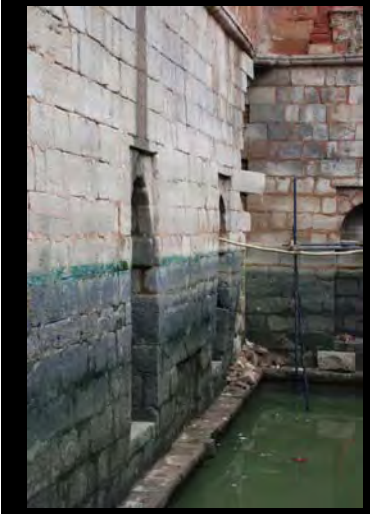
SCIENTIFIC INVESTIGATIONS



Collapsed eastern wall of the Baoli, July 2008

Conservation works commenced with the collapse of a large portion, almost 200 sq feet of the Baoli wall in July 2008 and the severe buckling of another similar area.

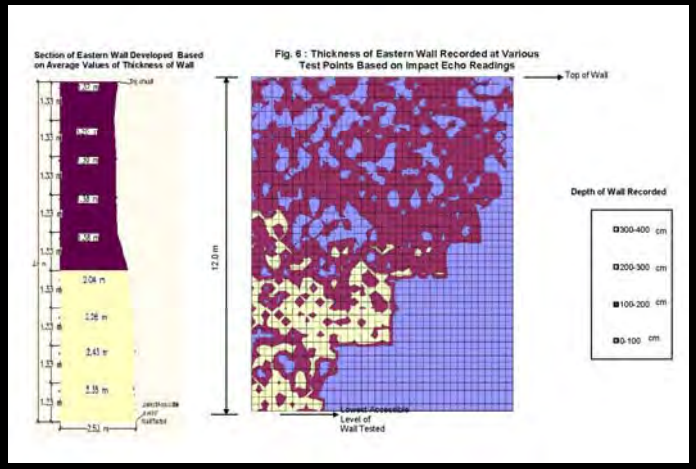
As a first step the water from the Baoli was drained out to understand the extent and nature of collapse and structural stress in the standing portion. This was followed by a structural analysis by a team of international structural engineers.

Water of the Baoli was drained out regularly to maintain the water level required for repair works

INVESTIGATIONS

Investigations carried out at Baoli
- Impact echo test
- Ground Penetrating Radar Survey
- Geo technical studies to check the quality of the soil
- Lime mortar testing

Ground Penetrating Radar Survey was used to document the condition/ deformation in the structure and the hidden layers beneath the wall surface respectively; both systems were used **for the first time in India for Conservation** purpose.



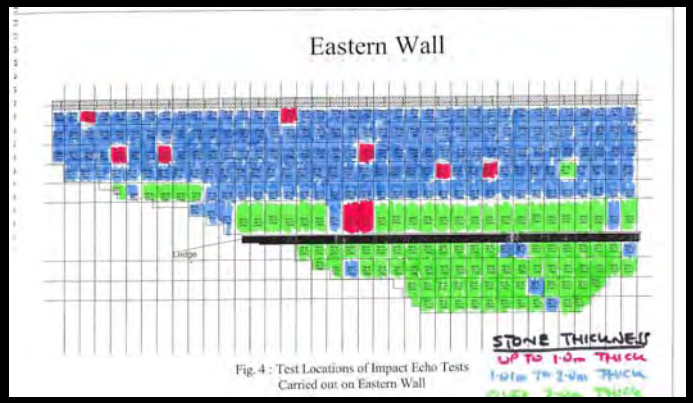
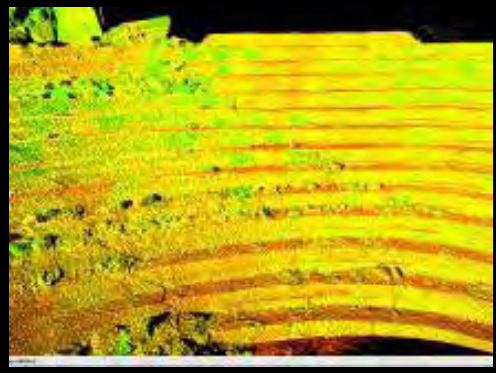


Fig. 4 : Test Locations of Impact Echo Tests Carried out on Eastern Wall

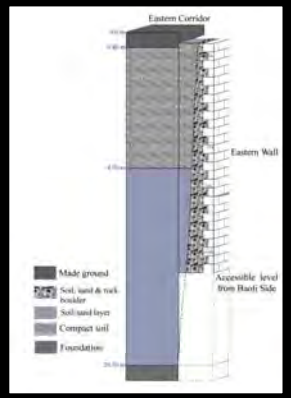
DOCUMENTATION

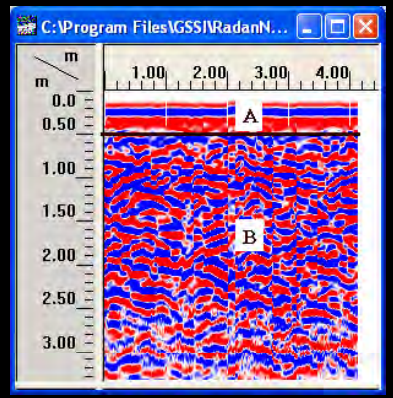
Scanned images of the Baoli



The Baoli was documented using state-of-art technology such as *High Definition Survey* with 3D Leica Laser Scanners. Stone by stone details were documented using the scanner

The wall section was derived using GPRS at a few locations of the eastern wall. The section shows the thickness of the filling materials behind the stone wall .





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CONSERVATION WORKS

Conservation works on the collapsed portion could commence in December 2008, once the studies and demolition of the overhead structure were completed. During this period temporary shoring was installed to prevent further collapse and safeguard the visitors using the passage to the Dargah.

Temporary supports were provided on structurally weak arches and wall for safe working conditions

Masonry Stones which had fallen in the Baoli and were buried in the sludge were manually collected washed and dressed again before reuse in the masonry

Masonry Stones were dressed on site using hand tools

RECONSTRUCTION OF THE COLLAPSED WALL

The collapsed portion was rebuilt and portions of the Baoli dismantled prior to rebuilding using traditional building materials and building techniques. Works were carried out from sunrise to sunset for over four months to rebuild this small collapsed portion.

Heavy stones were lifted by cranes to the wall height for repair works, February 2009

Collapsed stone masonry was reconstructed following the existing profile and original construction technique.

Stone members jointed together using copper dowels. Ashlars masonry wall fixed with the back fill using stone slabs

Stone masons reconstruct the top layer of the Baoli wall

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CONSERVATION WORKS

DE-SILTING

Works included the de-silting the well where debris from the collapse and hundreds of years of accumulated rubbish had accumulated. This had to be done manually while ensuring that a few inches of water remained in the Baoli to respect the community sentiment.

Removing sludge from the well, February 2009

Removing sludge from the well, February 2009

Well after desilting and cleaning

Following the rebuilding of the collapsed portion and the removal of epoxy, the entire wall surface was re-pointed with lime mortar and grouted to fill up the underlying voids.

REMOVAL OF EPOXY LAYER AND REPOINTING WITH LIME MORTAR

Conservation works required the removal of a 2-3 cm thick epoxy layer applied to the Baoli in 2002 by the Delhi Jal Board. This treatment used for concrete tanks was inappropriate for the historic structure and accelerated decay. This was carefully and painstakingly removed by master stone craftsmen using traditional tools

2-3 cm thick epoxy layers February 2009

Removal of 2-3 cm thick epoxy layers March 2009

Repointing of the stone masonry with lime mortar March 2009

QUALITY OF WATER

A water quality test of the stagnant Baoli water before reconstruction revealed very high levels of *E coli* indicating sewage contamination. The ground water sources as well as the well water were retested post reconstruction and it was found that the water quality had considerably improved with a drastic reduction in *E-Coli* levels .

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Conservation Works

Discovery of Blocked Off Access

During conservation works a passage leading from the Dargah to the Baoli, possibly used by the saint, *Hazrat Nizamuddin Auliya* was discovered. Works are now ongoing to remove rubble filled in this passage and carry out required repairs to the vaulted roof of this passage – portions of which have collapsed.

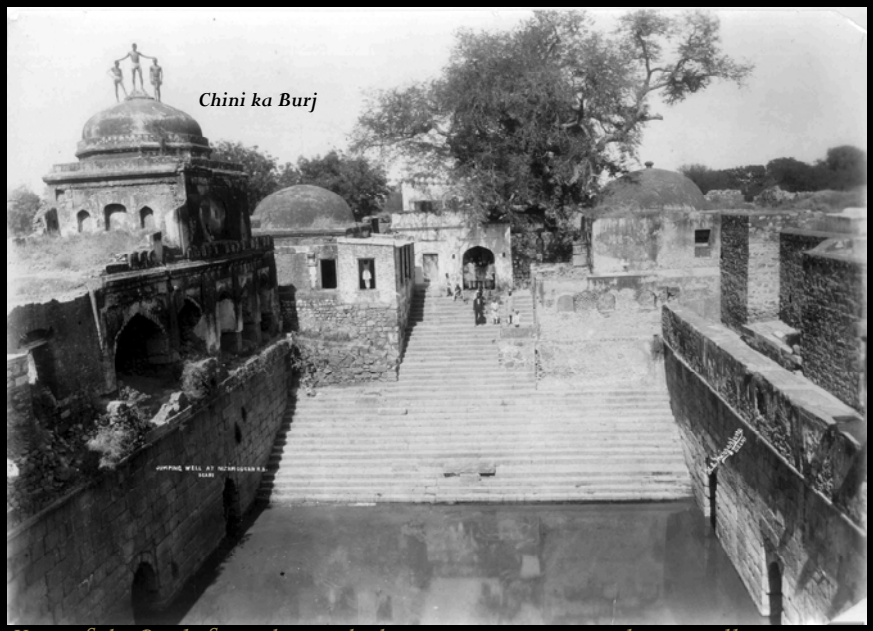
Stone craftsmen are opening the closed arch passage on east wall. April 2009

Vaulted passage from inside April 2009

Archival Research

View of the Baoli from the north, showing east, south and west wall 1920 AD

The Baoli built by the revered Sufi Saint Hazrat Nizamuddin Auliya in the years 1321-22 A.D is one of the earliest surviving step-wells in Delhi and one of very few structures built under the patronage of the saint himself. Several historical legends link the construction of the Baoli to the Saint and his disciple Roshan Chirag Dilli.



View of the Baoli from the south showing steps , east and west wall, 1920 AD

View of the south wall Baoli , 2008 AD

The Baoli has a unique plan with a circular well, 80 feet below the adjoining ground level, contained within the structure itself. It is also the only step-well in Delhi to still contain water fed by several underground springs.

View of the Baoli from the north, 2008 AD

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STAKEHOLDER MEETINGS AND COMMUNITY DISCUSSION

Discussions with various stakeholders such as the Dargah Committee, resident families and local officials to develop an action plan for the repair work at Baoli

LEARNING FROM LOCAL WISDOM

- The Baoli is an integral part of the *Basti* and to the pilgrimage for visitors to the Dargah.
- In addition to scientific studies, conservation works were preceded with several community consultations with the Dargah Committee.
- This was especially important as local community knowledge was required to better understand the structure and access to the Baoli would be limited for the duration of conservation works.

ENSURING SAFE ACCESS FOR ALL

- One of the access to the Dargah, (from the passage along the Baoli) used by hundreds daily, had to be discontinued for almost three weeks as collapsed portions were rebuilt.
- As part of conservation works, the water from the Wuzu area – draining into the Baoli was re-routed in a complex procedure that required a pumping station to be installed in the narrow lanes leading to the Dargah.
- Similarly over 100 meters of sewer lines found to be leaking into the Baoli were replaced at a depth of 7-8 feet on the adjoining lanes.

Access to Dargah along the Baoli during reconstruction of the collapsed wall below

Rehabilitation of the sewer line leaking into the baoli near the entrance to the Baoli Gate

REHABILITATING 'AT RISK' FAMILIES

- The house immediately over the collapsed portion of the Baoli was demolished with mutual consent and as part of the project an alternate dwelling unit built for the owner.

Construction of alternate dwelling unit for family residing above the collapsed portion

Consultations with families occupying the terrace of the baoli for relocation

- For the 21 families occupying the terrace of the baoli, alternate plots are being provided by MCD with AKTC bearing the costs of the relocation.
- Further as part of the rehabilitation process we would be working with these affected families to ensure smooth transition to a new area and an improvement of living standards for these families.
- The families have consented to be relocated.

Biometric survey of families by MCD and ASI for relocation with support from AKTC

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