

PINNACLES OF THE TALEJU TEMPLES

Report of the Institute of Conservation (IoC), University of Applied Arts Vienna

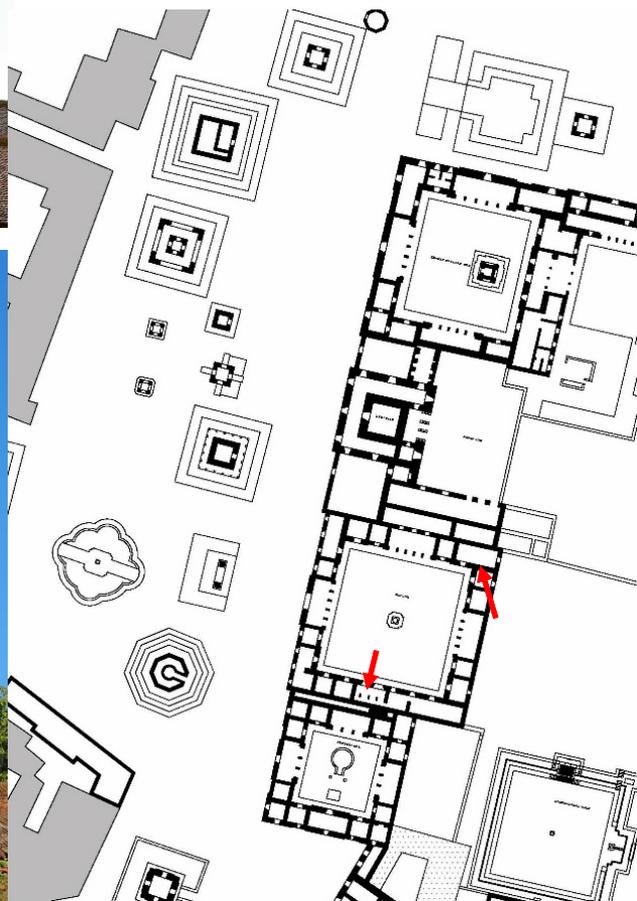
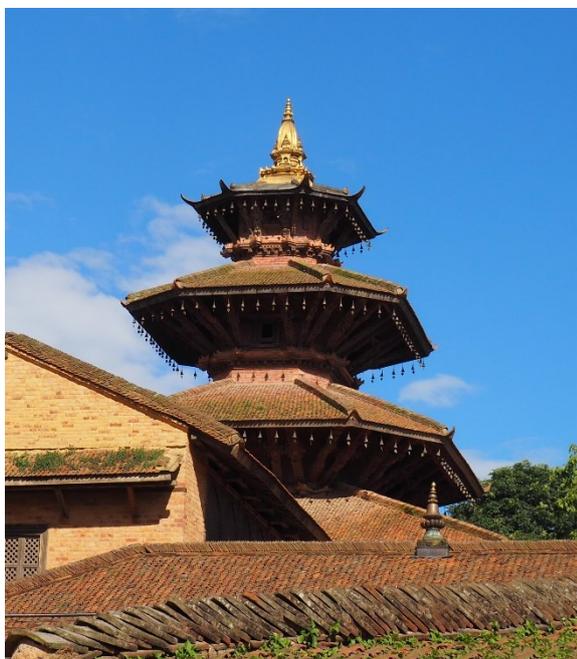


Fig. 1: Overview of the Taleju Temples

Fig. 2: Location within the Palace Complex

Data Sheet

Description

The North Taleju (1671) and the smaller South Taleju Temple (1666) are two of the primary multi-tiered brick and timber temples of the Royal Palace complex in Patan. Both are dedicated to the Goddess Taleju, the tutelary deity of the Malla kings, and are still used for religious and ritual purposes to this day. South Taleju for instance is the hub of Dashain festival, Nepal's most celebrated annual holiday. The temples feature exquisite carved timber struts and each of their uppermost roofs is crowned with a fire-gilded copper pinnacle (gajura), typical in Newar architecture. These pinnacles are sculpted in the shape of a sikhara temple and consist of hundreds of individual parts made in traditional metal repoussé technique.

Although both Taleju temples survived the earthquake 2015, their pinnacles were threatened by collapse. Thus, they were completely dismantled. The aim of the subsequent conservation carried out by the Institute of Conservation in close collaboration with local craftsmen was to preserve as much of the original components as possible and enable their re-use. Only missing or incorrect pieces were replaced by replicas. The originals were carefully cleaned to ensure minimum impairment of their gilded surface.

For waterproofing a separating layer of new copper sheets was applied between the original conserved metal elements and the wooden substructure. After their conservation, these distinctive features of the Darbar Square's temple-dotted skyline were re-assembled again.

Names

Dated North Taleju Temple 1671, South Taleju Temple 1666

Measurements (H x W x D)

Materials/Technology Wooden core, fire gilded copper repoussé and chasing work

Interventions (IoC) Assessment 2015, 2017
Conservation 2015 (South), 2017 (North)

Team (IoC) Gabriela Krist, Kathrin Schmidt

Academic Research (IoC)

Survey: Materials and Technology

- Wooden base structure / wooden core
- Copper sheets in repoussé and chasing techniques, fire gilded



Fig. 3: Dismantled pieces of South Taleju pinnacle



Fig. 4: Dismantling of North Taleju pinnacle © KVPT

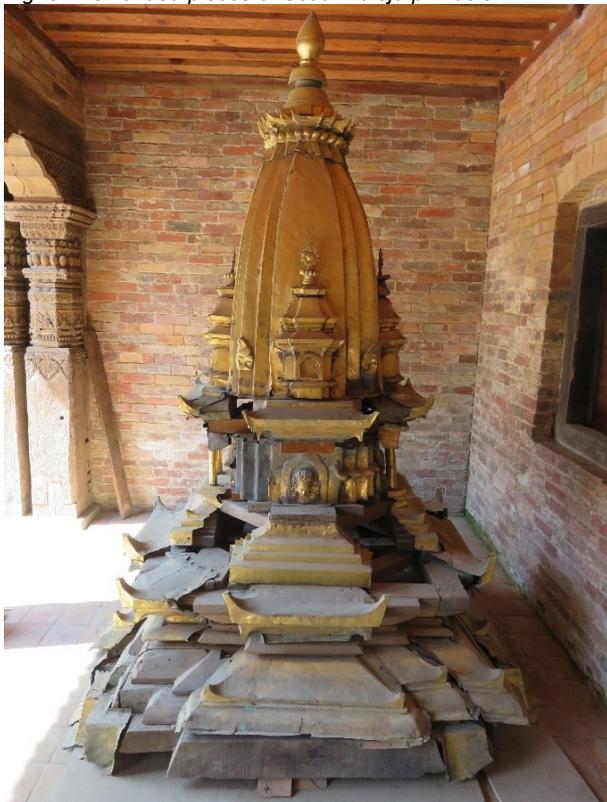


Fig. 5: Dismantled North Taleju pinnacle



Fig. 6: Metal sheets mounted on wooden core

Previous (Conservation) Interventions

Unknown silicone was found on several small pieces of South Taleju Temple
After 1934 repair and renovation of both rooftops after the earthquake

Survey: Condition and Causes of Decay

- Thick soiling layers
- Deformations of metal parts due to the partial collapse during the earthquake 2015
- Worn gilding
- Cracks and holes
- Corroded surfaces due to direct exposure to weather and pollution
- Missing elements

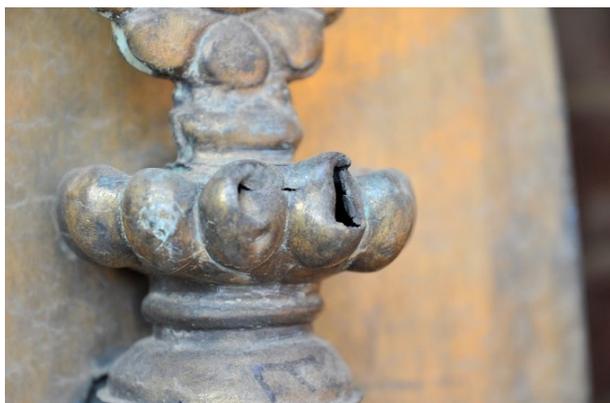


Fig. 7: Holes, element of South Taleju



Fig. 8: Cracks and holes, element of South Taleju

Conservation (IoC)

South Taleju Pinnacle (2015)

- Dry cleaning with soft brushes to remove loose layers of dust
- Wet cleaning of metal parts with drinking water and surfactant (dish detergent) with sponges and brushes, rinsing off with drinking water and exposure to sun for drying
- Removing of copper corrosion with citric acid (complexing agent), elements were either placed in citric acid bath (1:10 citric acid and water) or treated with cotton wool patches soaked with citric acid, on bigger parts citric acid was sprayed, application time for all methods 4 to 6 minutes, immediate subsequent cleaning with drinking water and brushes
- Labelling of individual pieces with a waterproof marker

North Taleju Pinnacle (2017)

- Dry cleaning with soft brushes to remove loose layers of dust
- Wet cleaning of metal parts with drinking water and surfactant (dish detergent) with sponges and brushes, rinsing off with drinking water and exposure to sun for drying
- Removing of copper corrosion with citric acid (complexing agent), elements were either placed in citric acid bath (1:10 citric acid and water) or treated with cotton wool patches soaked with citric acid, on bigger parts citric acid was sprayed, application time for all methods 4 to 6 minutes, immediate subsequent cleaning with drinking water and brushes
- Manufacture of new copper elements by coppersmith to replace missing elements, surfaces were etched with citric acid (diluted in water 1:10) and re-gilded using leaf gilding and linseed oil
- Partial regilding of worn-off parts / surfaces with gold leaves (Dukaten-Doppelgold) using Mixtion, newly gilt areas were covered with a protective layer of acrylic resin (Paraloid)

- Remounting of metal sheets on wooden core done by coppersmith

Conservation Materials* and Recipes used:

- Dukaten-Doppelgold 23 Kar. 80 x 80 mm (Erich Dungi Blattgoldschlägerei GmbH)
- Mlxion LeFranc 3h
- Paraloid B72, in Acetone 20%

* Product / technical data sheets can be found in the supplement [A]



Fig. 9: Wet cleaning



Fig. 10: Wet cleaning



Fig. 11: Removal of corrosion with poultices



Fig. 12: Remounting of metal elements on wooden core



Fig. 13: Wooden core of North Taleju pinnacle



Fig. 14: Metal sheets re-mounted on wooden core of North Taleju



Fig. 15: Newly manufactured elements, partly already gilded



Fig. 16: Re-gilding



Fig. 17: South Taleju pinnacle elements after conservation



Fig. 18: North Taleju pinnacle elements after conservation

Before and after Conservation



Fig. 19: North Taleju Temple, 2015 © KVPT



Fig. 20: North Taleju Temple, 2018



Fig. 21: South Taleju Temple, 2015



Fig. 22: South Taleju Temple, 2017

Supplements

[A] All product / technical data sheets can be found in this additional document.

Photo Credits

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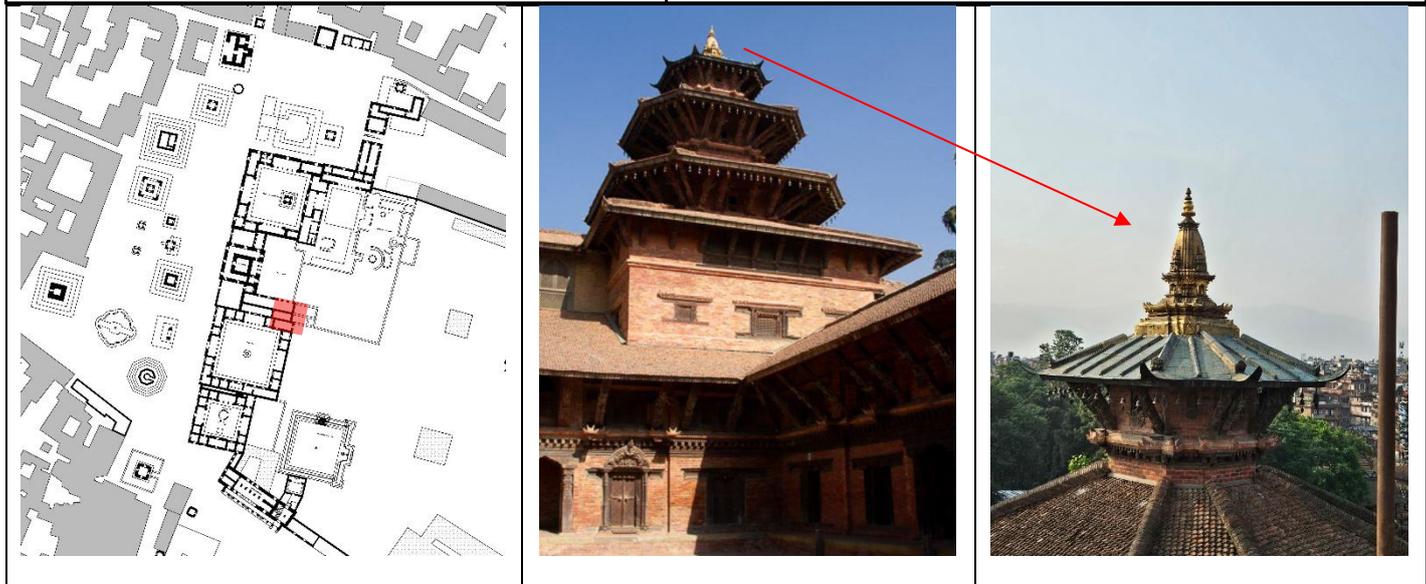
GENERAL INFORMATION

| | | |
|---|---|------------------------------|
| Object / Monument Three-tier octagonal roof with a gilded Shikhara-style finial on the Taleju Temple (North Taleju) | Orientation Southeast, behind the Degutale Temple | Size (H x L x W) - |
|---|---|------------------------------|

| | |
|-----------------------------------|---|
| Date of Production 1671 | Location Part of the Royal Palace |
|-----------------------------------|---|

| |
|--|
| Material and Technology - finial: Copper repoussé, fire-gilded - wooden support structure - roof slabs, semi-round shaped rib elements (<i>nāgvah</i>) and <i>kulām</i> : Copper sheet, partly chased - wrought iron chains for cast bronze bells |
|--|

| | |
|--|--|
| Date of the last Treatment Conservation 2017: see short report | Institutions of the last Treatment IoC |
|--|--|



EVALUATION

| | |
|---------------------------------------|---|
| Date of Evaluation May 2024 | Evaluation done by Meral Hietz, Katharina Mendl |
|---------------------------------------|---|

| | |
|---|---|
| Recent Damages: | |
| <input type="checkbox"/> Stability Problems | <input type="checkbox"/> Major <input type="checkbox"/> Medium <input type="checkbox"/> Minor |

Comment:

| | | |
|---|--|--|
| <input type="checkbox"/> Broken / - into several Pieces | <input type="checkbox"/> Many <input type="checkbox"/> Some <input type="checkbox"/> Few | |
| Comment: | | |
| <input checked="" type="checkbox"/> Loose / Missing Parts | <input type="checkbox"/> Many <input type="checkbox"/> Some <input checked="" type="checkbox"/> Few | <ul style="list-style-type: none"> - Some galvanised steel cross-head screws (Phillips screws) used for assembly - Some holes in the copper sheet visible with no screws |
| Comment: | | |
| <input checked="" type="checkbox"/> Cracks / Holes | <input type="checkbox"/> Many <input type="checkbox"/> Some <input checked="" type="checkbox"/> Few | <ul style="list-style-type: none"> - W-side: one c. on lower, one crack on upper <i>kulām</i>; two long c. on Shikhara base - N-side: four c. on Shikhara middle; one on top area, one hole on <i>kulām</i> |
| Comment: | | |
| <input checked="" type="checkbox"/> Deformation / Dents | <input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor | <ul style="list-style-type: none"> - W-side: deformation on Shikhara base (area where the long cracks are) |
| Comment: | | |
| <input checked="" type="checkbox"/> Abrasion / Worn out Gilding | <input type="checkbox"/> Major <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Minor | <ul style="list-style-type: none"> - w.o.g. on the pinnacle tip part (<i>cvalāmū</i>, <i>hah</i>) and lotus base (<i>gam</i>) → the three middle parts (<i>hah</i>, <i>kalas</i>, <i>ambahsāh</i>) were regilded in 2017 - Some of the temple elements of Shikhara and also the <i>kulām</i> on the roof have w.o.g. or abraded areas (more pronounced on the north side <i>kulām</i>) - evenly slightly worn out on the whole Shikhara - roof sheets and semi-round shaped rib elements (<i>nāgvah</i>) are mostly worn out |
| Comment: Temple-elements, <i>kulām</i> above and three pinnacle elements are shiny gold (oil gilding) | | |
| <input checked="" type="checkbox"/> Corrosion | <input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor | <ul style="list-style-type: none"> - Green corrosion visible on some indentations (e.g. on window-like temple elements) on the roof and other temple elements |
| Comment: | | |

| | | | |
|---|--|--|---|
| <input checked="" type="checkbox"/> Soiling | <input type="checkbox"/> Dust | <input type="checkbox"/> Heavy <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Light | - Especially on top sides |
| | <input checked="" type="checkbox"/> Dirt | <input type="checkbox"/> Heavy <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Light | - Few bird droppings - stains (especially on the inscribed copper sheets below the roof) |
| | <input type="checkbox"/> Blood | <input type="checkbox"/> Heavy <input type="checkbox"/> Medium <input type="checkbox"/> Light | |
| Comment: | | | |

Evaluation of the Condition

- good
- satisfactory
- unsatisfactory

Conclusion

In general, the condition of the roof sheets and the Shikhara style finial of the North Taleju temple was judged to be good. Due to inaccessibility, details of the conservation work could only be assessed using binoculars. The implement technical measures (e.g. reshaping of deformations, replication of missing parts, replacement of loose elements, riveting of copper sheet patches to close cracks) were carried out by the local coppersmiths and have proved to be stable so far. The galvanized steel screws that were used to remount the elements to the wooden substructure do not corrode.

The surface treatments that were carried out by the IoC in 2017 have proved to be stable over time. There is some darkening of the gilded surface, particularly in areas of worn gilding, apart from the newly oil-gilded replacements which are very bright gold in colour, but the overall appearance blends well with the surroundings. Minor green corrosion has been noted in some indentations.

Deposits (soiling, bird droppings) can be found on the surface and are a major cause of corrosive reactions. In this respect, maintenance is the key to the long-term preservation of the North Taleju finial. Regular cleaning and removal of bird droppings must be considered by the local community as the most important factor in long-term conservation. Where citric acid is used to chemically reduce corrosion, it is essential that the surface is thoroughly rinsed after cleaning, as acidic residues accelerate corrosive reactions.

PHOTO DOCUMENTATION



Fig. 1: Base structure of the Shikhara style finial after conservation, 2017



Fig. 2: Parts of the base structure gilded copper repoussé elements after conservation and before reassembling, 2017



Fig. 3: Part of the Shikhara style finial after conservation, 2017



Fig. 4: Shikhara style finial in May 2024



Fig. 5: North Taleju rooftop after reassembling, 2018



Fig. 6: North Taleju Temple finial and sheet metal roof, 2022



Fig. 7: North Taleju Temple finial and sheet metal roof, May 2024



Fig. 8: North Taleju Temple finial and sheet metal roof, May 2024



Fig. 9: Abraded and darkened areas on the roof slabs and Shikhara finial



Fig. 10: Worn of gilding on some of the kulām



Fig. 11: Soiling and darkening on roof plates and Shikhara base



Fig. 12: Gilded metal with different grades of darkening on Shikhara base



Fig. 13: Gilded metal with different grades of darkening on Shikhara style finial



Fig. 14: Gilded metal with more pronounced darkening on the tip part (*cvalāmū, hah*) and lotus base (*gam*) of the pinnacle



Fig. 15: North Taleju Temple finial and sheet metal roof, May 2024

GENERAL INFORMATION

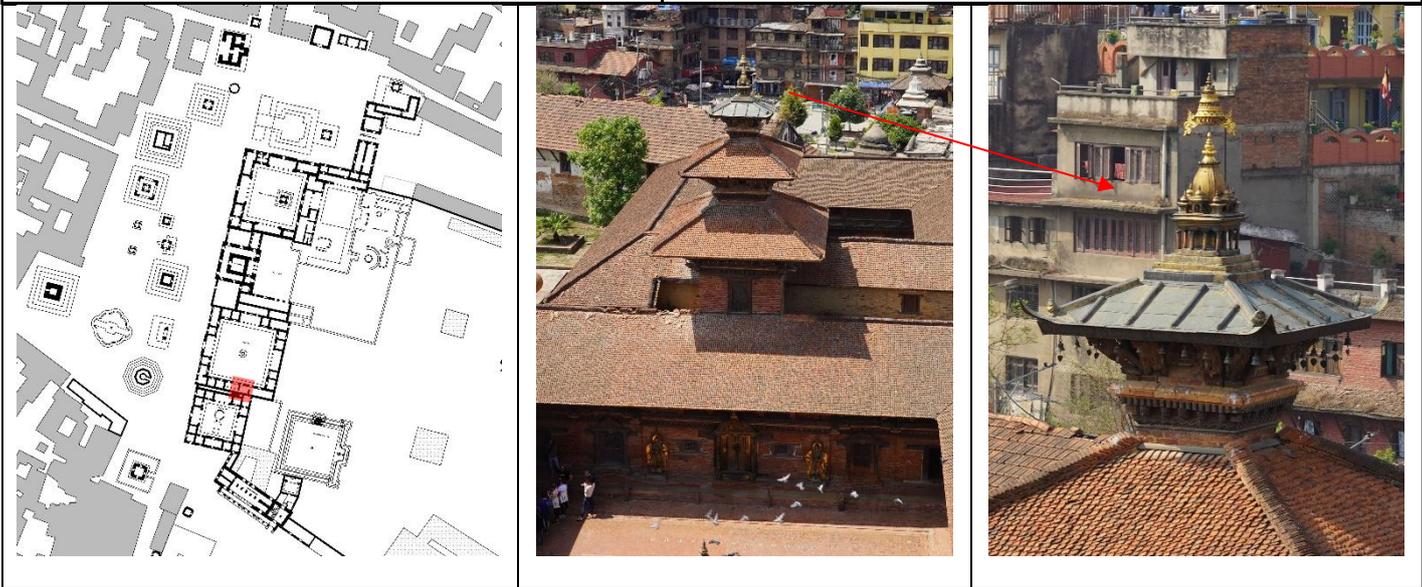
| | | |
|--|---|------------------------------|
| Object / Monument Triple-tiered brick and timber South Taleju Temple of the Malla period | Orientation Southwest of Mulchowk | Size (H x L x W) - |
|--|---|------------------------------|

| | |
|-----------------------------------|---|
| Date of Production 1666 | Location Mulchowk, Part of the Royal Palace |
|-----------------------------------|---|

Material and Technology

- finial: Copper repoussé, fire-gilded,
- wooden support structure
- roof slabs and semi-round shaped rib elements (*nāgvah*): Copper sheet, partly chased
- wrought iron chains for cast bronze bells

| | |
|--|--|
| Date of the last Treatment Conservation 2015: see short report | Institutions of the last Treatment IoC |
|--|--|



EVALUATION

| | |
|---------------------------------------|---|
| Date of Evaluation May 2024 | Evaluation done by Meral Hietz, Katharina Mendl |
|---------------------------------------|---|

Recent Damages:

| | |
|---|---------------------------------|
| <input type="checkbox"/> Stability Problems | <input type="checkbox"/> Major |
| | <input type="checkbox"/> Medium |
| | <input type="checkbox"/> Minor |

Comment:

| | |
|---|-------------------------------|
| <input type="checkbox"/> Broken / - into several Pieces | <input type="checkbox"/> Many |
|---|-------------------------------|

| | | |
|---|--|--|
| | <input type="checkbox"/> Some <input type="checkbox"/> Few | |
| Comment: | | |
| <input checked="" type="checkbox"/> Loose / Missing Parts | <input type="checkbox"/> Many <input type="checkbox"/> Some <input checked="" type="checkbox"/> Few | - probably a few missing nails - E-side: capital of middle column slightly detached? |
| Comment: | | |
| <input checked="" type="checkbox"/> Cracks / Holes | <input type="checkbox"/> Many <input type="checkbox"/> Some <input checked="" type="checkbox"/> Few | - few cracks/holes (most probably old ones) - N-side: Two c. on left <i>nāgvaḥ</i> ; three cracks on shikhara base (2 nd , 3 rd and 4 th step) - W-side: big hole on the small temple element on the right - one c. on right <i>nāgvaḥ</i> (4 th step left on corner) |
| Comment: | | |
| <input checked="" type="checkbox"/> Deformation / Dents | <input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor | - probably not visible from afar - E-side: small dent on right <i>nāgvaḥ</i> |
| Comment: | | |
| <input checked="" type="checkbox"/> Abrasion / Worn out Gilding | <input type="checkbox"/> Major <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Minor | - <i>nāgvaḥ</i> and roof slabs (roof surfaces) are mostly worn out - shikhara: mostly visible on the steps and the capitals as well as on the very small pinnacle on top of the umbrella |
| Comment: | | |
| <input checked="" type="checkbox"/> Corrosion | <input type="checkbox"/> Major <input type="checkbox"/> Medium <input checked="" type="checkbox"/> Minor | - some darkening on worn out areas - green corrosion on whole roof (roof surface) and especially on shikhara base (steps), doors of small temple elements and the roof top side of the temple |
| Comment: pinnacle below umbrella and umbrella are very bright gold, also gold on the cupola is well preserved | | |
| <input checked="" type="checkbox"/> Soiling | <input checked="" type="checkbox"/> Dust | <input type="checkbox"/> Heavy <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Light |
| | | - especially on top sides |

| | | | |
|----------|--|--|---|
| | <input checked="" type="checkbox"/> Dirt | <input type="checkbox"/> Heavy | - some bird droppings, especially on steps and some spots on the roof surface |
| | | <input checked="" type="checkbox"/> Medium | |
| | | <input type="checkbox"/> Light | |
| | <input type="checkbox"/> Blood | <input type="checkbox"/> Heavy | |
| | | <input type="checkbox"/> Medium | |
| | | <input type="checkbox"/> Light | |
| Comment: | | | |

Evaluation of the Condition

- good
- satisfactory
- unsatisfactory

Conclusion

In general, the condition of the roof copper elements and the Shikhara style finial of the Soutgh Taleju temple was judged to be good. Due to inaccessibility, details of the conservation work could only be assessed using binoculars. The implement technical measures (e.g. reshaping of deformations, replication of missing parts, replacement of loose elements, riveting of copper sheet patches to close cracks) were carried out by the local coppersmiths and have proved to be stable, apart from the capital element of the central column, which appears to have become slightly detached. The galvanized steel screws that were used to remount the elements to the wooden substructure do not corrode.

The surface treatments that were carried out by the IoC in 2017 have proved to be stable over time. There is some darkening of the gilded surface, particularly in areas of worn gilding, apart from the newly oil-gilded replacements which are very bright gold in colour, but the overall appearance blends well with the surroundings. Minor green corrosion has been noted in some indentations.

Deposits (soiling, bird droppings) can be found on the surface and are a major cause of corrosive reactions. In this respect, maintenance is the key to the long-term preservation of the North Taleju finial. Regular cleaning and removal of bird droppings must be considered by the local community as the most important factor in long-term conservation. Where citric acid is used to chemically reduce corrosion, it is essential that the surface is thoroughly rinsed after cleaning, as acidic residues accelerate corrosive reactions.

PHOTO DOCUMENTATION



Fig. 1: Shikhara style pinnacle and roof slabs after conservation, 2015



Fig. 2: Part of the Shikhara style pinnacle after conservation, 2015



Fig. 3: South Taleju Temple pinnacle and sheet metal roof, 2022



Fig. 4: South Taleju Temple pinnacle and sheet metal roof, May 2024



Fig. 5: Sheet metal roof, May 2024



Fig. 6: Roof with abraded areas on the gilded surface, May 2024

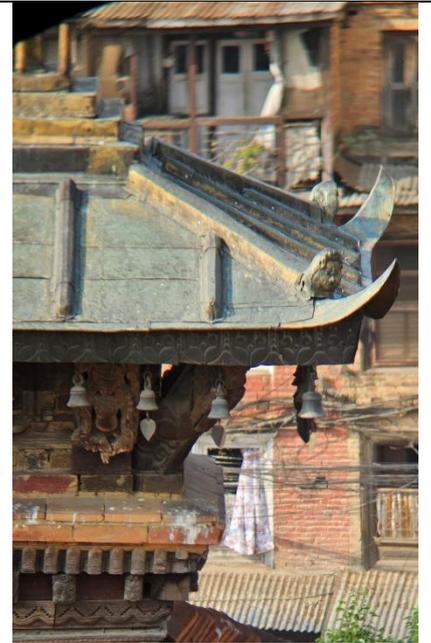


Fig. 7: Worn out gilding on the roof, May 2024



Fig. 8: Soiling and worn out gilding on the Shikhara finial, May 2024



Fig. 9: Partial darkening on the Shikhara finial, May 2024

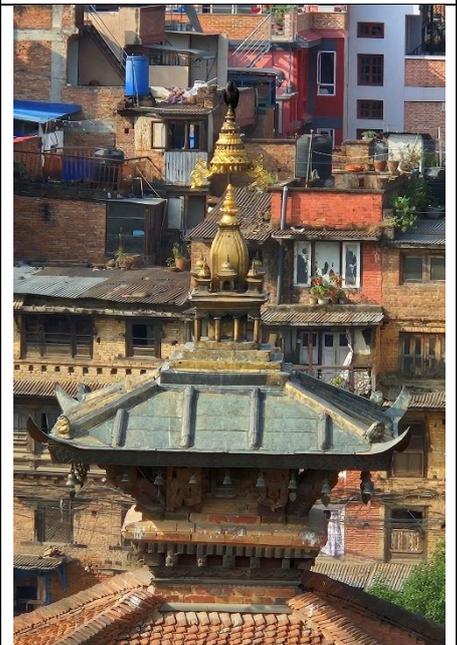


Fig. 10: Roof surface and Shikhara style finial with umbrella on top, May 2024



Fig. 11: South Taleju (front) and North Taleju (back) in May 2024

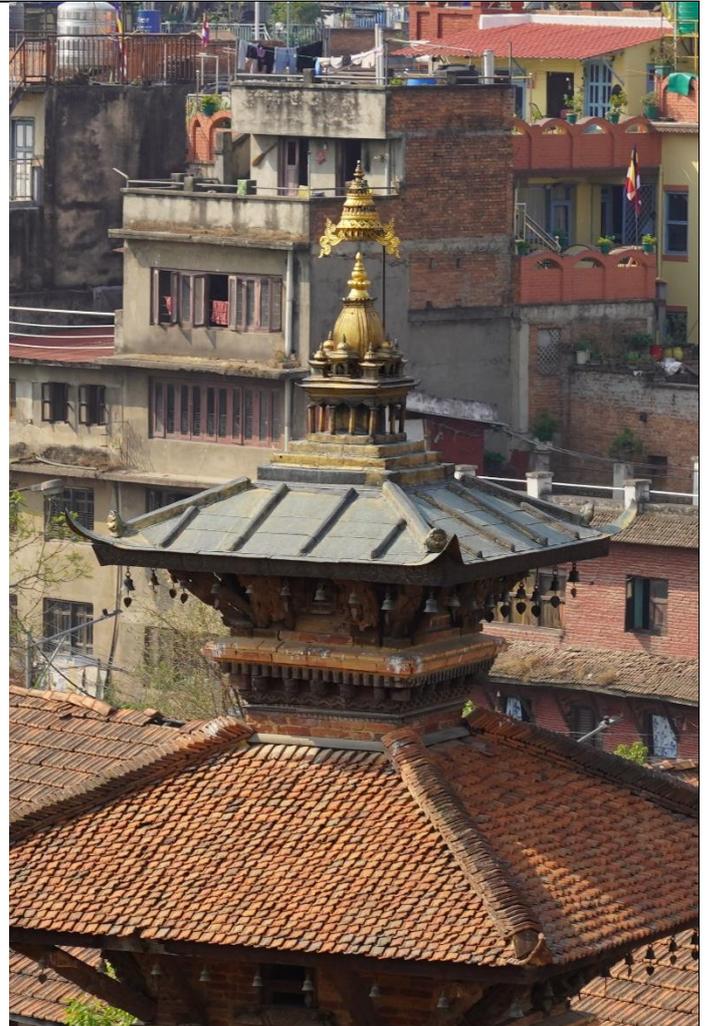


Fig. 12: Shikhara finial and roof of South Taleju temple, May 2024

[A] Product Data Sheets – Links¹ to Suppliers/Manufacturers

AEROSIL® 200

https://products.evonik.com/assets/or/ld/AEROSIL_200_TDS_DE_DE_TDS_PV_52043839_de_DE_WORLD.pdf

Aviva Silikat Grundierung

https://www.adler-lacke.com/Canto/tmb/aviva-silikat-grundierung_tmb_4079_de.pdf

Alkylbenzyltrimethylammonium chloride

<https://www.sigmaldrich.com/AT/en/sds/mm/8.14858?userType=anonymous>

KluceI™ EF

<https://www.kremer-pigmente.com/elements/resources/products/files/63701-63713.pdf>

Aviva Tirokat-Color, Adler

https://www.adler-lacke.com/Canto/tmb/aviva-tirokat-color_tmb_4087_de.pdf

Mixtion Le Franc, Kremer

<https://shop.kremerpigments.com/elements/resources/products/files/98000e.pdf>

Waxes, Deffner und Johann

https://deffner-johann.de/media/datasheets/4186000/EN/Zusatzinformation_Wachse_DE_DJ.PDF

Injection mortar HFX

https://productdata.hilti.com/APQ_HC_RAW/ASSET_DOC_7567931.pdf

Kölner Classic Ölmixtion 3h; 12h; 24h

<https://www.kolner-vergolderprodukte.de/produkte/koelner-oelmixtion/>

KSE 500 E

https://media.remmers.com/celum/export/documents/Remmers_0715_KSE-500-E-_Technisches-Merkblatt_de_DE_26355.pdf

Lascaux 498 20 X acrylic adhesive

[https://deffner-](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

[johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

Marble dust

https://www.kremer-pigmente.com/elements/resources/products/files/58500-58580_59001-59690.pdf

Natural hydraulic lime

<https://www.preservationworks.us/wp-content/uploads/2019/10/NHL-Datasheet-Lafarge-23.5.pdf>

Plextol B-500 (acrylic dispersion)

[https://deffner-](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

[johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

Primal® SF 016

[https://deffner-](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

[johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

AKEPOX® 2010

https://data.akemi.de/fileadmin/user_upload/products/productdocuments/TMB/Akepox_2010_TMB_D.pdf

¹ All links were last accessed on 13 May 2025.

EPO-TEK® 301-1

<https://www.epotek.com/docs/en/Datasheet/301-1.pdf>

Titebond Wood Glue

<http://sds.franklini.com/msds/1411.042k0nmo0020.pdf>

Paraloid™ B-72, Kremer

<https://www.kremer-pigmente.com/elements/resources/products/files/67400-67409.pdf>

Keim Granital®

https://www.keim.com/documents/de-AT/723/TM_Granital_DE-AT.pdf