cross and longitudinal sections showing layouts of timber backup frame in existing condition.



- A. Two layers of planking on diagonal (1" thick)
- B. Existing joist
- C. New pine wooden beam 6"x 6"
- D. New pine wooden post 6"x 6"
- E. Existing wall plate
- F. Brick masonry

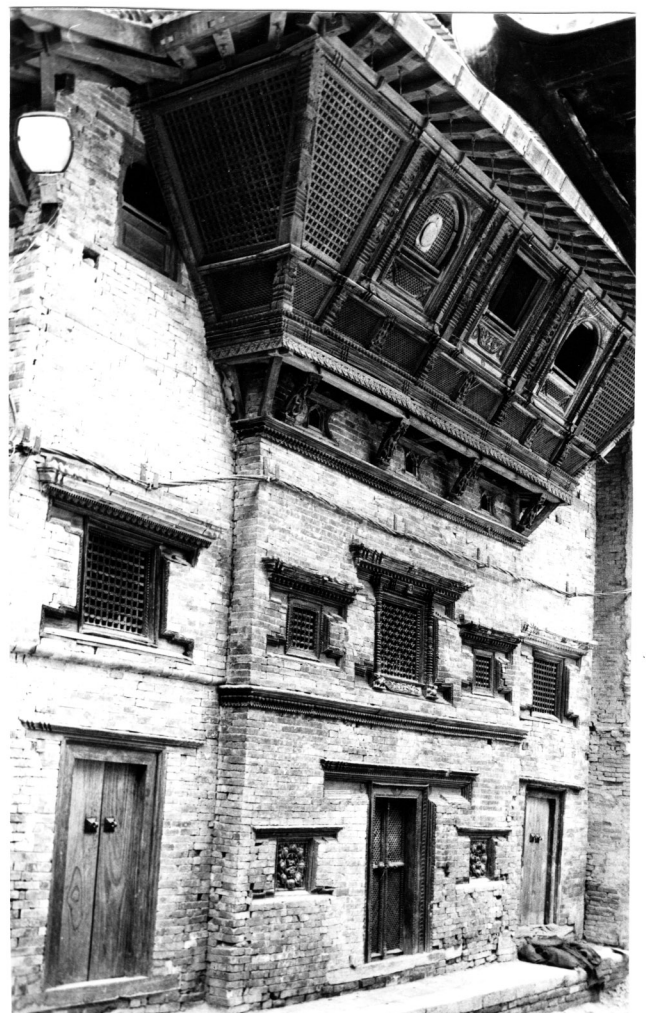
Seismic reinforcements

Left: Axonometric view (NE corner of first floor) showing stiffening of the building as achieved by this timber backup frame in combination with double layered and angled planking floor system. Right: Detail showing location of fix new timber backup frame at existing joist.



Restoration of historical facade openings

Upper left: South doorway on the ground floor had been replaced with a larger modern doorway for use as a shopfront. Top right: North doorway on the ground floor had been blocked up with bricks during recent repair by the guthi. Bottom left: Lower three floors of the front facade after restoration. Bottom right: south door, principal facade after restoration with historically appropriate plain timber blades.



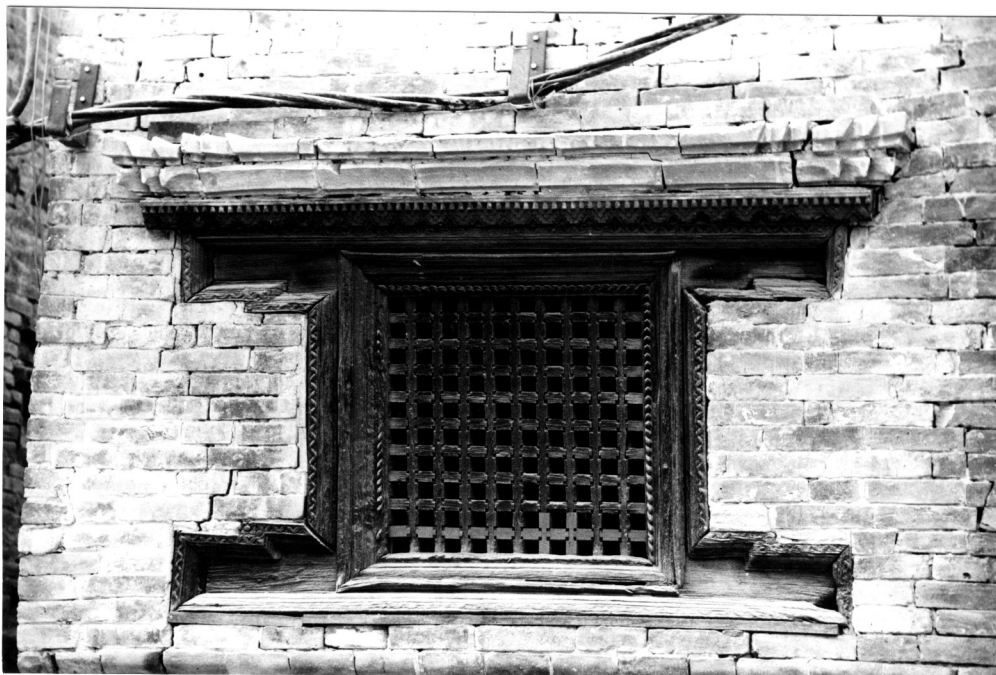
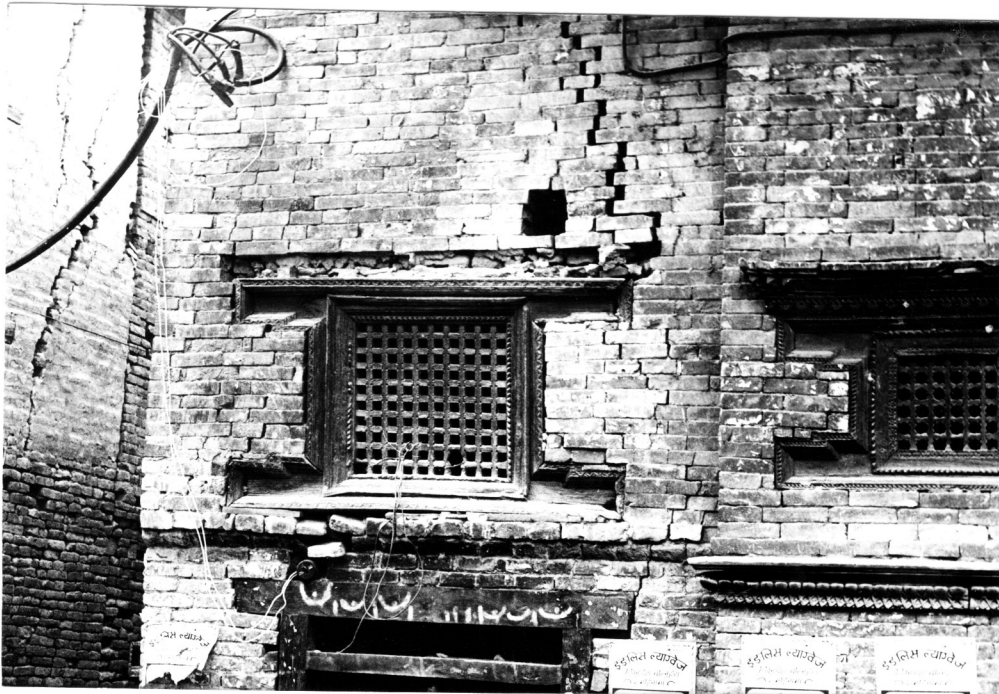
Bay window (san jhyah)

Left: lost southern portion of bay window on principal facade. Right: after restoration incorporating historical corner post and new replacement lattice work (south end only).



Cleaning of carvings

Carved timber elements were carefully cleaned with soap and water using soft brushes. All cleaning work was accomplished in situ.



Decorative terracotta

Lost terracotta cornice elements above the window (above) were replaced with new elements made to match (below).



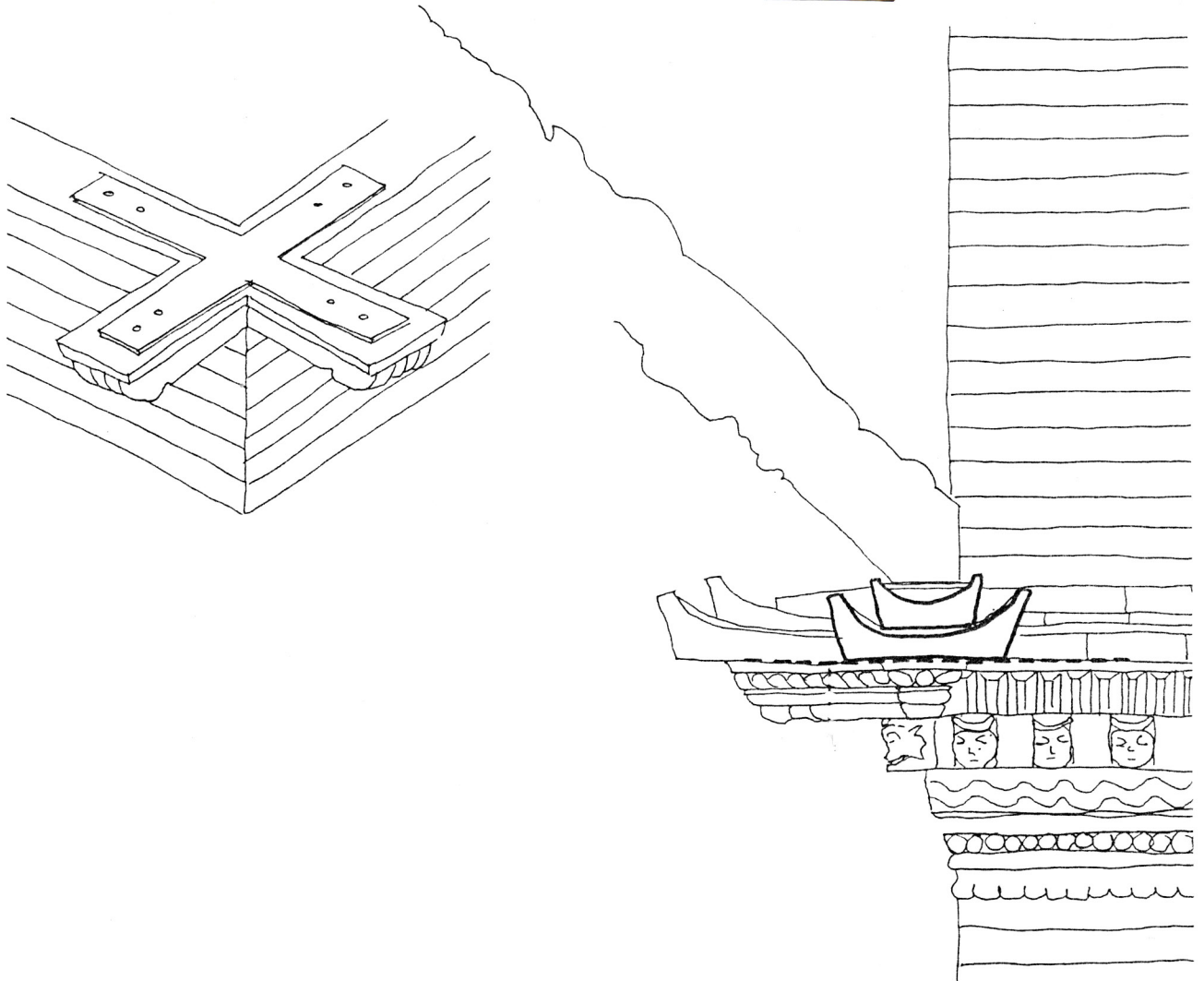
Repair of timber columns

Top: The timber columns rotten at their bases after years of dampness, while the upper 2/3 were still in fair condition. Below: Upper 2/3 of the old column (right) preserved as a historical fragment with new "foot".



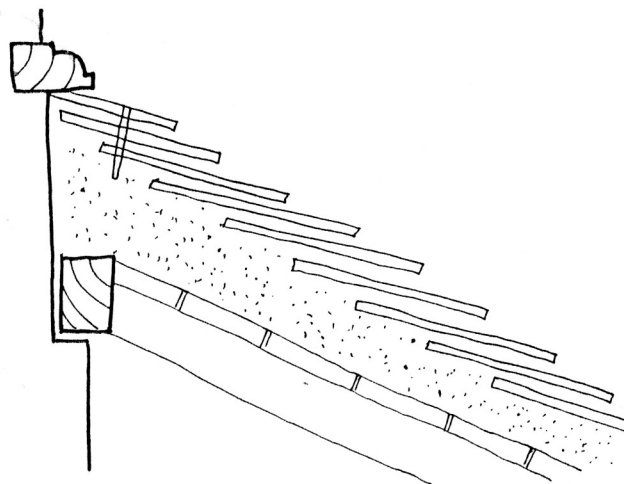
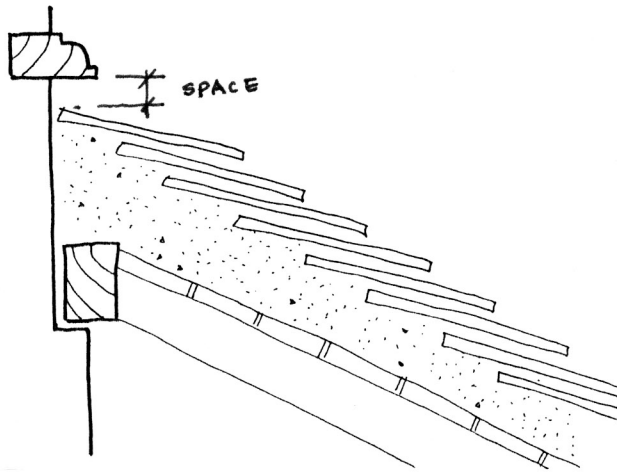
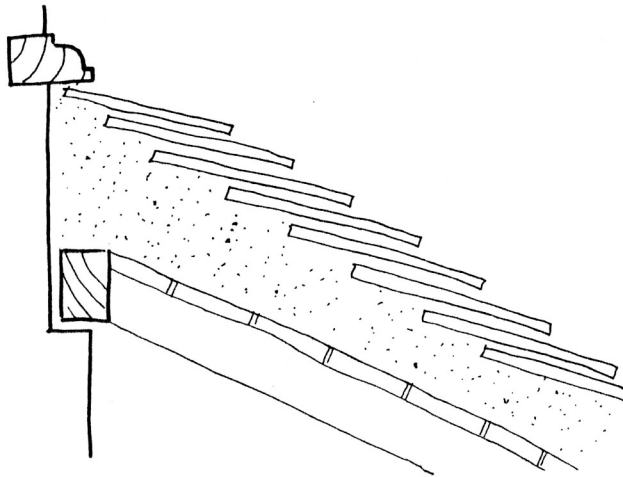
Mud and tiles

Above: all mud floors were removed to reduce dead loads. Below: the tile of the ground floor was maintained to demonstrate the rich lustre of the historical brick despite cracking.



Reinforcement of lah-kah

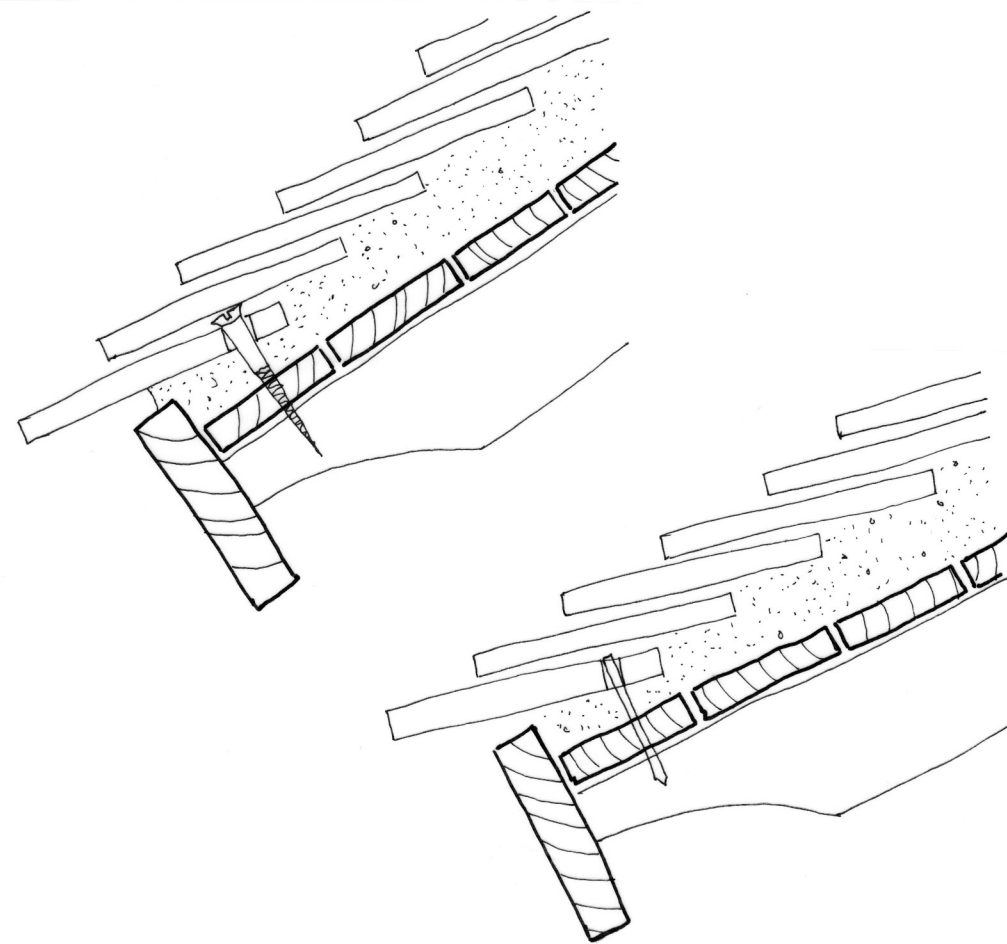
Top: The corners of the decorative timber cornices (Newari: Lah-kah) just below the corner strut bear heavy terracotta corner pieces. Because the timber corner pieces are half notched their section is insufficient to bear the load of the terra cotta pieces. This often leads to broken corners and fallen terracotta lah-kah. Bottom: A metal cross pieces is screwed on top of the lah-kah which prevents failure. The terracotta pieces rest above thereby concealing its presence.



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

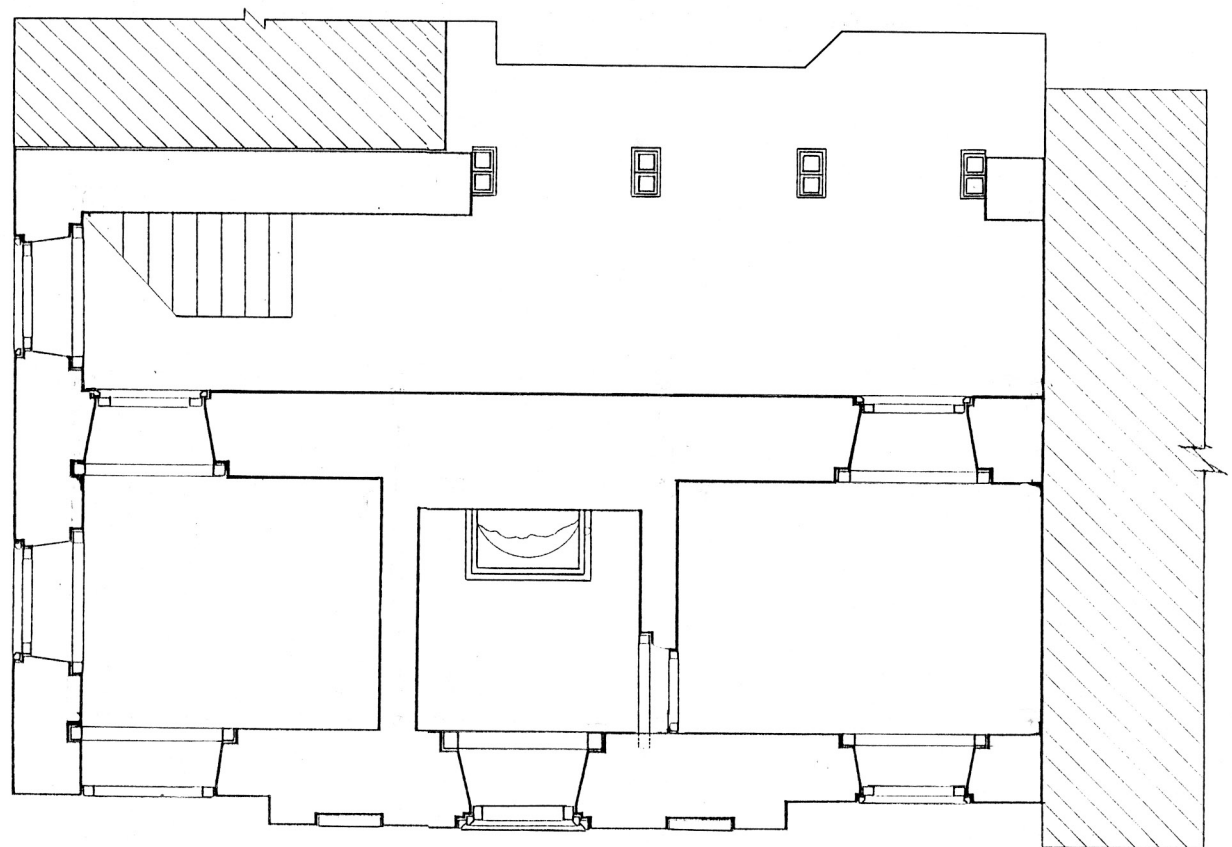
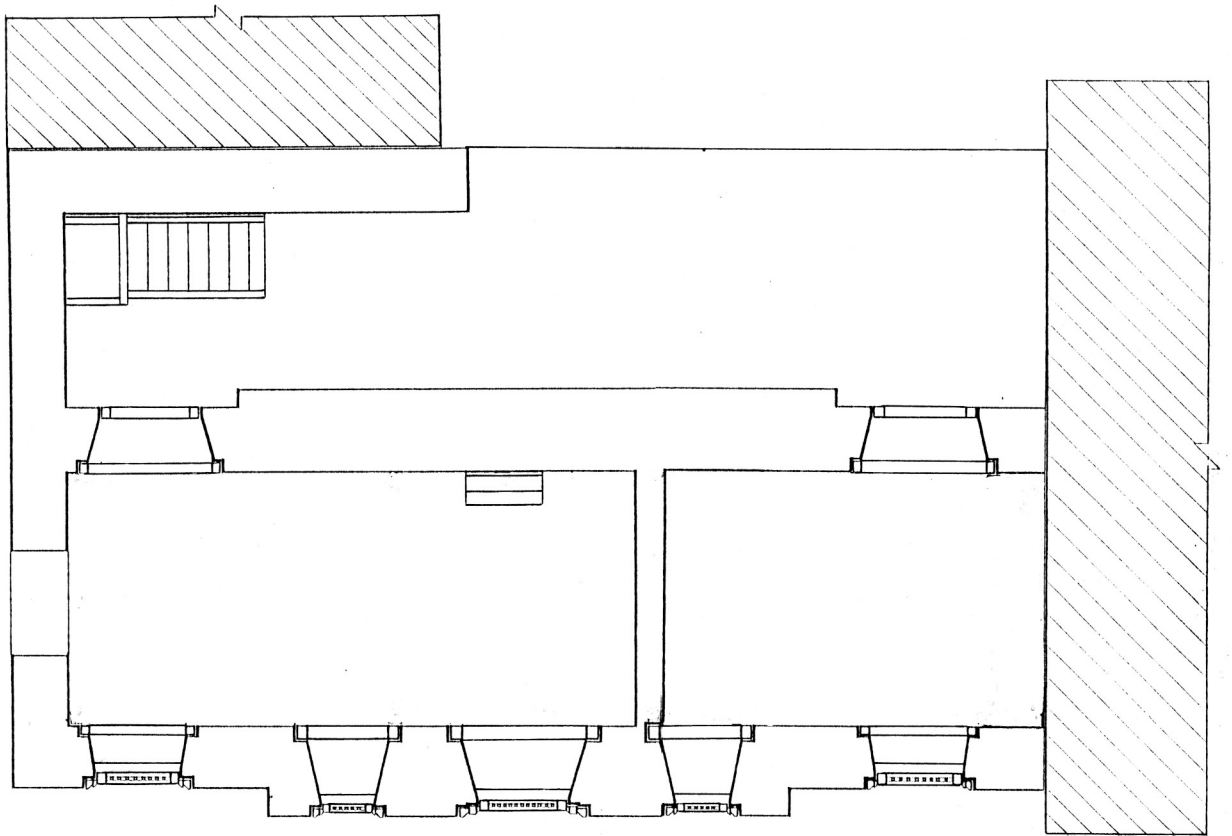
Roof tile (jhingati) detailing

Top: Typical detail with the upper most row of jhingati laid just under a timber cornice. During the shifting of the tile with time this upper row of the tiles slides down. And all the lower jhingati always overlapped and only app. 1/4 of the total length is visible. But the upper most jhingati are visible totally, except overlapped by the timber cornice on the wall. Middle: When jhingati are laid on a thick mud bed, after the mud dries there is always settling, which makes aspace between the timber cornice and jhingati., Bottom: A few days after the laying of the jhingati (when mud has dried) there is space between the timber cornice and jhingati to add a 3/4 length jhingati. This does not allow shifting.

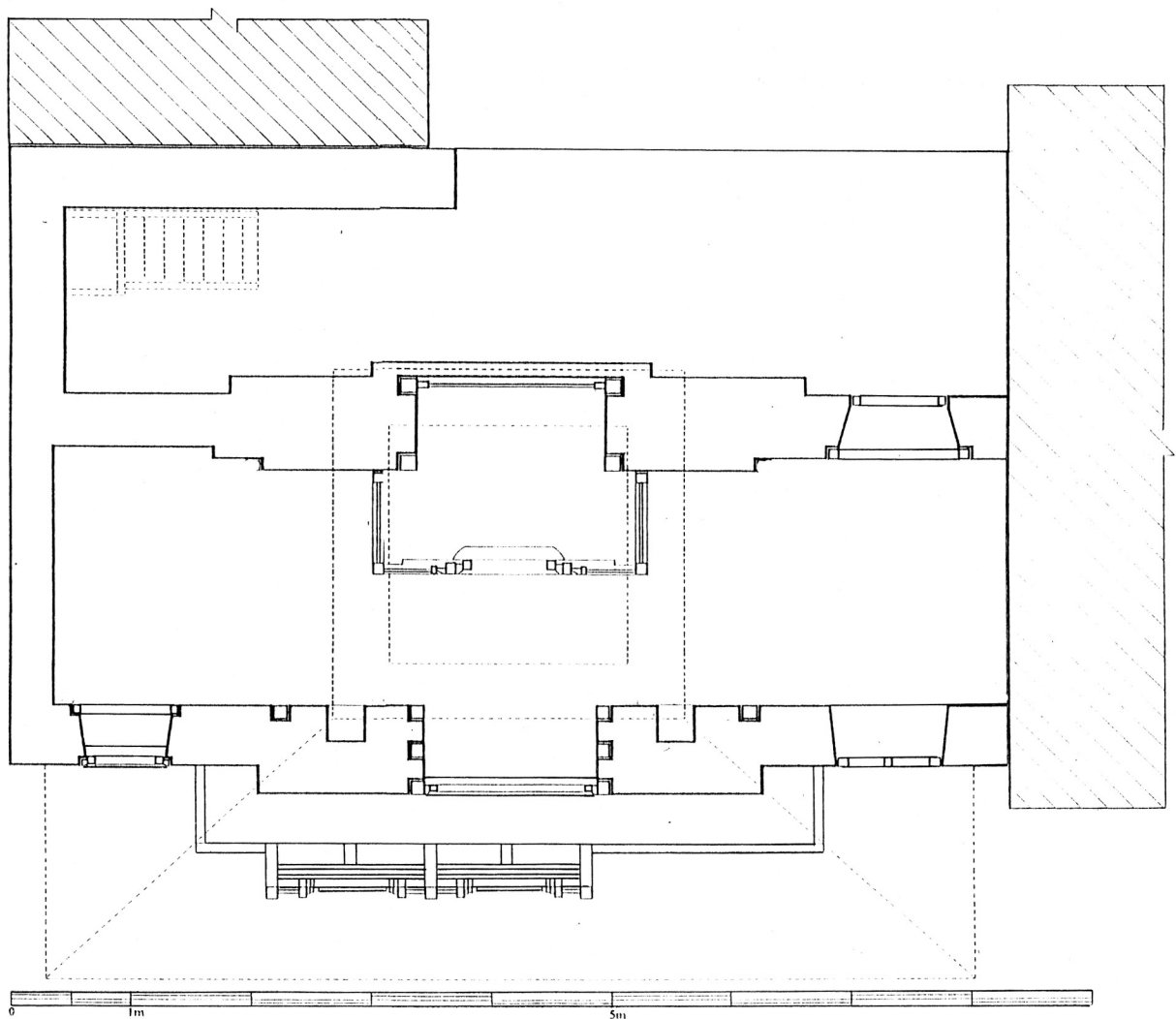
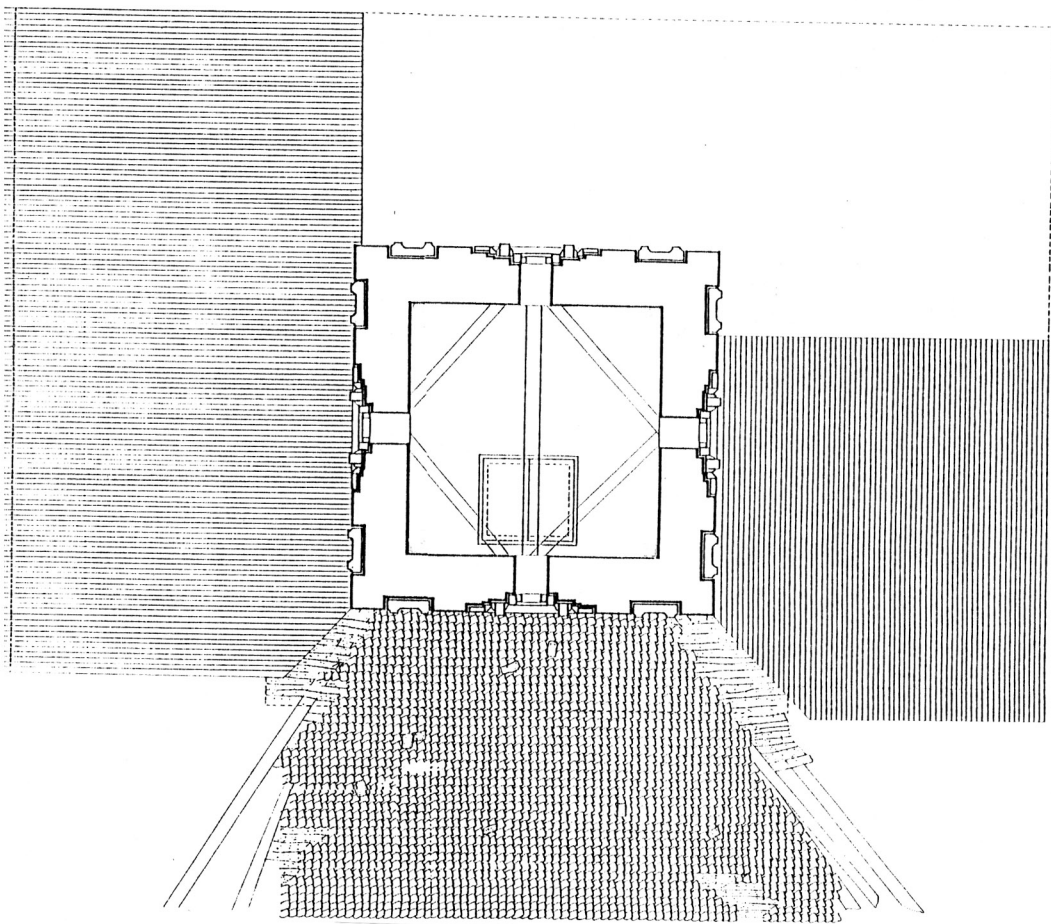


Improved detail for fixing the first row of jhingati (roof tiles) on the roof

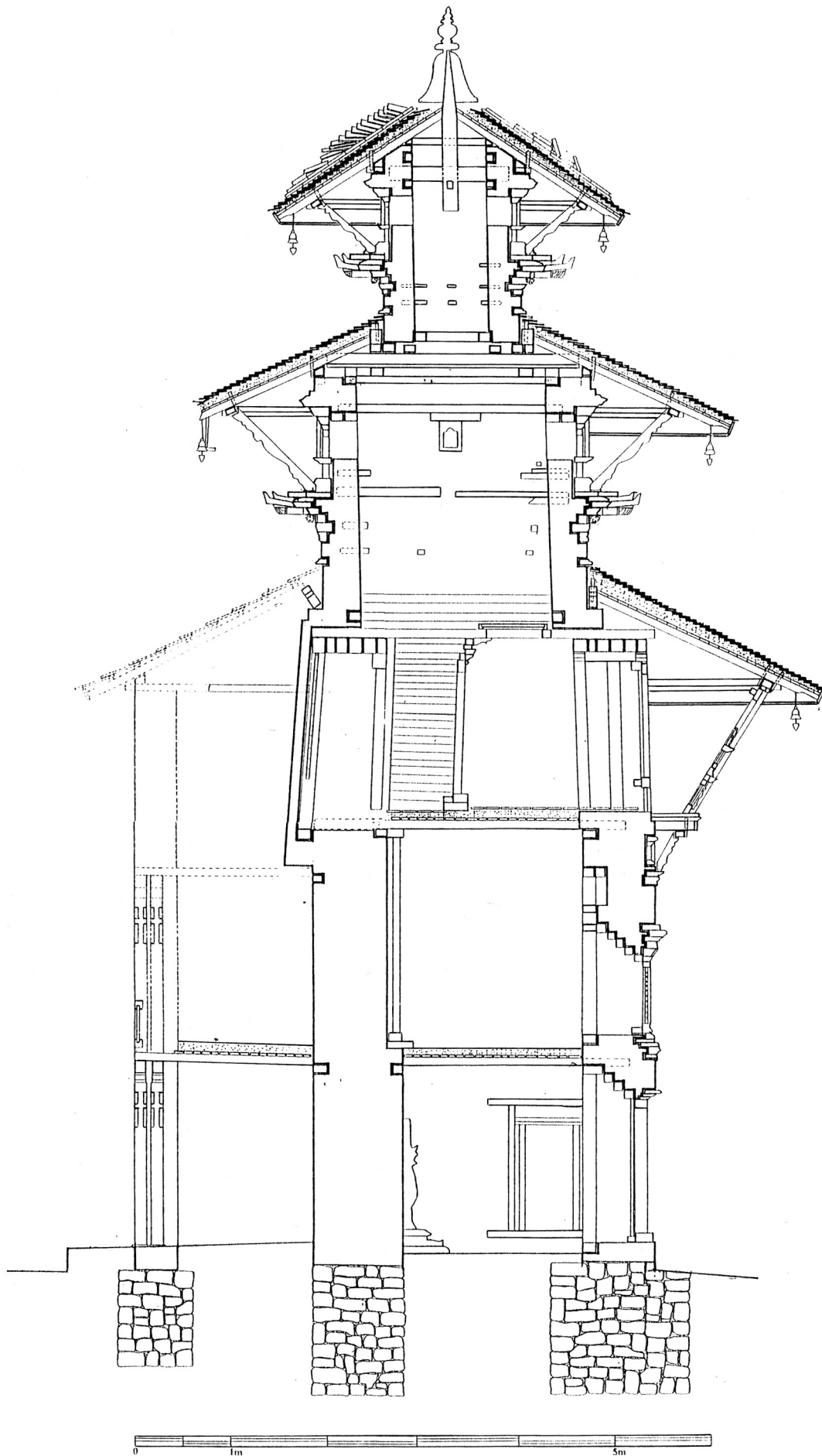
Top: Typical detail with half of the jhingati in the first row overhang the eaves board. Once the first row falls away further loss continues above. In the Hanuman Dhoka Restoration Project the first row of jhingati were screwed into place to prevent loss. After some years many jhingati were lost. Replacement, however, was difficult, due to the screw heads which must be removed before jhingati replacement can be undertaken. Middle: 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. Bottom: photograph showing the first row of jhingati with headless nails.



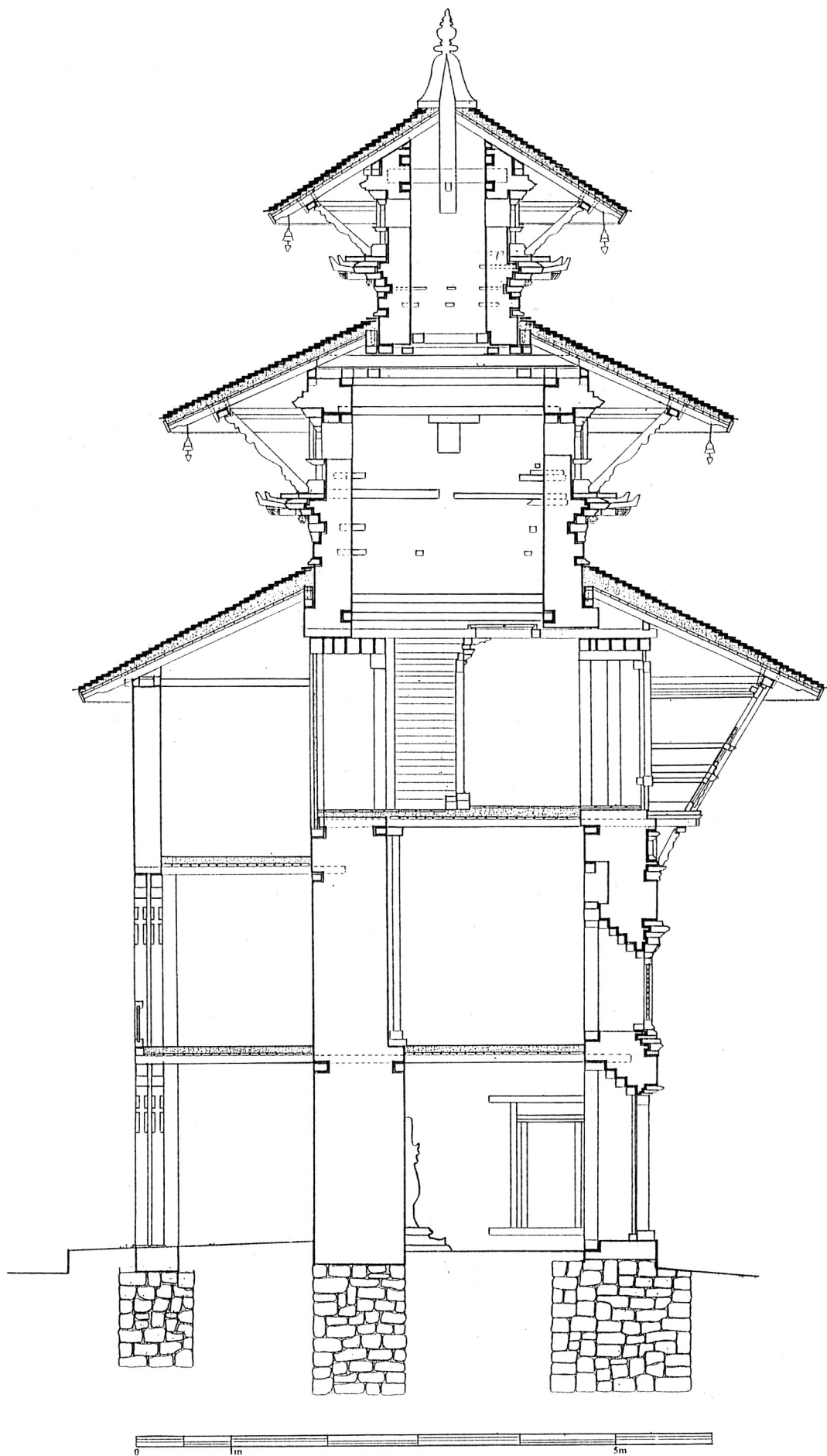
Ground and first floor plans: existing conditions, 1992



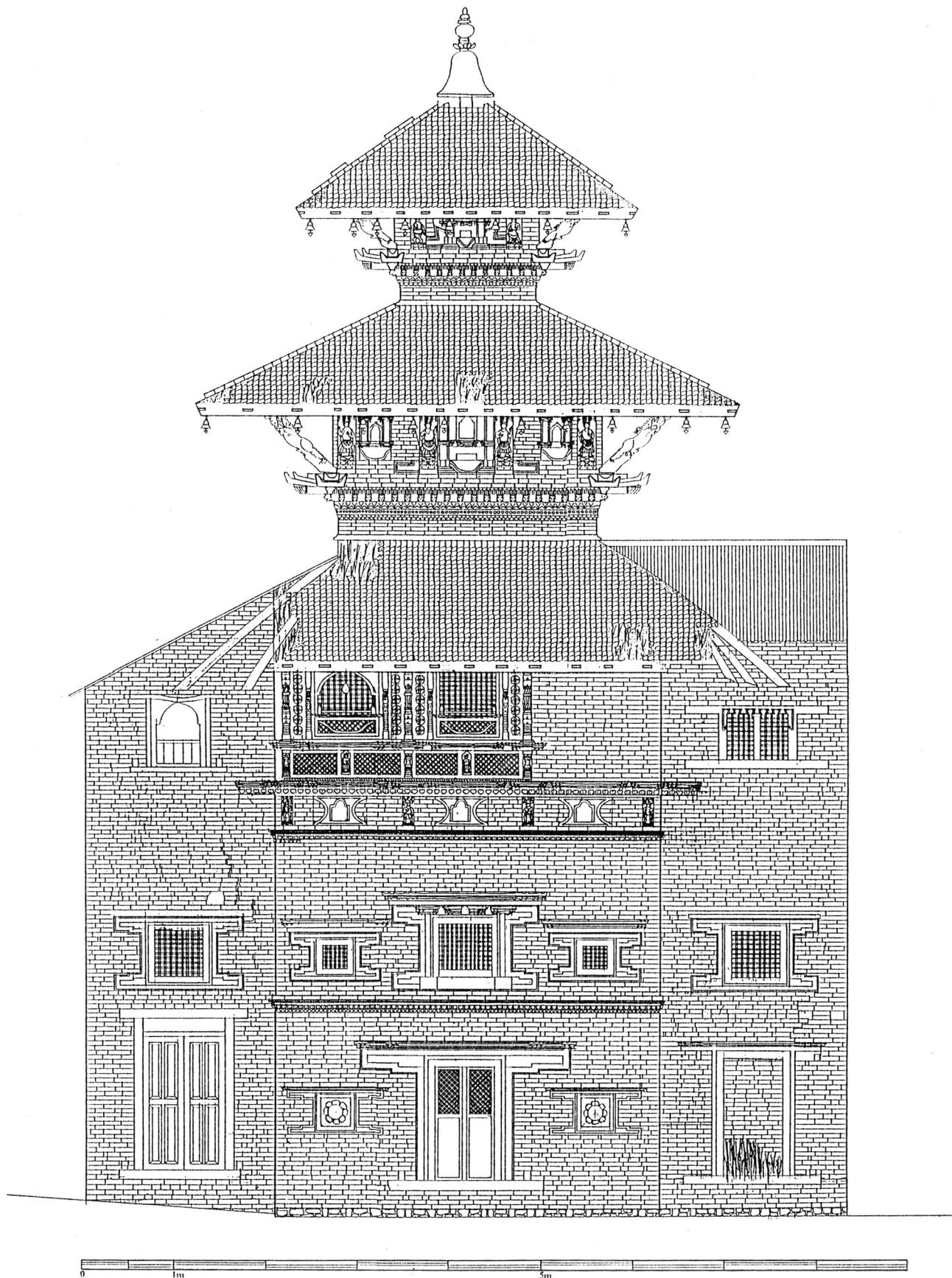
Second and third floor plans: existing conditions, 1992



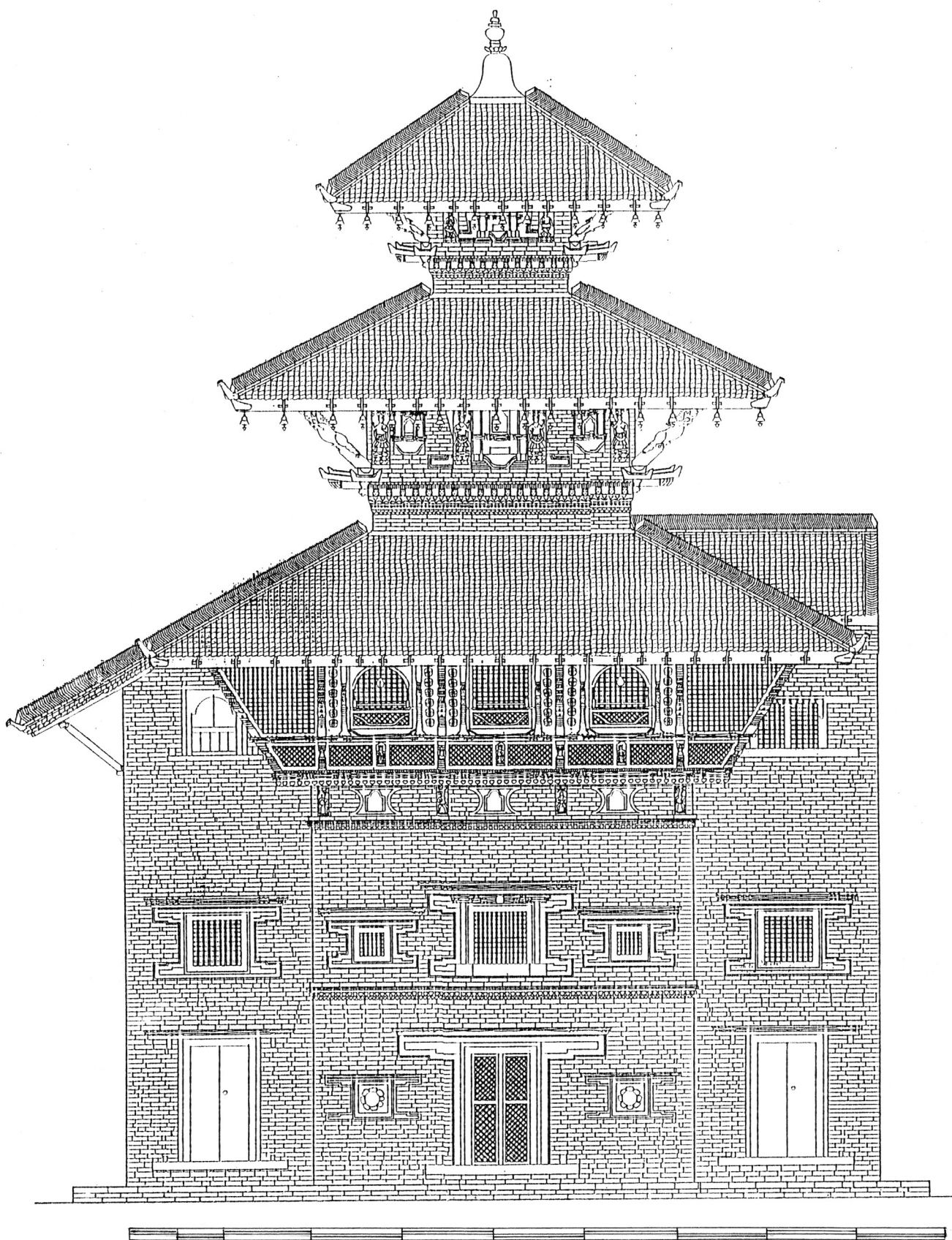
Building section: existing conditions, 1992



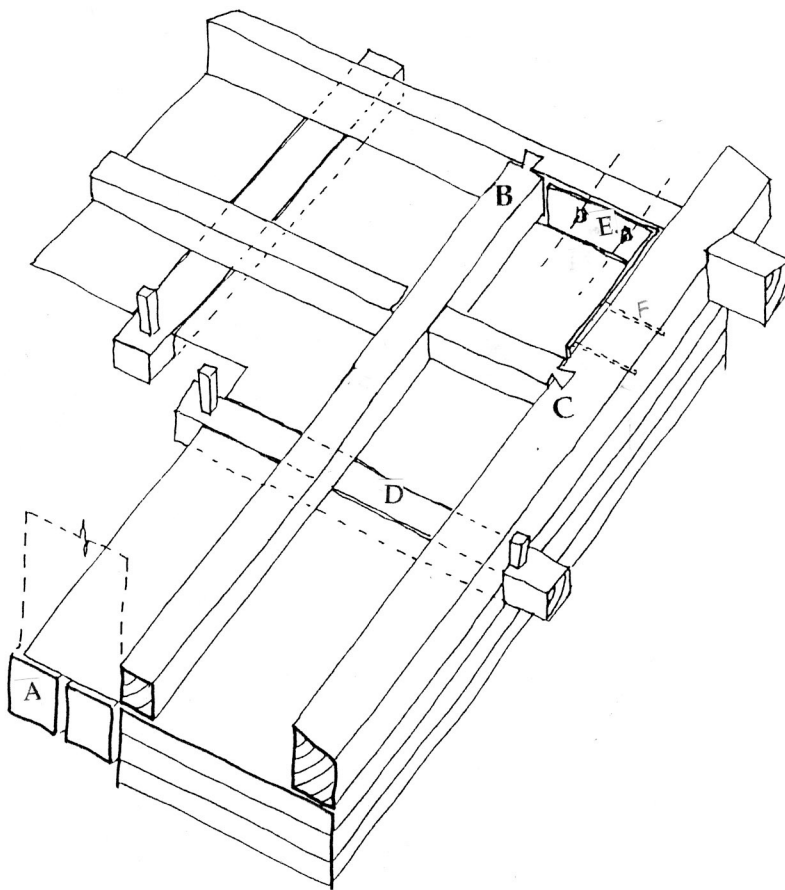
Building section: restored, 1997



Principal facade: existing conditions, 1992



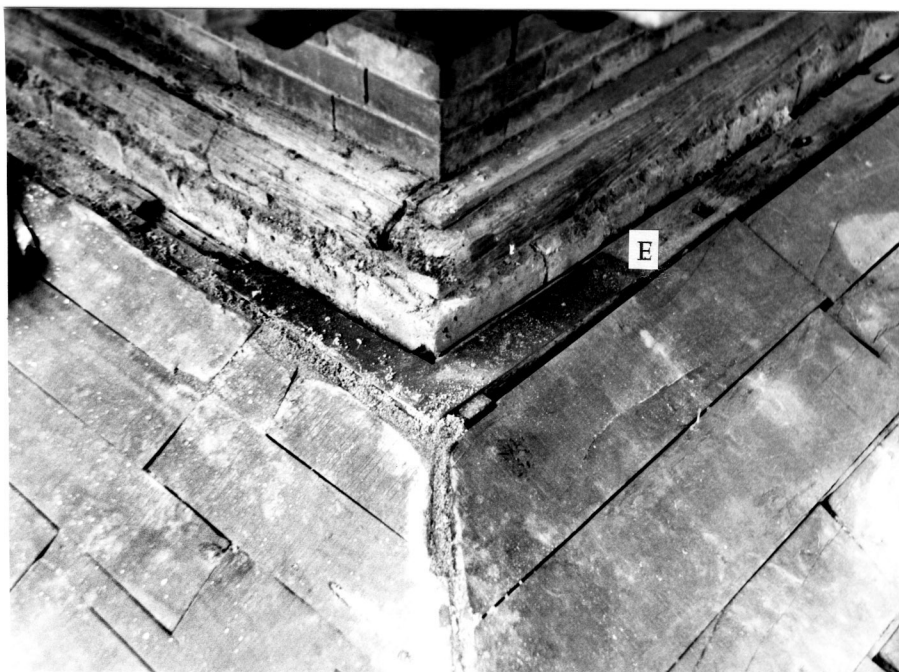
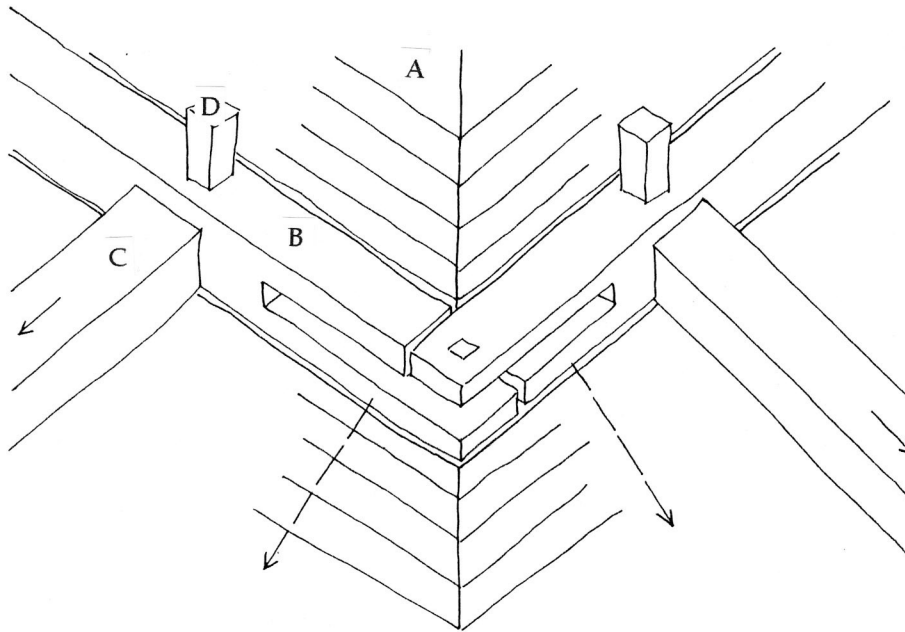
Principal facade: restored, 1992



- 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

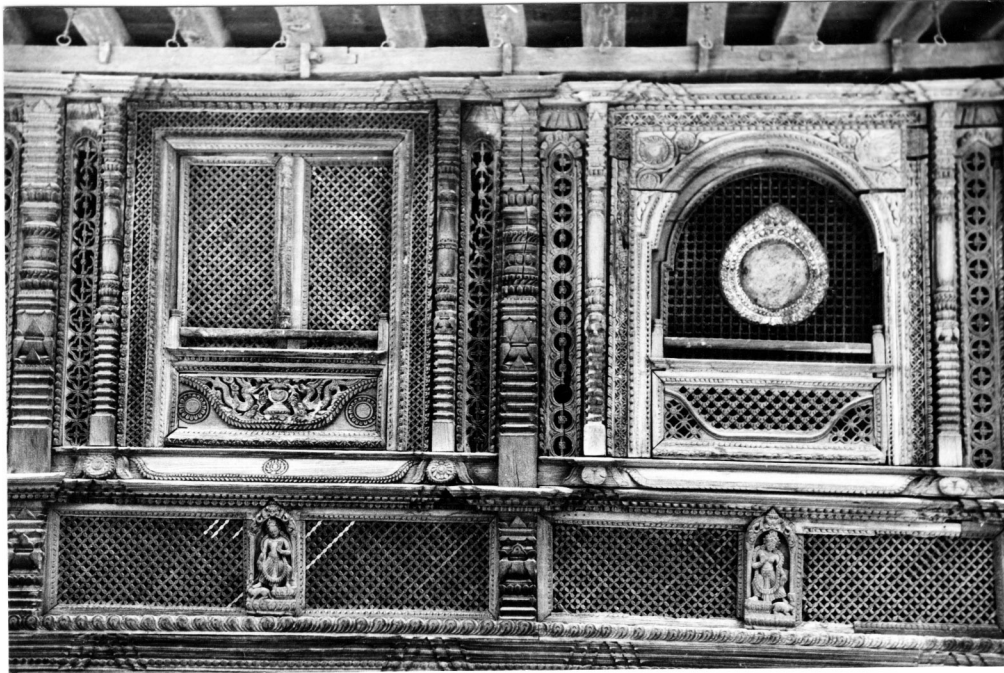
Top: Section showing location of wall plate level. Bottom: Axonometric view at wall plate level below the roof rafters. Metal collar connection in between the outer wall plates to improve the weak corner of a half-lap joint, which must carry the thrust of the rafters.



- A. Masonry work in mud mortar
- B. Upper wall plate
- C. Rafter
- D. Timber pates
- E. Iron strips

Reinforcement of upper wall plates

Top: Because of heavy roof loads, rafters tend to slide down, outwards. Bottom: Metal strip in "L" shape bolted in between the upper wall plates, connecting upper wall plates together to prevent failure of timber joinery.



Recarving of lost elements

Top: East main facade, left side bay, right side bay and right end of the carved sanjhya (bay window) were damaged due to the lack of roof maintenance. Some parts were kept in storage, but many were lost. Bottom: Lost parts were recarved. New parts are assembled together with historical components.



Courtyard elevation (west)
after restoration showing rebuilt gallery incorporating four historical timber posts with new "feet".



After restoration
Upper levels of main facade after restoration. Photo: John Hall, May, 1997.



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