



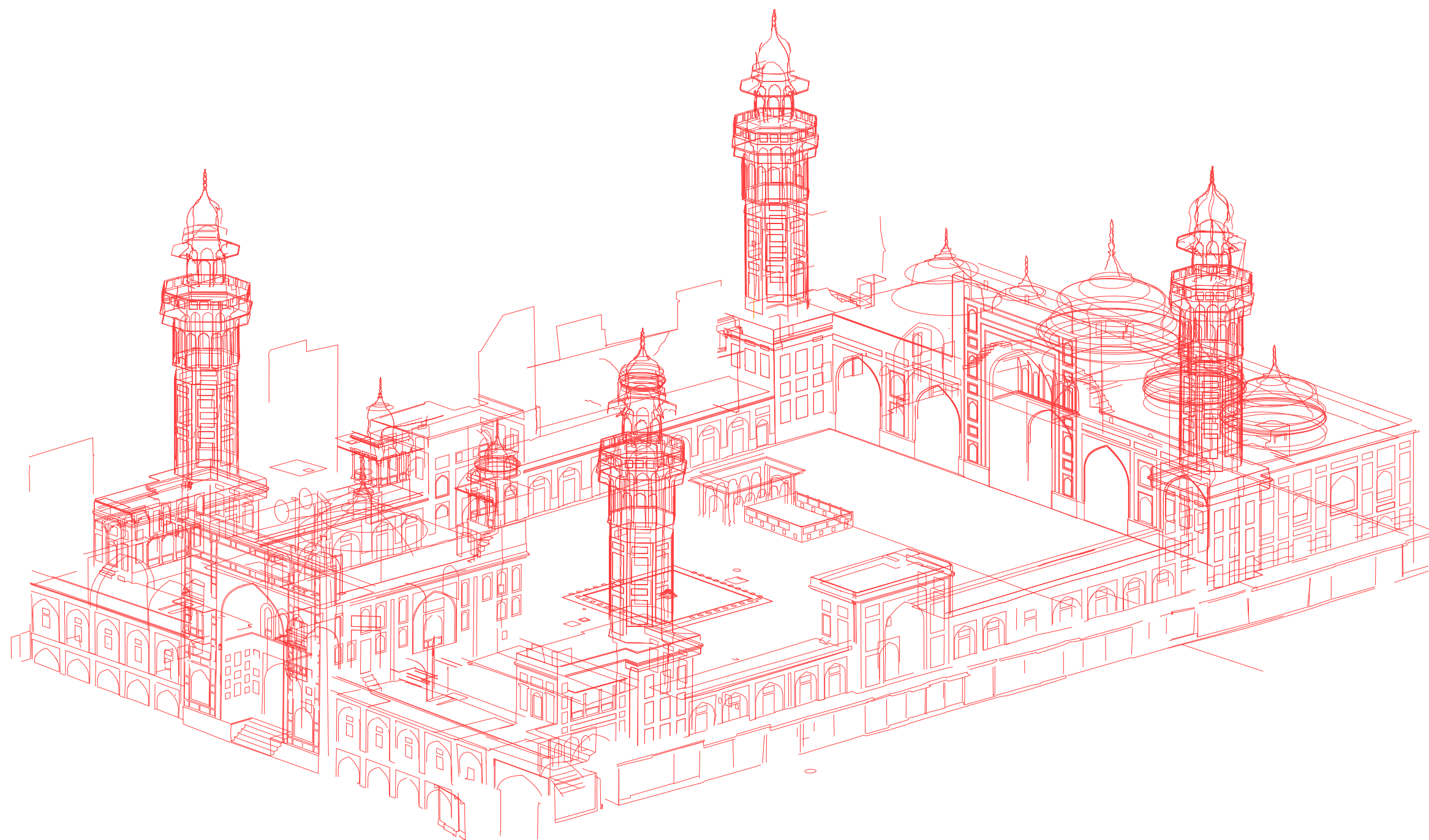
CONSERVATION OF THE WAZIR KHAN MOSQUE LAHORE

PRELIMINARY REPORT ON
CONDITION AND RISK ASSESSMENT



AGA KHAN TRUST FOR CULTURE
AGA KHAN CULTURAL SERVICE - PAKISTAN

**PART II: DOCUMENTATION AND
DAMAGE ANALYSIS**



OVERVIEW: DOCUMENTATION AND DAMAGE ANALYSIS

For nearly two years, a small AKTC-AKCSP group of conservation architects and engineering staff has been examining the Wazir Khan Mosque and its neighbourhood context in some detail. The purpose has been to develop a comprehensive data base within the constraints of time and resources available. Such a data base and the analytical and problem solving processes that would ensue from it has never been attempted for a historic monument in Lahore up till the present time.¹ The process of documentation that has produced this data includes observations carried out at several planes, using various methodologies, and at several levels of resolution: archival research and research into administrative documents, simple observation of the situation on the ground, assessment of the institutional and administrative framework, collecting photographic evidence, detailed survey of the neighbourhood, detailed electronic documentation supplemented by orthorectified photographs of the monument itself, and a documentation of the structural issues the monument faces accompanied by analyses of the structure and the geophysical conditions of the monument. This documentation has for its own context the detailed baseline studies of the Walled City of Lahore carried out by AKTC-AKCSP, which includes a comprehensive topographical survey of the city, a socio-economic household quality-of-life survey, and a plot and building inventory that has given rise to a LWC geographical information system (GIS).

A preliminary review of the condition of the mosque leads us to the conclusion that its physical fabric has been inadequately protected from the elements and has been subject to unavoidable natural threats, such as earthquakes, causing certain structural impacts. However, it also appears glaringly evident that a significant amount of the present damage in the mosque is caused by human factors. The mosque has never been as exposed to the pressures of rapid development in its immediate surroundings as it is at present. These pressures range from the immediate and long term impacts of inappropriate activities and the building of unauthorized structures

to contain them, to environmental factors like the pollution generated by vehicles in the cramped physical environment of the Walled City. Additionally, lack of sophistication in the appreciation of the heritage, of adequate technical and interpretive skills in the care and maintenance of the monument and the regulation of its use, and the deliberate vandalism of the structure are also main contributors to the damage.

The absence of a professionally qualified team and lack of regular maintenance procedures greatly threaten the mosque complex with further deterioration. The non-permanent and periodic interventions in both the structure and the building fabric in the past have contributed little to safeguarding the architectural fabric of the mosque and to enhancing the appeal of its decorative craft techniques. The absence of a permanent mechanism for maintenance during these past efforts has significantly contributed to damages sustained by the mosque complex.

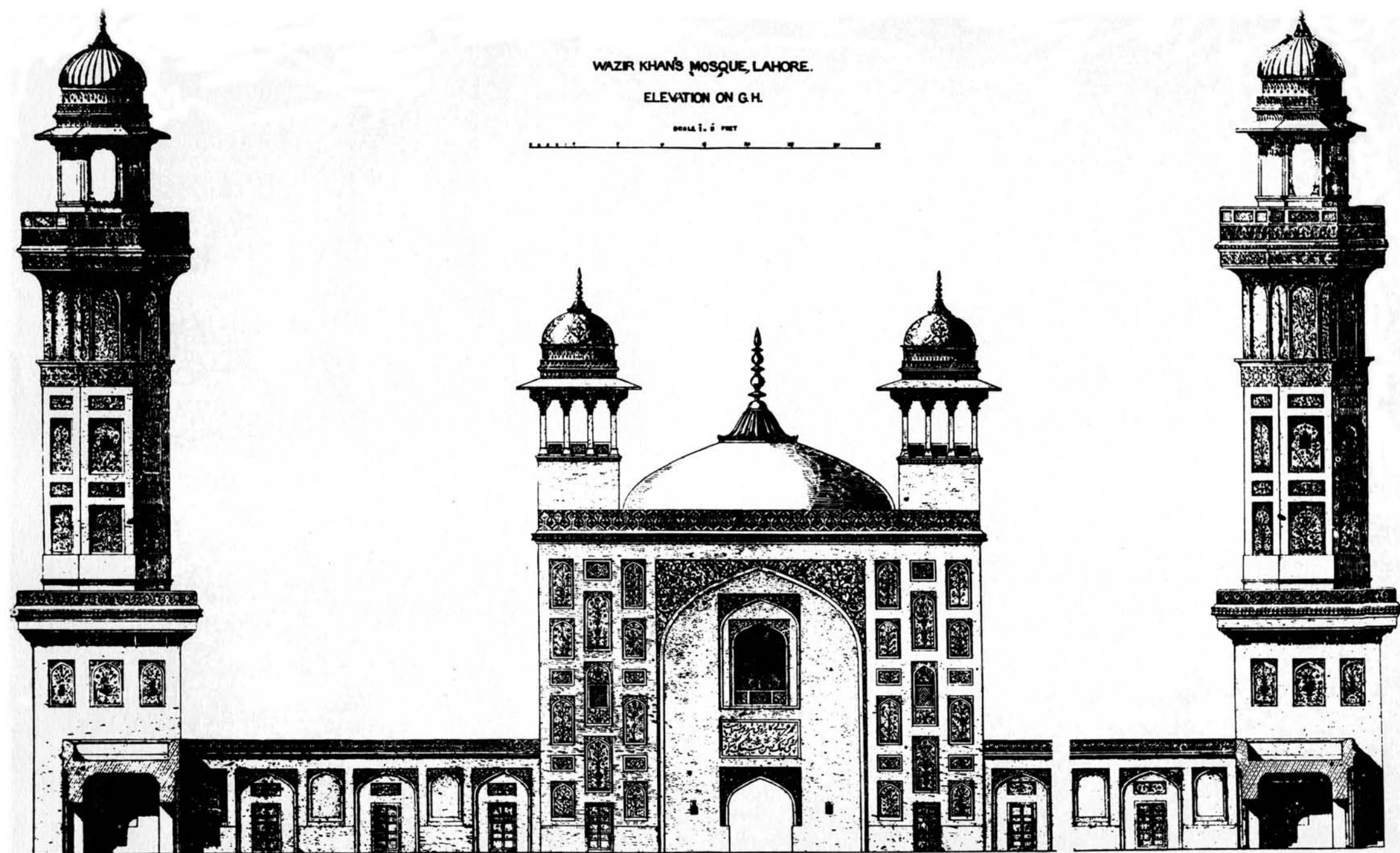
Part II aims to present the existing conditions documented and describe in analytical terms the problems and issues they pose for the conservation and rehabilitation of the Wazir Khan Mosque and its context. The following chapters begin by briefly describing the methodology used in carrying out the documentation and the graphic content of the documentation spread over several pages. This is followed by an analytical section describing the existing conditions, problems and issues of the monumental complex. This includes a discussion of the neighbourhood context of the monument and the ways in which at least three centuries of urban social and political mayhem has resulted in the present conditions. This is followed by a description of the infrastructure conditions attending the monument and its context. A detailed description of the existing conditions of the monument as documented follows and is accompanied by an analysis of the processes of decay that it faces.

Right, Top: Crack monitoring in the prayer chamber, with the use of digital callipers.

Right: REDM survey underway of the hujras on the north side of the courtyard.

Opposite: The 3D wire frame produced by AKCSP after 2 years of surveying and documentation.





15. PORCH or EASTERN PORTION WITH MINARETS

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Heritage documentation is an integral part of the conservation process and documentation of the appropriate intensity and detail is the means to arrive at an effective understanding of a given situation. It is essential because it provides the data for recording conditions, understanding, interpretation and action. This section explains the documentation process and is followed by an assessment of the different types of damage occurring in various sections of the mosque complex. It is important for the project to identify the various threats and map the weathering forms and damage to the structure both at a macro and micro scale.

The earliest available architectural documentation of the mosque was carried out in 1875 by Farid Baksh, a student of the Mayo School of Arts, Lahore.² The drawings prepared by him are said to be in the custody of the Federal Archaeology Department at the Lahore Fort. Reproduction of the drawings in certain publications³ attests to their meticulous detail and idealization of form. However, it is unknown if they were accurate enough to meet the stringent requirements of objectivity that modern heritage conservation procedures require.

The current conservation project of the mosque aims to strive towards those requirements. Apart from careful observation of the physical conditions and the necessary background and archival research, a precise and detailed documentation programme of the mosque complex has been carried out to fulfil basic requirements of international charters and conventions of ICOMOS⁴ and UNESCO,⁵ and in order that a scientific record of its present condition is established for use in carrying out studies and conservation programmes. It is also very important for us to use this opportunity to attempt to demonstrate the highest possible standards of recording buildings. This would lay the precedence for a new trend in the conservation of monuments in urban settings in Pakistan.

A basic component of the surveying technology and method used in this documentation - Reflector-less Electronic Distance Measuring - is identical to that used to carry out the Lahore Walled City topographic survey, conducted by AKCSP over roughly the same period as the documentation of the mosque. As a result, the physical documentation of the mosque complex is geographically embedded in the topographical survey of the entire Walled City at

the same degree of dimensional tolerance.⁶ This enables an effective assessment of the characteristics of the mosque complex in relation to the much more dynamic historical, transformational and present-day locational and dimensional characteristics of the urban fabric surrounding it.

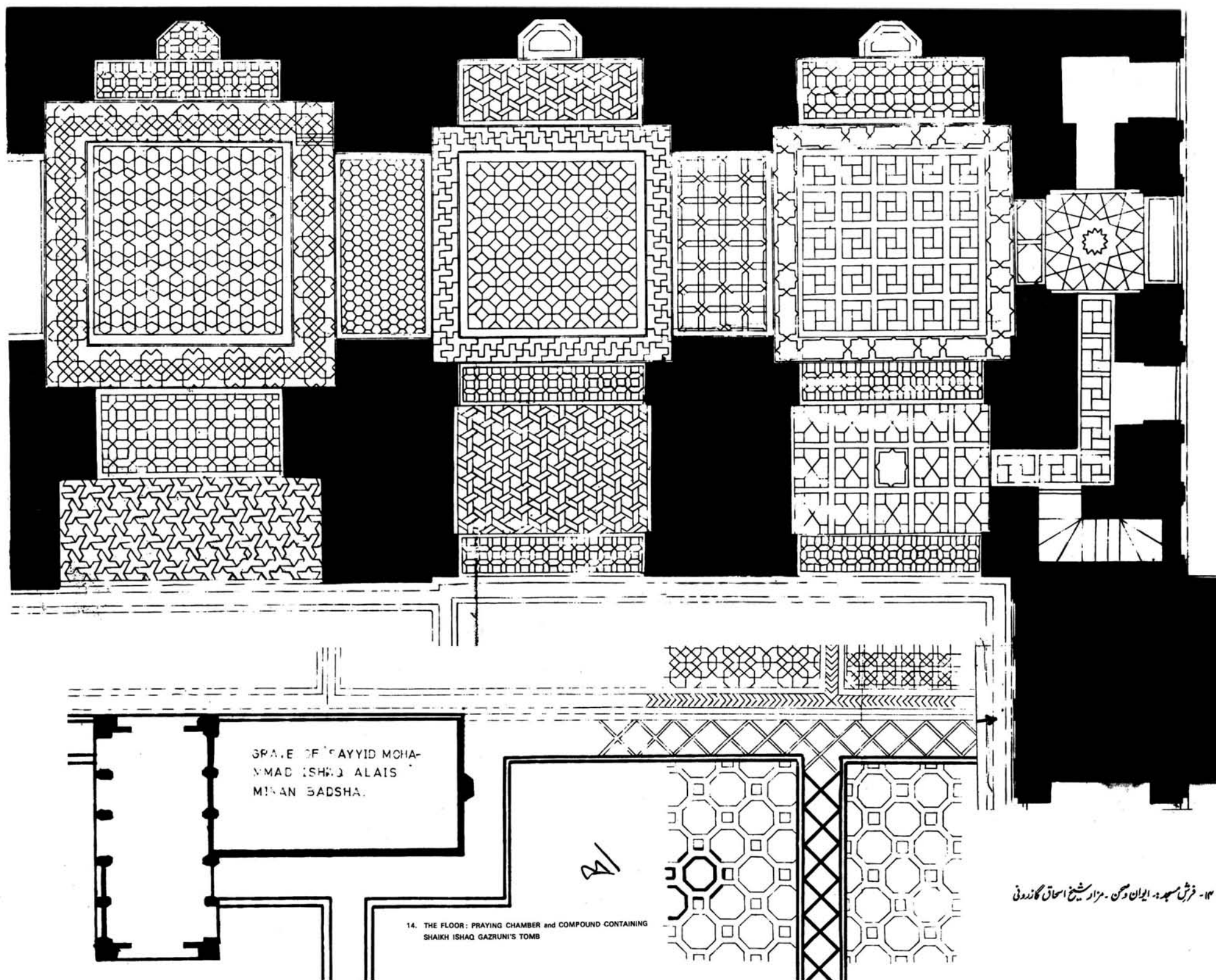
The present project provides a suitable opportunity to begin the first thorough documentation effort of recent time. The documentation programme devised is an REDM survey with a Total Station, in combination with real time CAD software and image orthorectification software. The documentation process has the following objectives:

- To gather detailed information in respect of the Wazir Khan Mosque and its surroundings in the form of base drawings.
- To establish a detailed record of the as-found state of the monument to allow conservation measures to be proposed.
- To provide a strong investigation and monitoring tool for recording the extent of damage and structural deformations in different parts of the monument.
- To establish an architectural survey which would be available for researchers and experts for future studies.
- To use the documentation as the basis for management, monitoring and maintenance of the site and monument after the conservation process is over.
- To disseminate and build capacity in recording techniques with REDM.⁷

The documentation of the monumental complex commenced in March, 2008 after securing permission from the Auqaf Department. By January, 2009 enough basic documentation was carried out to enable the structural engineer, Dr. Wenzel, to make an initial assessment of the condition of the structure, and for him to establish the necessity of undertaking geotechnical investigations and to prepare specifications for the same. The documentation of the architectural fabric of the mosque continued apace until

Opposite: The earliest known architectural documentation of the Wazir Khan Mosque, undertaken by Farid Baksh in c. 1875. This is the elevation of the eastern façade of the courtyard.

(From Chaghatai's The Wazir Khan Mosque, Lahore).



July, 2010 when the architectural form of the entire complex was documented. Thereafter a process to document in detail the surface ornamentation of the monument, and damage sustained by the monument by weathering and other factors such as human intervention and vandalism was continued. As of April, 2011 this process continues. The present report includes the extent to which such detailed documentation and its analysis has been completed.

5.1 THE RECORDING PROCESS

Before commencing the survey, station points were established securely on the courtyard floor. The electronic documentation of the building began as a series of traverses, using a laser based (reflector-less) electronic distance measuring total station. Each line on the survey comprises a collection of points recorded in 3-D with reference to the station point from where the survey was commenced. Each point recorded has a unique coordinate reading in the x, y and z axes, and is automatically converted to a vertex in a polyline system. At the end, this survey was integrated with the AKCSP LWC-wide topographic survey.

Using a real time CAD interface,⁸ the process of documentation instantaneously created a CAD drawing on a laptop computer mounted on a light tripod, which moved along with the Total Station. The geometry of the monument is described at 4 primary planes - Level 0 (street-level), Level 1 (courtyard level), Level 2 (at the level of the upper gallery of the *dewrhi*) and Level 3 (cutting horizontally across the shaft of the *minars* and showing the roof in plan projection). The first of the traverses established the plan of the courtyard at Level 1. The plane was established at a datum of 1 metre at a point marked on the base of the north-west *minar*. The traverse then continued into the prayer chamber, then all the *hujras*, the northern and southern pavilions and the Calligraphers' Bazaar at Level 1.

Before carrying on to plan traverses at Level 0 and Level 2, several sections were first drawn. The sections also recorded the façades of the buildings nearest to the section plane. This aspect of the survey was accompanied by a photographic coverage of these façades, to be used in the development of orthorectified images using image rectifying software. Salient points on the façades were recorded using cross-hair targets, which also appear in the photographs. An image rectifying software⁹ was used in conjunction with both the electronic position of the targets and their photographic versions.

This enabled the insertion of orthorectified images, in their correct location, into the CAD drawing generated by the REDM survey and helped in the development of detailed drawings of the façade, leading to the appropriate level of analysis of its components. A time consuming manual "tracing over" of the details of elements in the photograph, such as tile work and the elements marking its decay, then commenced accompanied by an analysis of damage to these elements by weathering (including damage by biological causes) and other causes such as human vandalism, structural behaviour etc. This process is an ongoing one, and its speed is restricted by the meticulous nature of the work and the limitations of the size of the professional workforce involved.

Most sections drawn through the fabric of the mosque use a mirrored sectional plane, i.e., one that creates sections looking in both directions.

The first section was drawn through the north-western and south-western *minars*, looking west and east. The former included the façade elevation of the prayer chamber.

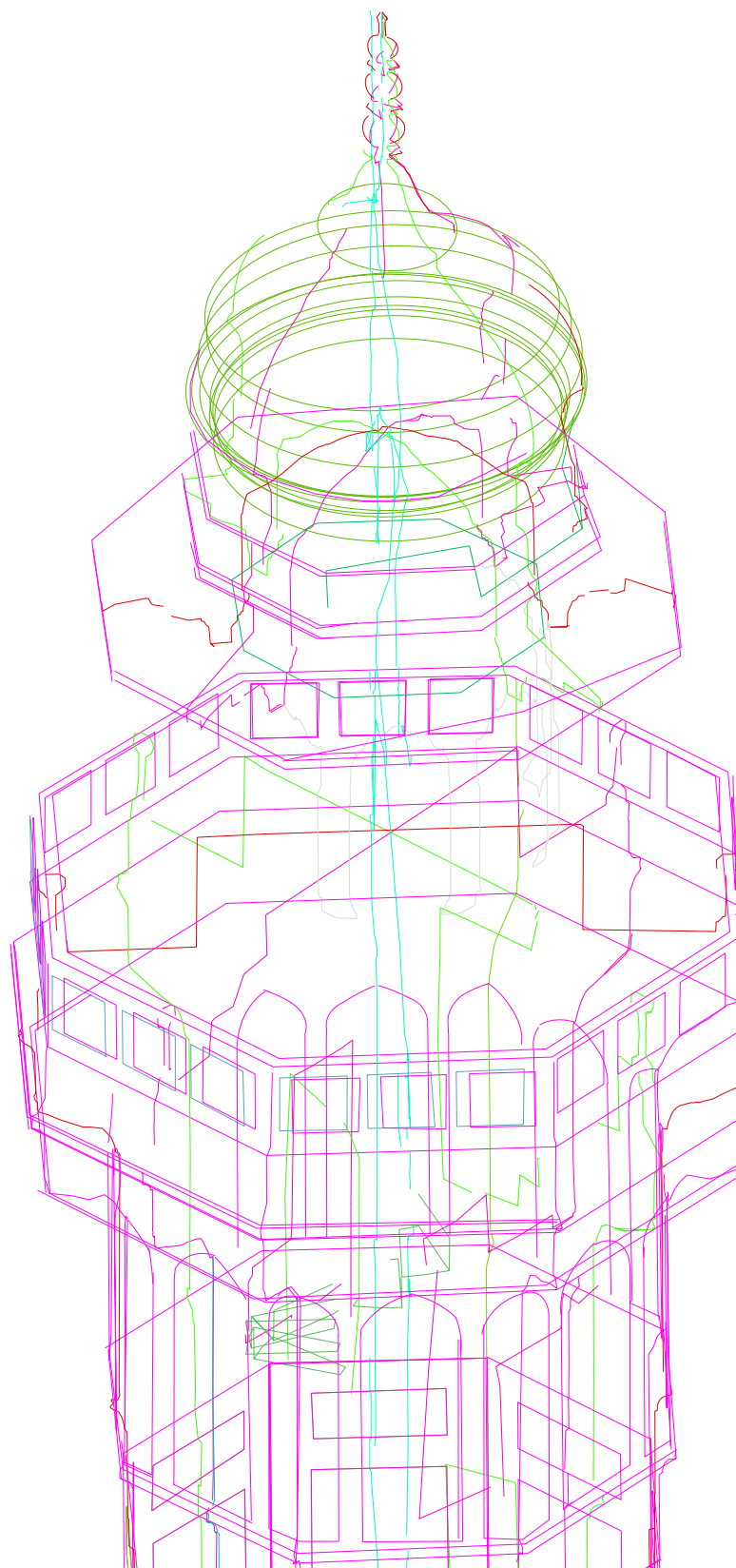
The sequence of work then established longitudinal sections AA (bi-directional), and AA' (looking south only—the only section plane that is projected in one direction) through the main courtyard, the prayer chamber, the *charsu* and its dome and the main *iwan* facing Wazir Khan Chowk. These sections include the façades of the northern and southern sides of the courtyard.

The next important section drawn was Section DD (bi-directional) whose plane slices the main chamber vertically and illustrates its features looking east and west.

Section EE is a section on a plane that runs north-south, through the centre of the second *hujra* from the east, on both the north and south wings flanking the courtyard. It faces east, illustrating the façade elevation of the eastern side of the courtyard, and the *hujras* on this side.

The fourth section in the chronological order used in the survey is Section CC which runs north-south along the centre line of the ambulatory in the Calligraphers' Bazaar, and comprises coverage

Opposite: The earliest known architectural documentation of the Wazir Khan Mosque, undertaken by Farid Baksh in c.1875. A documentation of the decorative brick flooring in the prayer chamber (from Chaghatai's The Wazir Khan Mosque, Lahore). N.B. taken from Chaghatai's reproduction in which Baksh's original drawing has evidently been cropped to show only the main central and northern two chambers of the prayer chamber. Consequently, the Ishaq Gazruni shrine and pavilion have been shifted out of their actual context, so as to fit on Chaghatai's page layout.



looking both east and west. Section FF runs in a plane parallel to the plane of section CC which runs through the building comprising the shops in the Calligraphers' Bazaar and parts of the main *iwan*.

The plane of section GG runs east to west and slices through Levels 0, 1 and 2 along the buildings of the north flank of the courtyard. Section HH runs longitudinally in similar fashion along the buildings that form the south flank of the courtyard.

All sectional planes that cut across the building at all three levels record spaces such as *hujras*, the (northern) pavilion and the shops at Level 0. Plans, sections and details are shown on the following pages.

More intense documentation was carried out on several different elements of the complex. Of these the most important documentation was that of the four *minars*, each of which was documented fully along its eight sides, and in addition four sections were prepared for each of the *minars*. Careful measurements were made of the inclinations of the *minars*. One set of these was made immediately after the earthquake of 28 October, 2009, (6.7 on the Richter scale) to observe any change of inclination caused by the earthquake.

5.1.1 DOCUMENTATION OF STRUCTURAL CRACKS

Structural cracks were documented in all important locations of the building. While some cracks are inert and have little or no increase or change, certain new cracks have appeared in some parts of the building indicating rapid and live movement of foundations, chiefly for reasons of poor drainage and saturation of the bearing soil. Both types of cracks were recorded on both the exterior and the interior of the buildings. In addition crack monitoring has been conducted by fixing tell-tales or by fixing crack monitoring studs and carrying out regular measurements (see also Section 9.1.3).

5.1.2 DOCUMENTATION OF THE FORMAL GEOMETRY OF THE BUILDINGS

In addition the geometry of transitions and *muqarnas*' was recorded carefully both inside and outside the prayer chamber and in the *charsu*, the *dewrhi* of the entrance system in the Calligraphers' Bazaar.

5.1.3 DOCUMENTATION OF INVESTIGATION PROCEDURES, EXPLORATORY PITS AND ONGOING INTERVENTIONS

a. Investigation procedures

Visible portions of the system of the mosque's courtyard were recorded, as these were crucial in determining the causes of the subsidence patterns that have prevailed. Some of these investigations led the documentation team into the rear of the shop under the third *hujra* from the east on the northern flank of the courtyard, into which the present water disposal drain appears to be flowing. This was properly documented.

b. Exploratory pits

A total of five exploratory pits were opened up to ascertain interventions and changes that have occurred in the parts of the monument below the existing floor or grade levels of the mosque and the Chowk Wazir Khan. Measurements were carefully made of the cultural strata and material found in these exploratory pits.

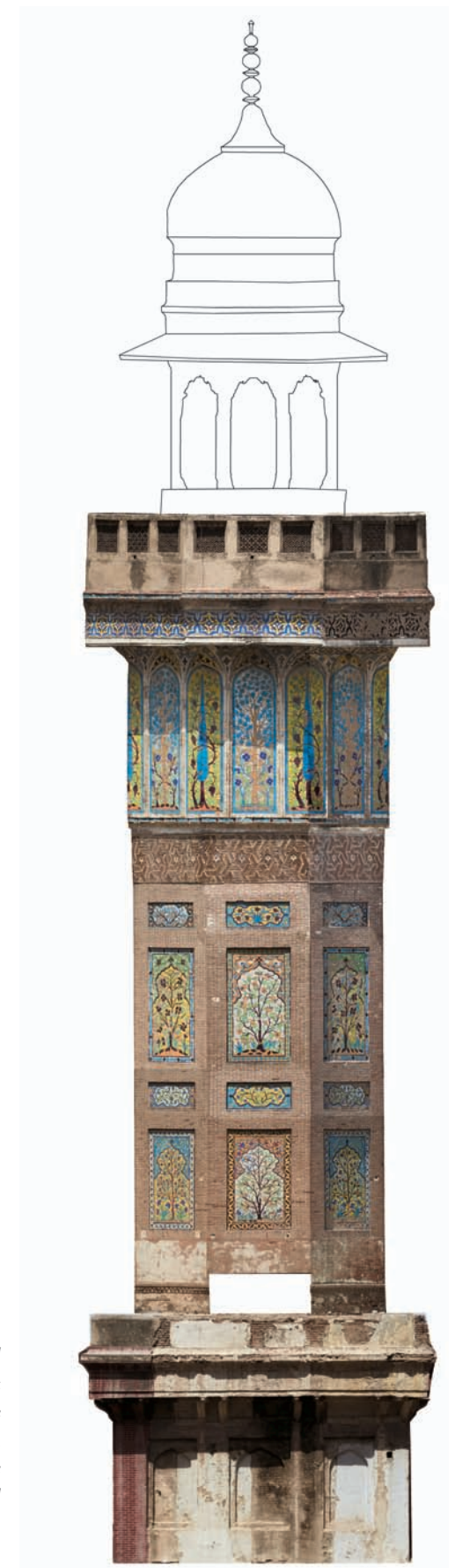
c. Ongoing intervention

The Punjab Archaeology Department, under a request from the Punjab Auqaf Department, have excavated a large part of the courtyard to address the issue of its subsidence in its south-eastern corner. The extent of this excavation and its depth at various locations were recorded. The historical material excavated was also photographed.

d. Documentation of existing use and critical locations of drainage and consequent structural damage

As described in the following pages, the mosque complex has suffered from a variety of inappropriate uses and abuses, as well as from unthoughtful interventions such as the construction of buildings that bear on the historic walls of the monument. These interventions and critical points at which they bear on the structural health of the monument were carefully recorded.

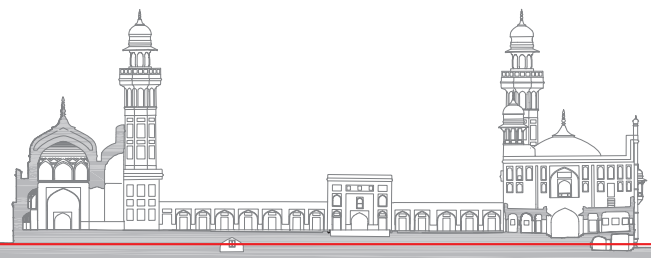
The four minars of the monumental complex have conspicuous artistic merit and elegance, but also face structural issues—all four minars are inclining to one extent or the other. As such the team documented them particularly intensively, through the REDM equipment as well as using photo-orthorectification techniques. Shown on the page opposite is the north-east minar, with the wire frame documentation of its geometry. Shown on the right is the south-east minar, with its eight sided central shaft completed with orthorectified photographs of its tiled panels.

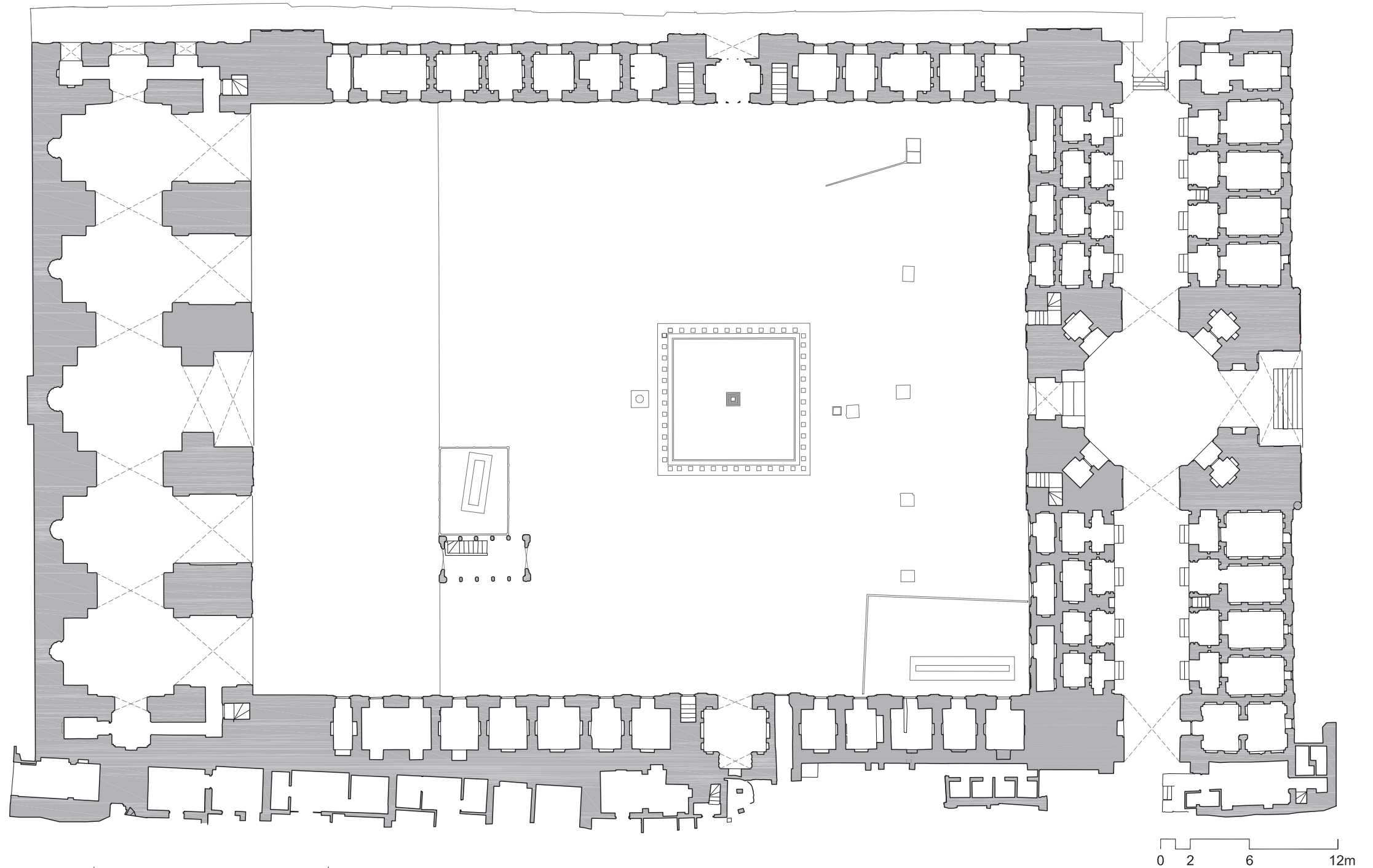




**PLAN AT LEVEL 0 OF THE MOSQUE AND
WAZIR KHAN CHOWK**

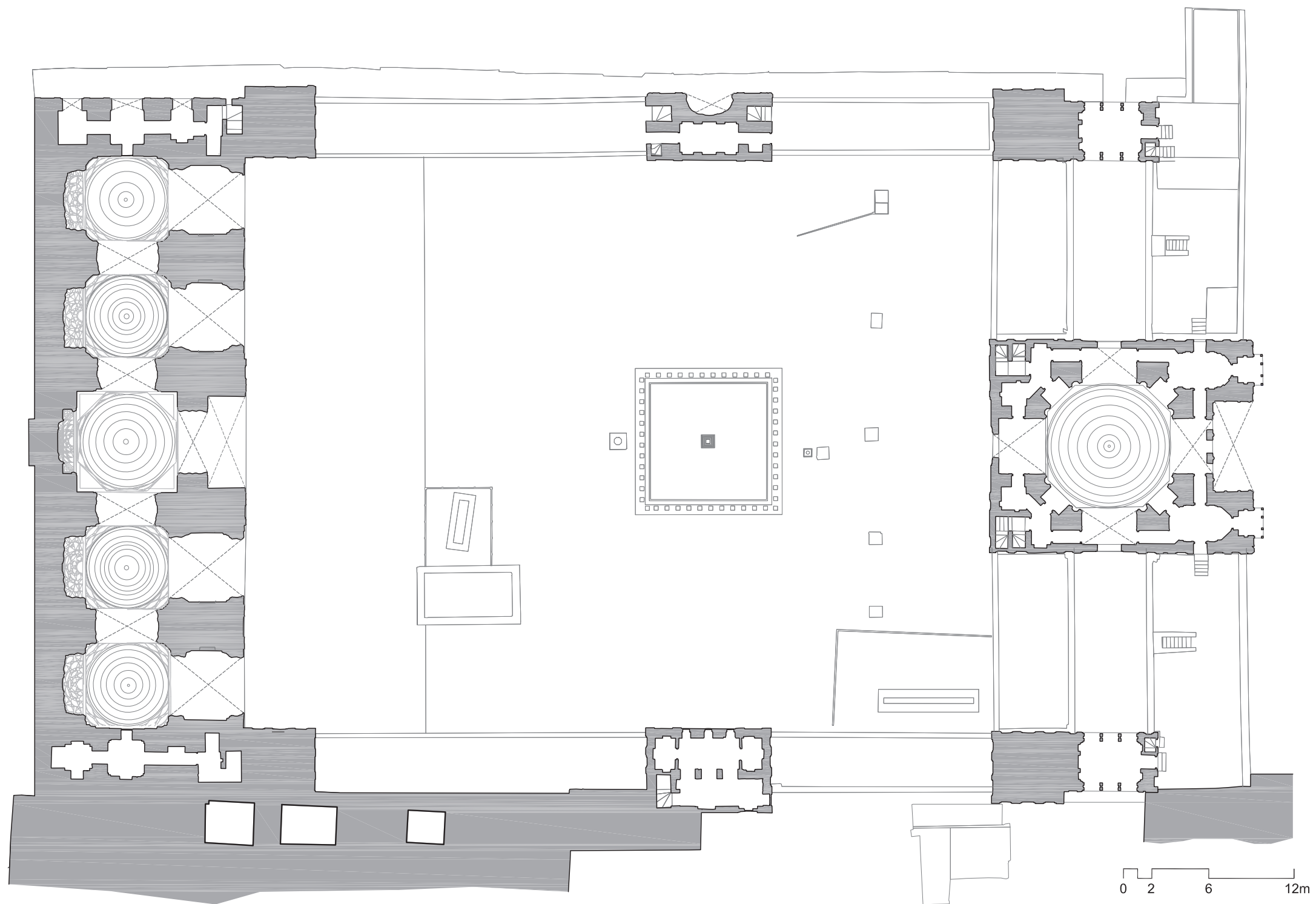
Showing the shops at street-level on the mosque's northern and eastern sides, and the Ishaq Gazruni shrine chamber under the level of the courtyard. The length of the shrine chamber is longer than the demarcation at courtyard level.





PLAN AT LEVEL 1

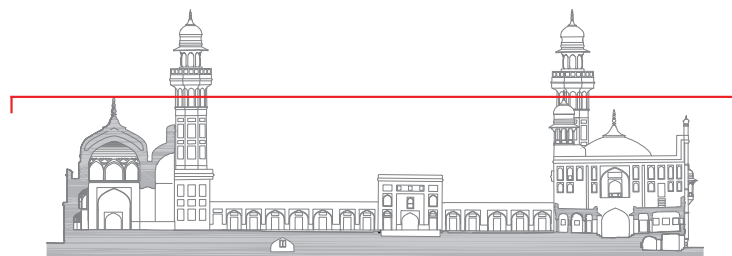
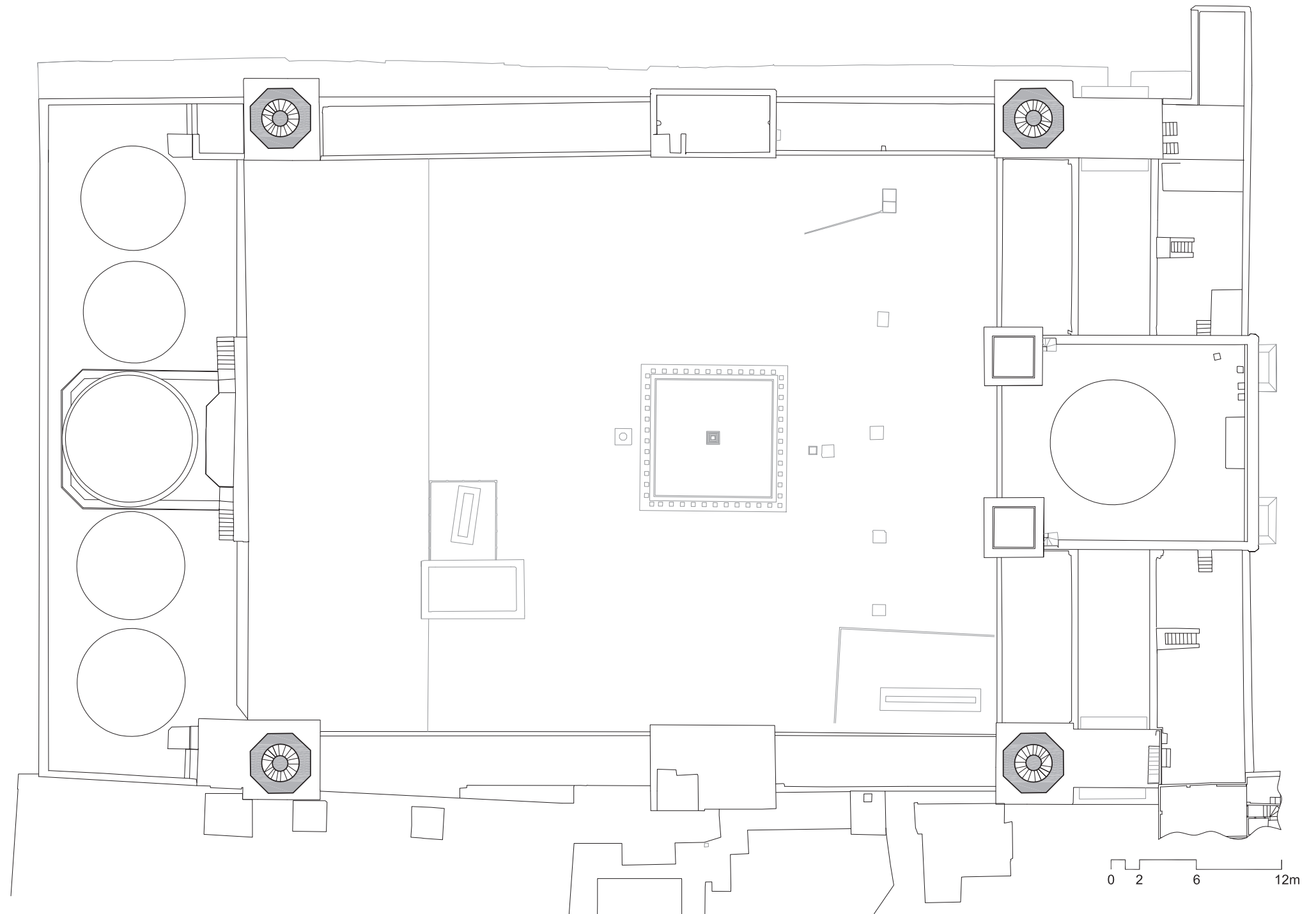
Showing the entrance dewrhi, Calligraphers' Bazaar, courtyard, northern and southern rows of hujras with pavilions, the prayer chamber, all four minar bases, Ishaq Gazruni Shrine pavilion, central ablution pool, and recently added ablution facility in the south-eastern corner of the courtyard.



PLAN AT LEVEL 2

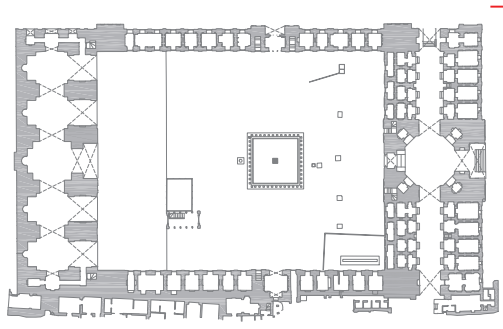
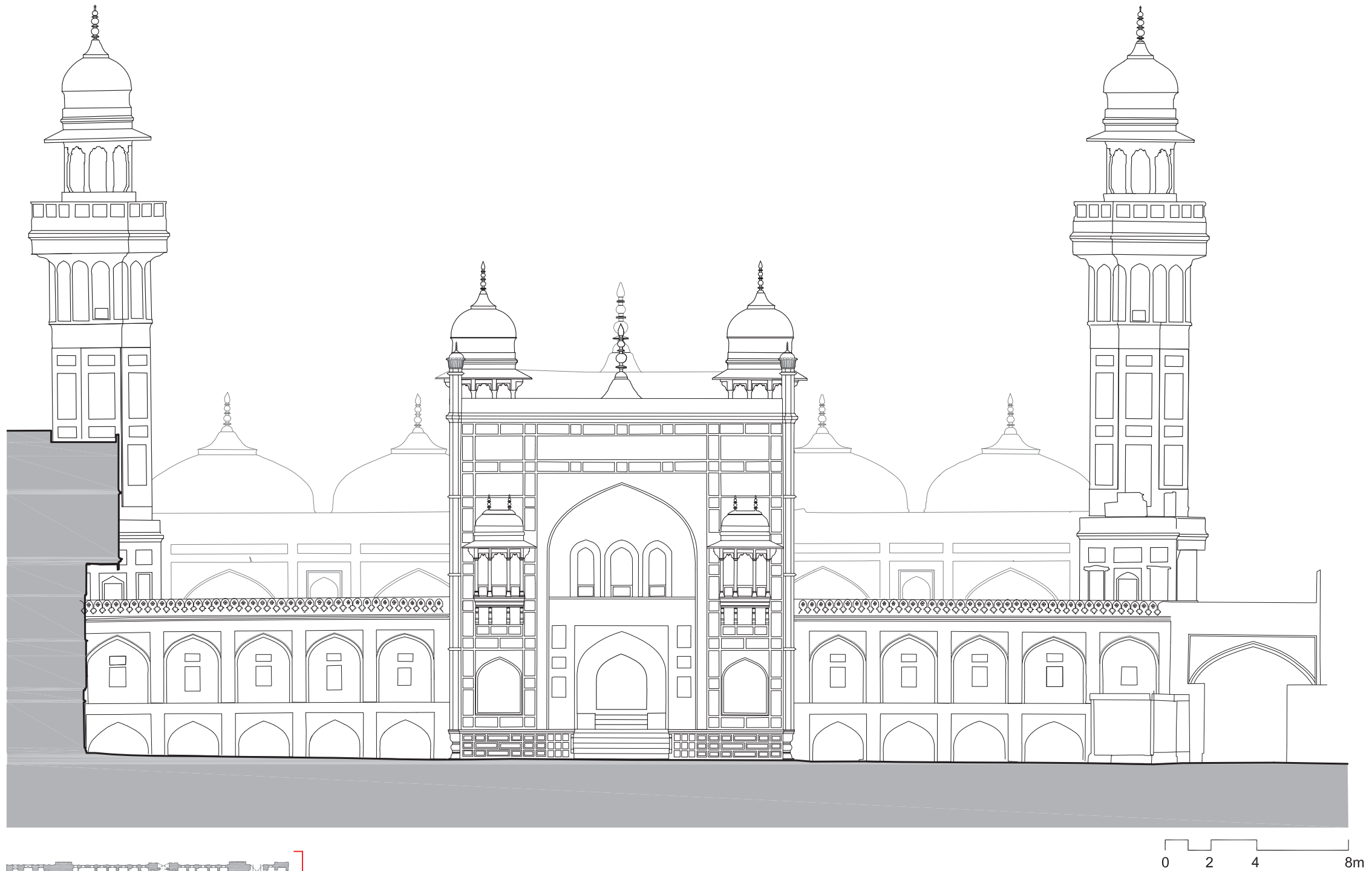
Showing all pavilions at Level 2 including those on the roofs of the Calligraphers' Bazaar, and the domes of the dewrhi and the prayer chamber. Additionally, the built residential area of the mosque's southern side is included where the houses abut the mosque's southern wall.





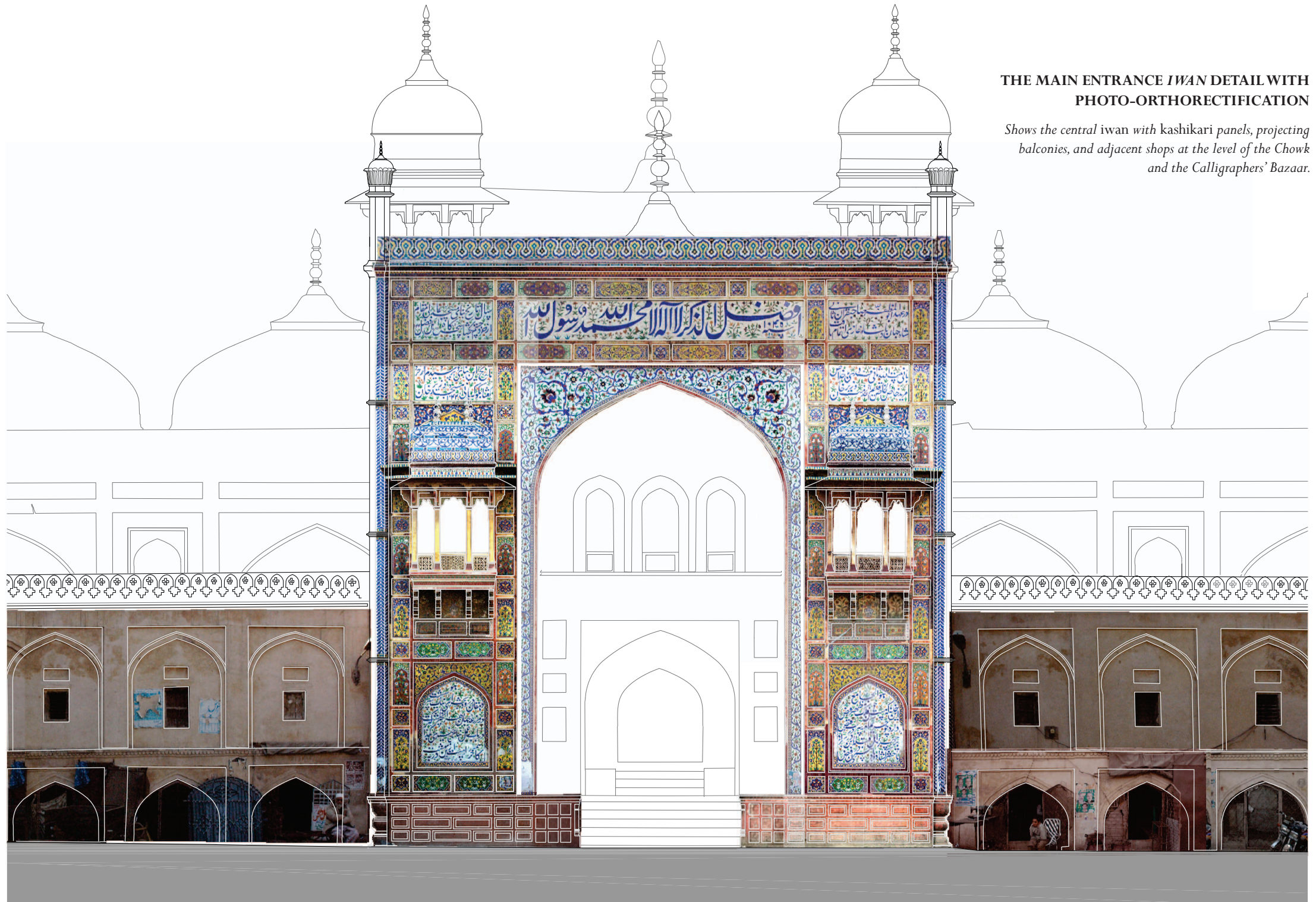
PLAN AT LEVEL 3

Showing the roof plans of all areas of the mosque and sections through the minars. The roof plans of the houses on the southern side abutting the mosque's wall are also shown.



THE EASTERN FAÇADE LOOKING OVER CHOWK WAZIR KHAN

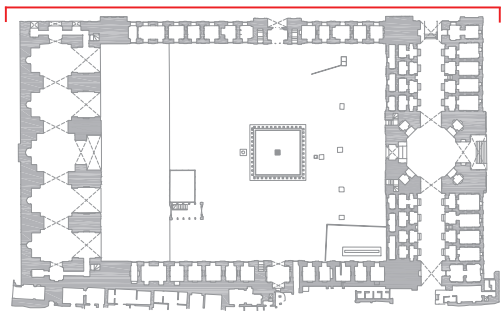
The external iwān overlooking the Chowk is shown together with shops at the street-level partially obscured by the elevated floor of the Chowk. The windows of the shops of the Calligraphers' Bazaar, accessed from within, look over on to the Chowk. The relative height of the prayer chamber is shown behind. On the right is Kotwali Gate, the north-western gate leading from the Chowk to Kotwali Bazaar on the mosque's northern side, and on the left is an abutting residential property.



THE MAIN ENTRANCE IWAN DETAIL WITH PHOTO-ORTHORECTIFICATION

Shows the central iwan with kashikari panels, projecting balconies, and adjacent shops at the level of the Chowk and the Calligraphers' Bazaar.

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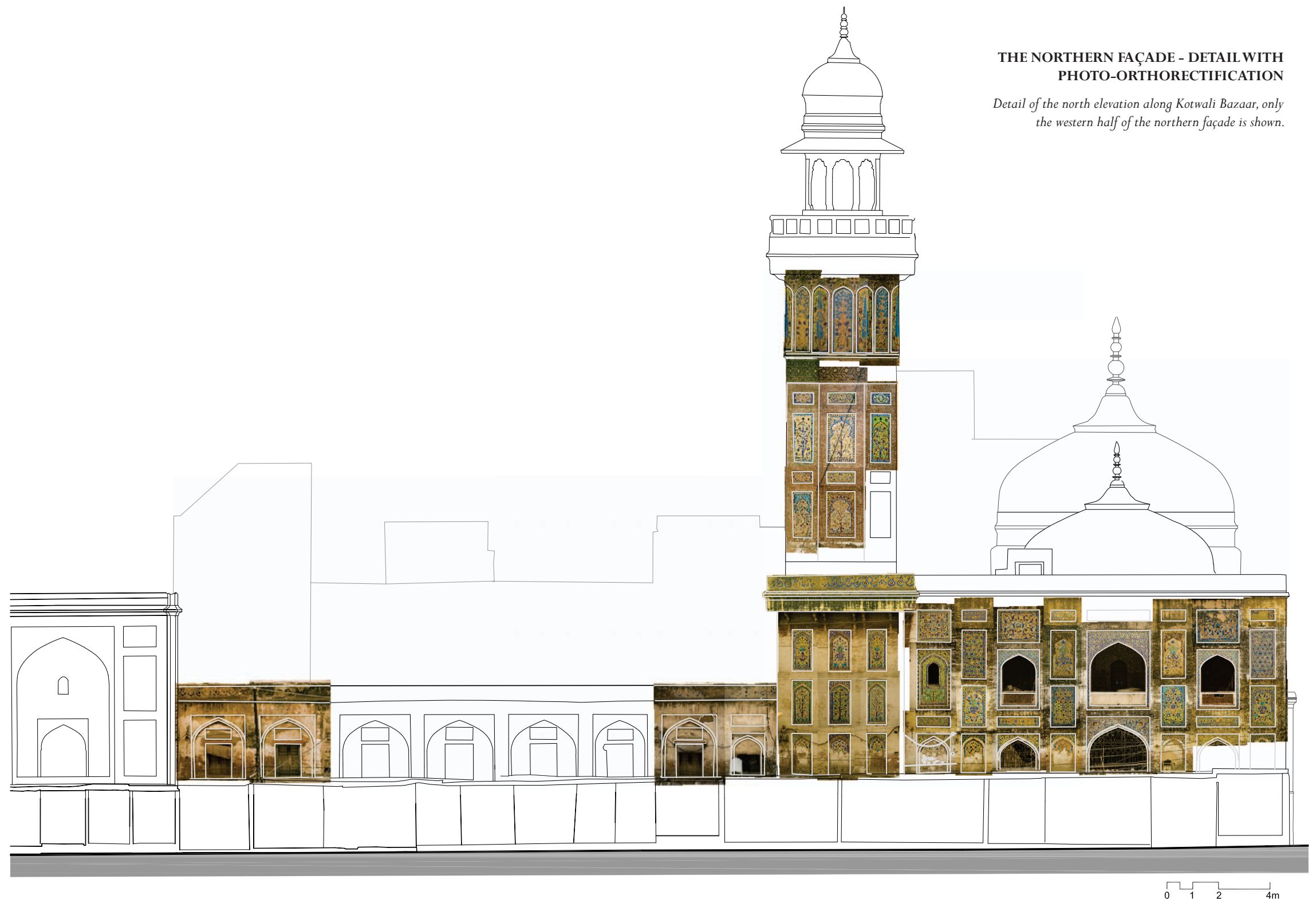


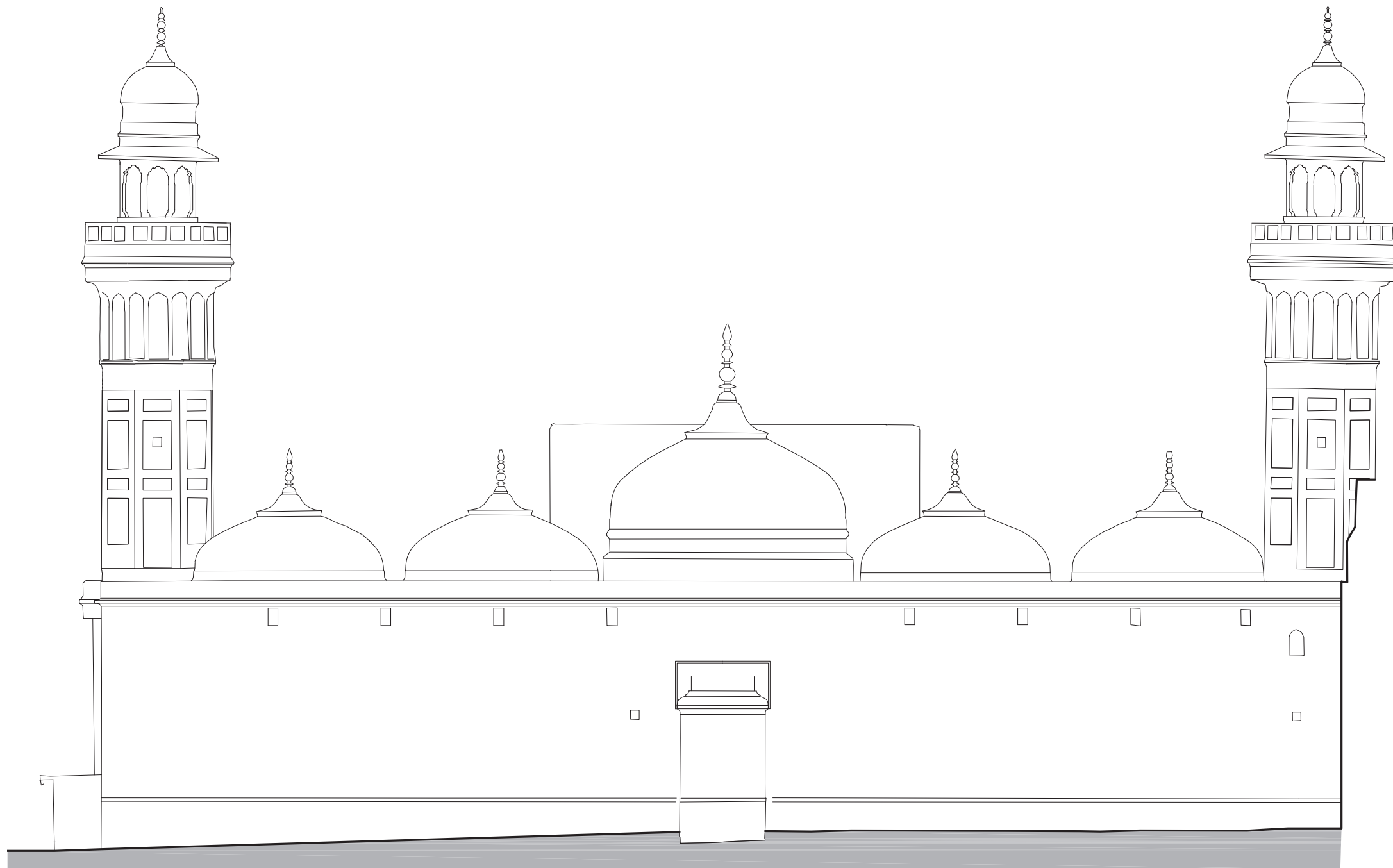
NORTH ELEVATION

North elevation of the mosque, showing in the foreground the modern additions to the original built-in shops along Kotwali Bazaar, and in the background the properties in the residential area beyond the southern limits of the complex. The balconies projecting into the Chowk from the iwān on the eastern façade are visible. The relative height of the register at the courtyard level (Level 1) in relation to the register at the street-level is obscured by the recent shops and the elevated street-level.

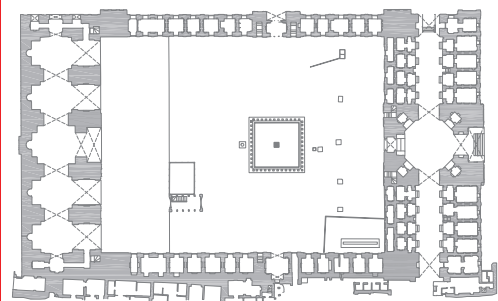
**THE NORTHERN FAÇADE - DETAIL WITH
PHOTO-ORTHOECTIFICATION**

*Detail of the north elevation along Kotwali Bazaar, only
the western half of the northern façade is shown.*



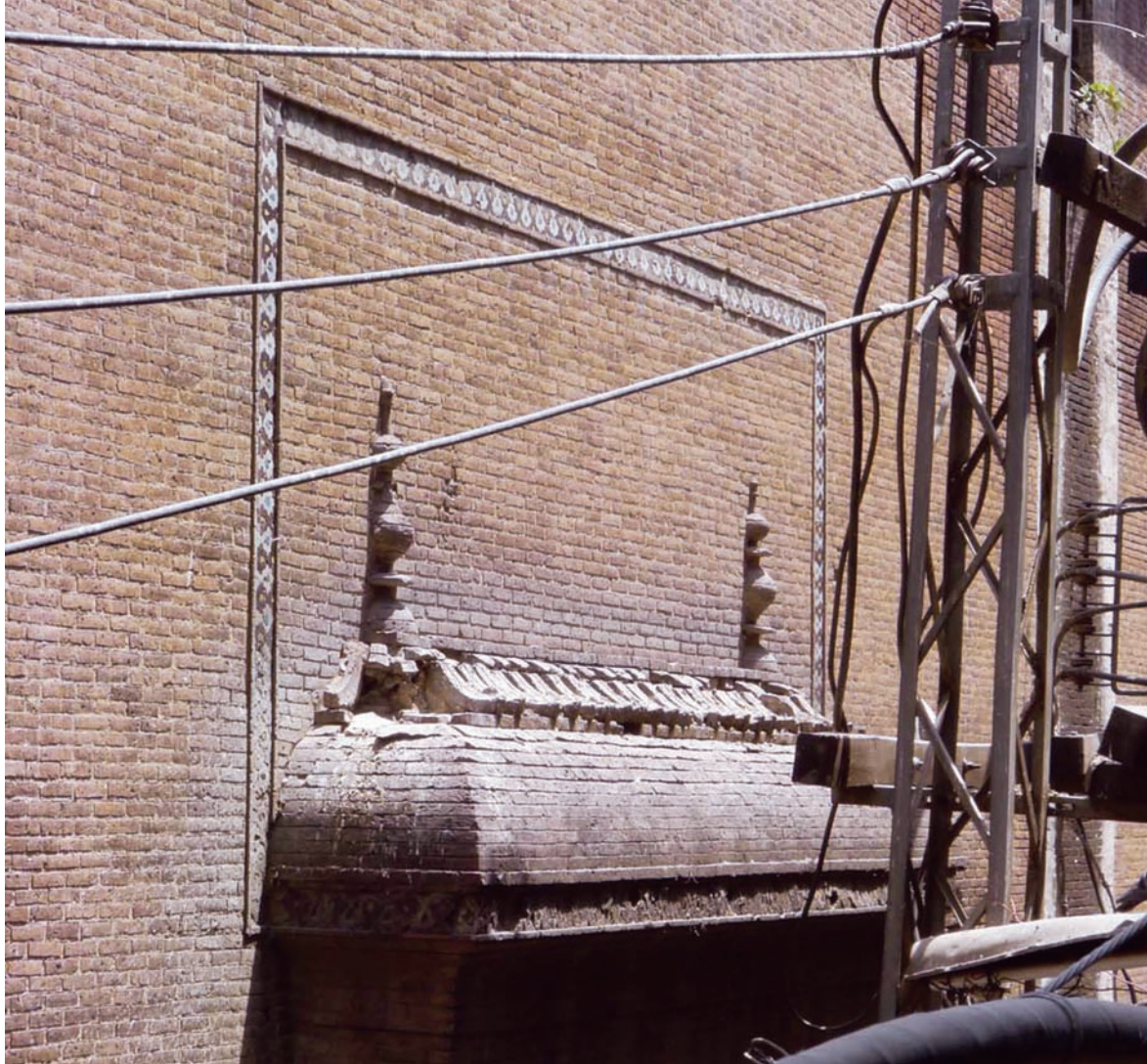


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WEST ELEVATION

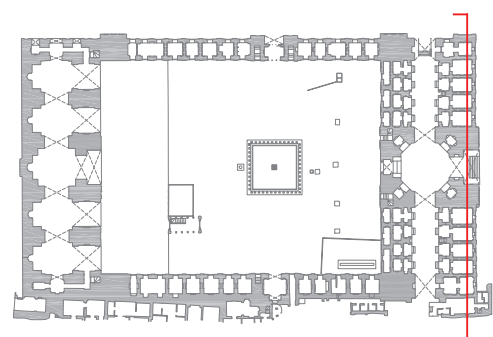
The west elevation consists primarily of the prayer chamber. The mihrab at the centre of the chamber is projected outwards into the street and is the primary architectural feature on this side. Also clearly shown in this elevation is the incline in street-level from the northern side to the southern side, demonstrating the difference in the land levels along the western and southern sides of the complex. The south-western corner of the mosque is not accessible for documentation due to a residential building abutting the mosque. The relative height of the iwan of the prayer chamber is shown in the background.



Above: There are no structures abutting the western façade of the mosque, with the exception of the south-western corner where a residential building is using the mosque's walls for support. The remaining western façade is fully accessible from the gali immediately adjacent, which is occupied only by street hawkers, mobile food trolleys, and a conspicuous electricity transformer.

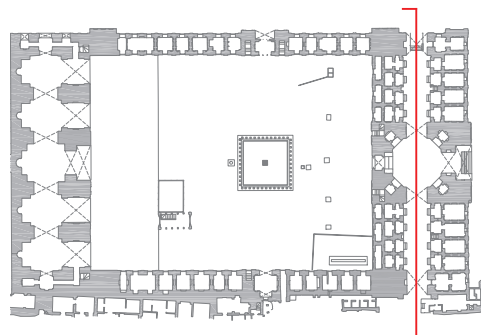
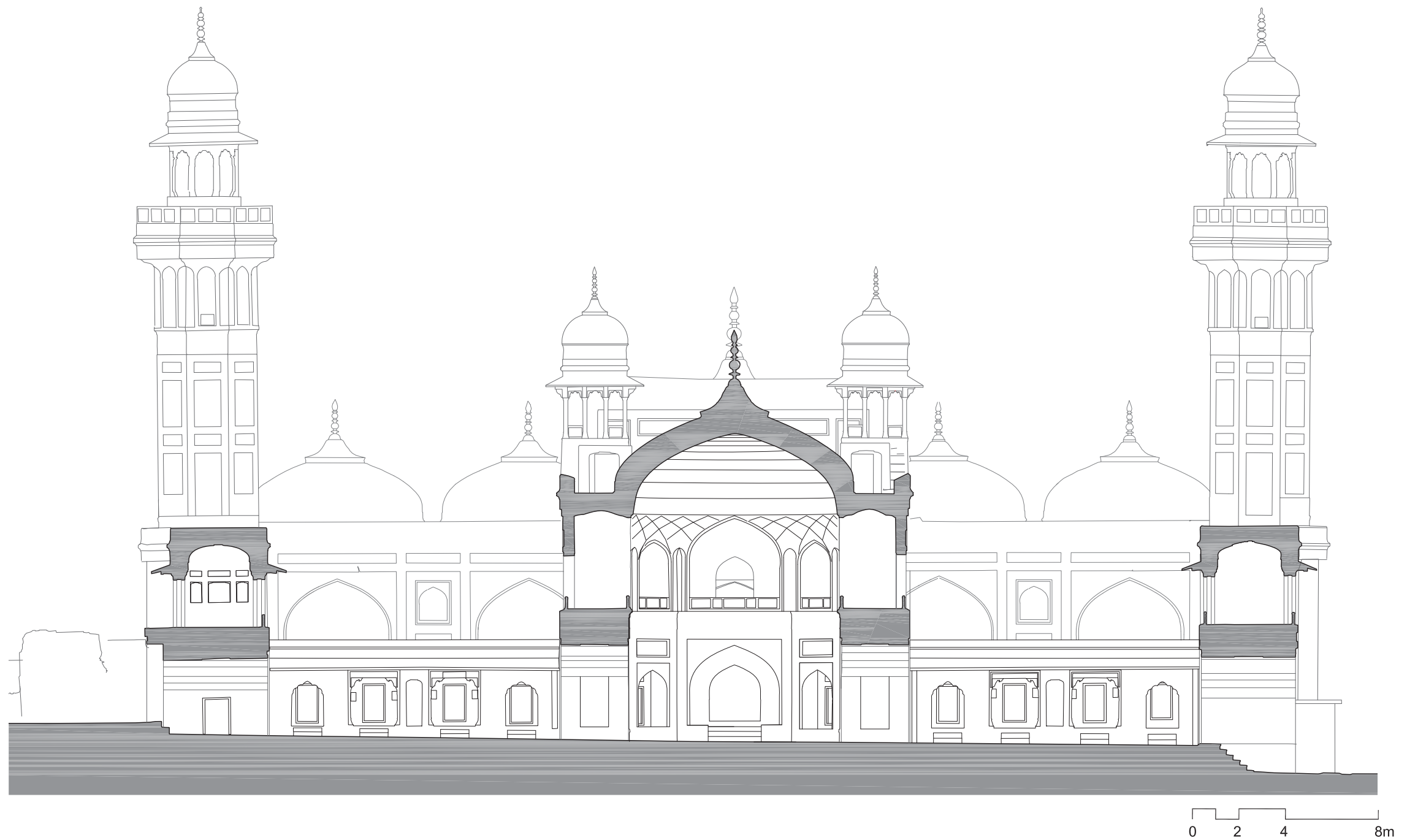
Top left and far left: Tile border around the mihrab projection on the western façade and detail.

Left: Detail of glazed tile work bordering the top of the western façade.



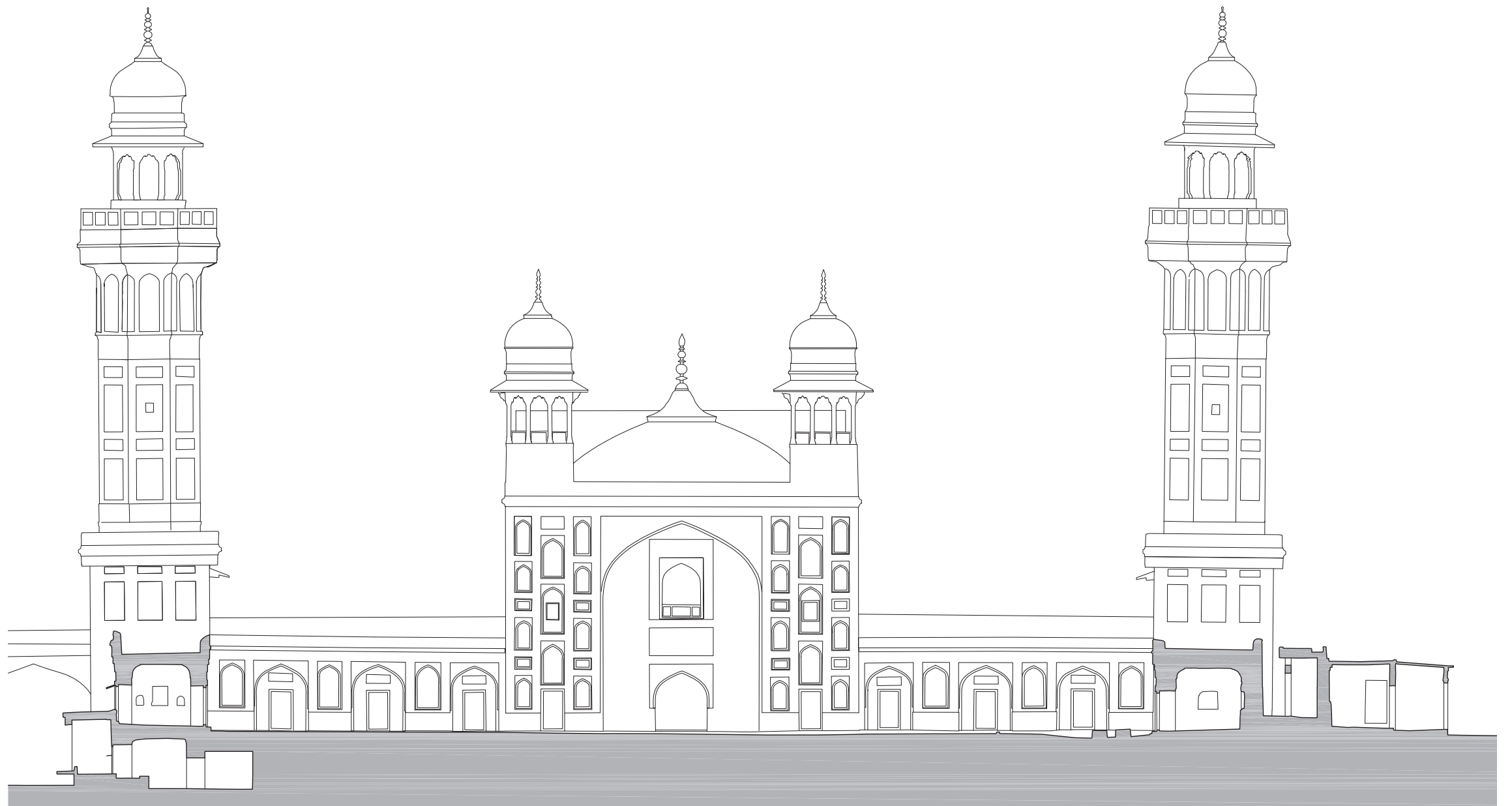
SECTION FF LOOKING WEST

This sectional elevation cuts through the eastern façade of the mosque: both the shops on the Chowk and the shops on the eastern side of the Calligraphers' Bazaar are in section. Additionally, the steps leading from the level of the Calligraphers' Bazaar and dewrhi level up to the level of the mosque courtyard are visible. On the northern side of the sectional elevation is Kotwali Gate, the north-western gate leading from the Chowk to Kotwali Bazaar with modern shops built into its sides. On the southern side on the left of the section is a residential property which abuts the south-eastern corner of the mosque and is partly built across the roof of the Calligraphers' Bazaar.

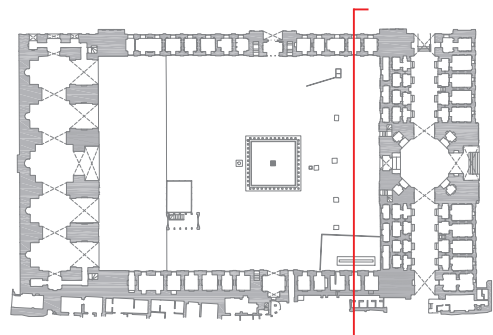


SECTION CC LOOKING WEST

This sectional elevation cuts through the street of the Calligraphers' Bazaar, and the entrance dewrhi. The individual archways, steps and raised platforms which form a transitional space outside each shop on the western side of the Calligraphers' Bazaar are visible. Additionally, on the northern and southern extremes of the Calligraphers' Bazaar roof are pavilions, which are located immediately east of the minars. Within the dewrhi, are the two western niches at the level of the Calligraphers' Bazaar mirroring two identical niches on the eastern side (not shown).



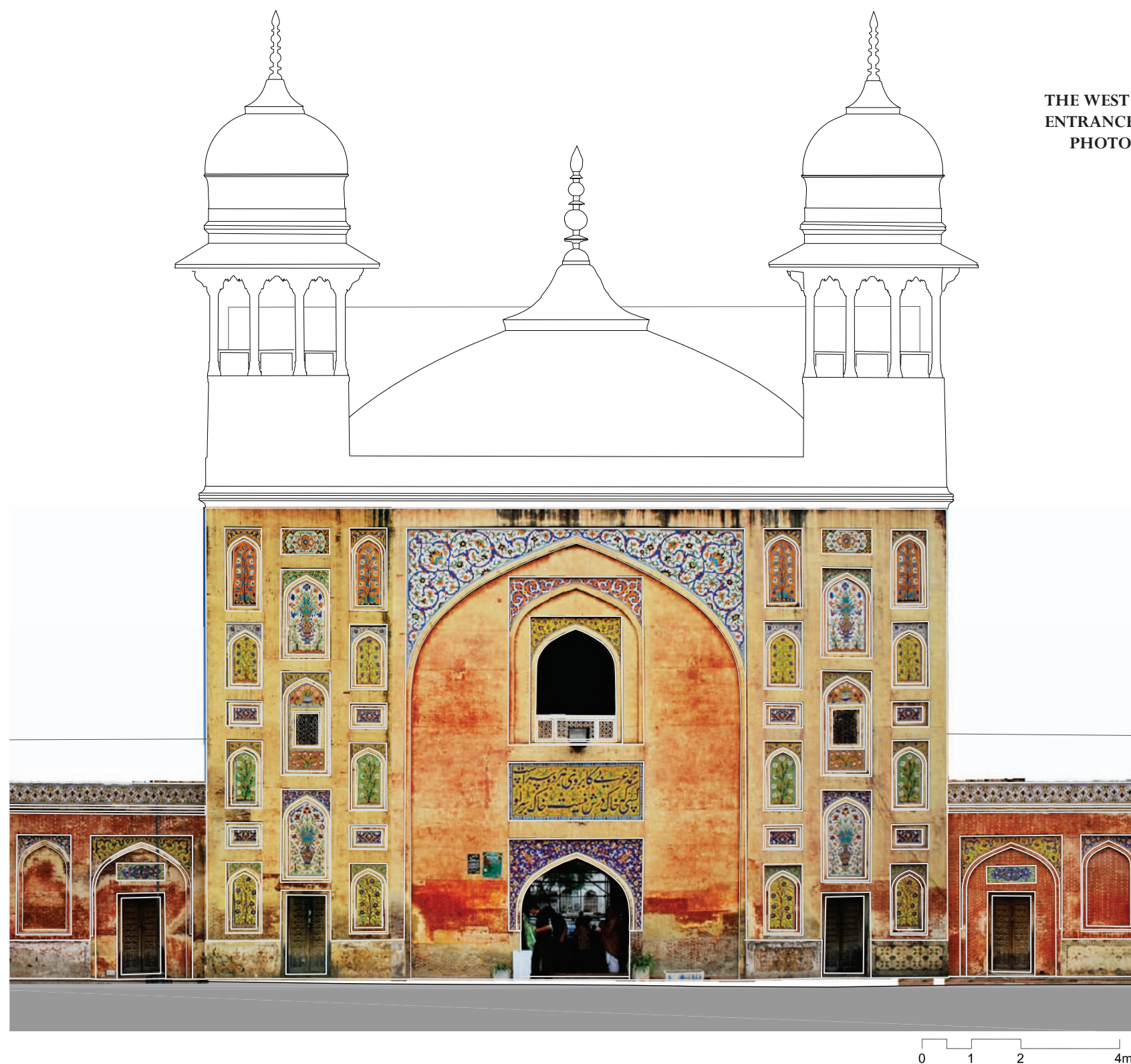
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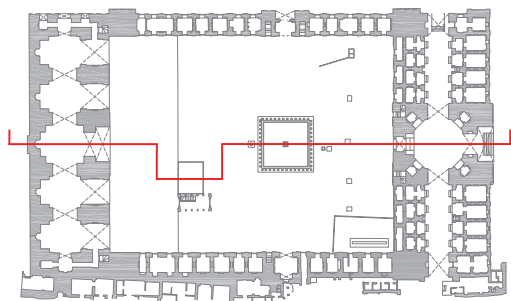
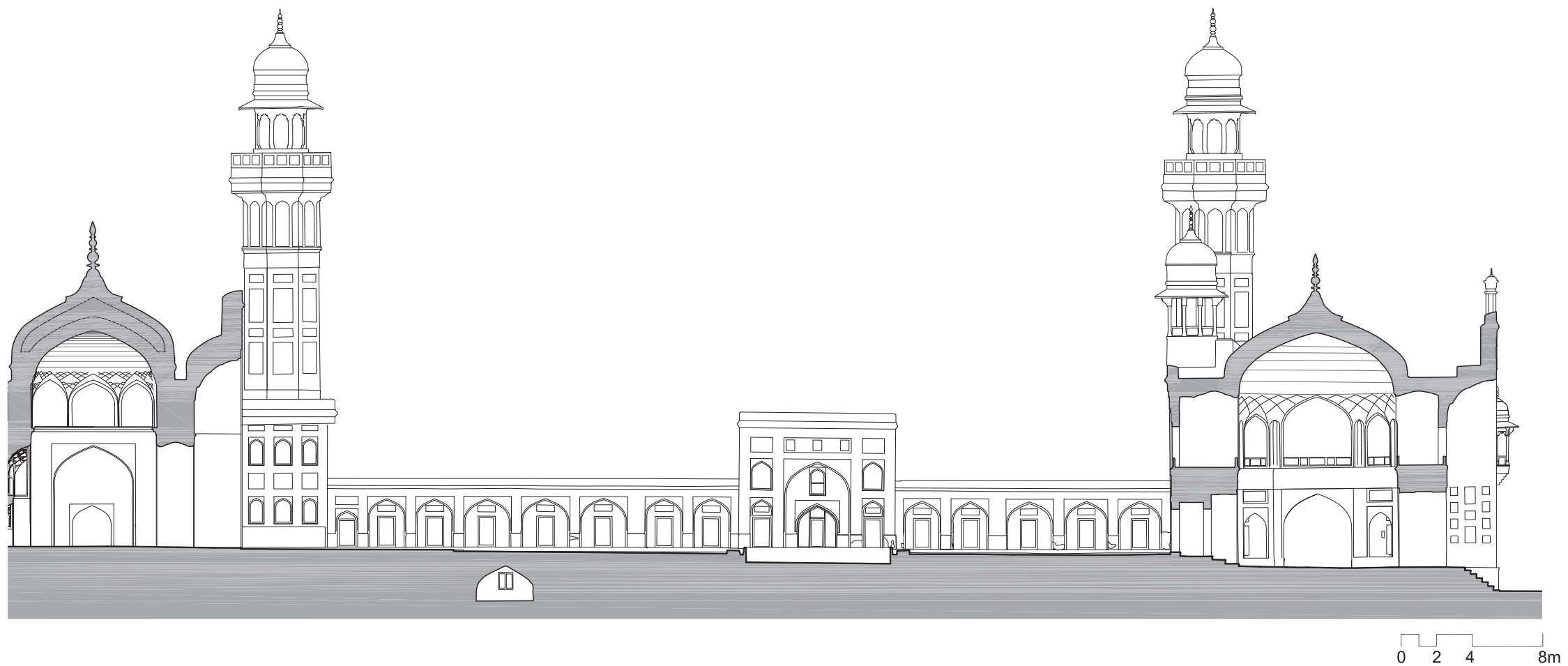


SECTION EE LOOKING EAST

This sectional elevation looks east back towards the entrance of the mosque. It shows the hujras on the eastern side of the courtyard, section through the hujras on both the northern and southern side, the ablution facility built in the south-eastern corner of the courtyard and the toilets built outside the southern limits. At street-level on the northern side the original shops under the hujras extend southwards under the courtyard. The rise in street-level over time has necessitated the addition of new structures in front of the shops extending northwards into Kotwali Bazaar at a higher level. In the background is the arch of Kotwali Gate. On the southern side, the base of the hujras correspond roughly to the street-level outside; the floors of the latrine structures built outside the limits of the historic structures on the southern side are at a higher level than the hujra floors.

THE WEST FACING FAÇADE OF THE
ENTRANCE SYSTEM - DETAIL WITH
PHOTO-ORTHOECTIFICATION





SECTION AA LOOKING NORTH

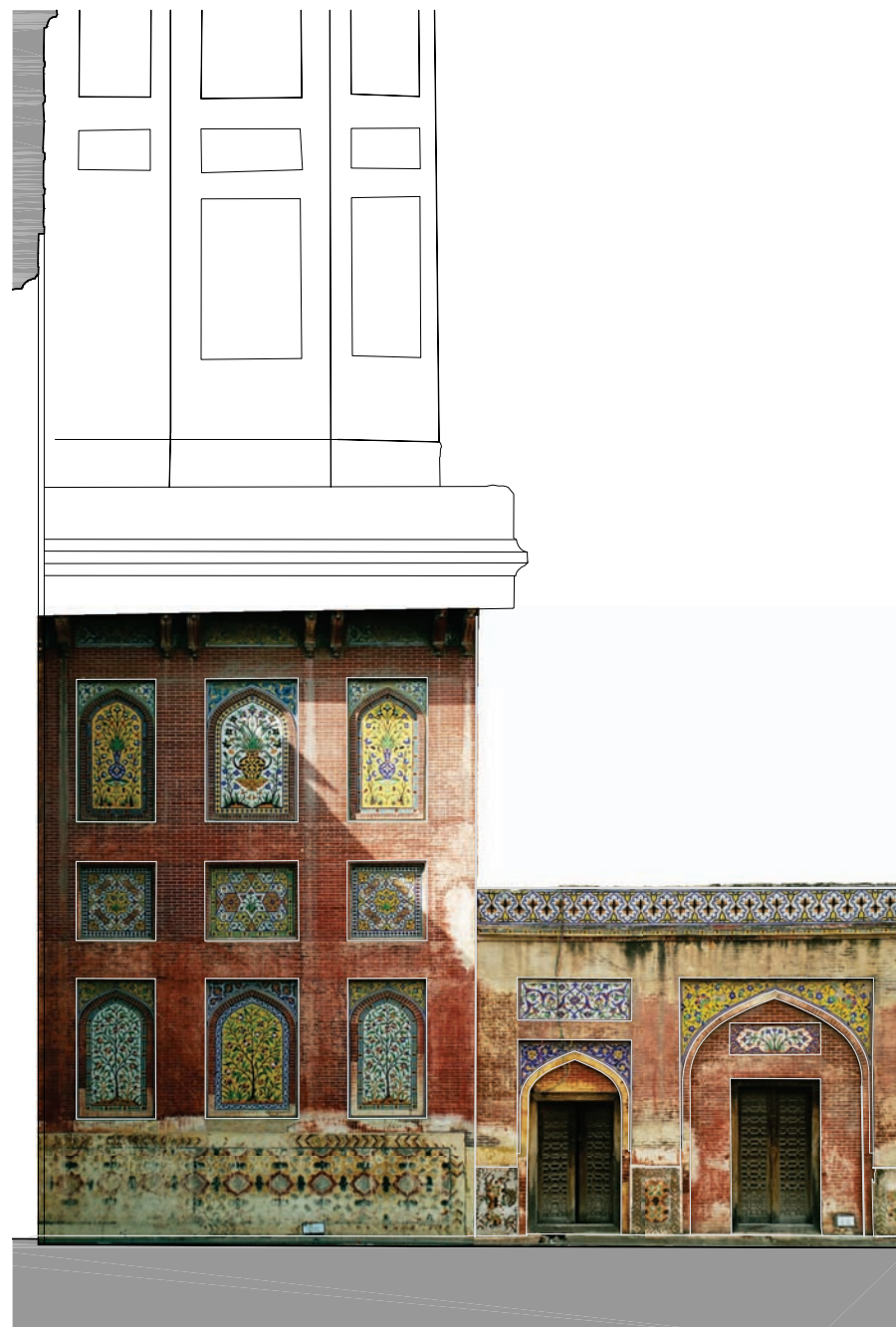
This section cuts through the courtyard, the prayer chamber's central dome, and the entrance dewrhi, as well as the shrine of Ishaq Gazruni located beneath the level of the courtyard, and the ablution pool in the centre of the courtyard.

Particularly evident is the successive rises in floor height from the Chowk in the east, to the Calligraphers' Bazaar and to the courtyard with the almost imperceptibly elevated western part of its floor.

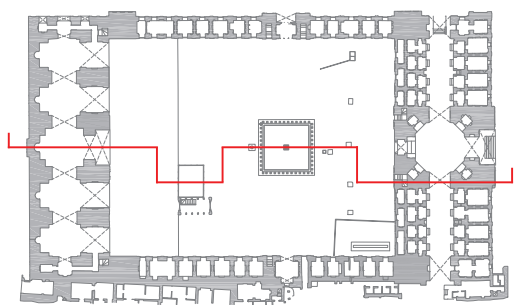
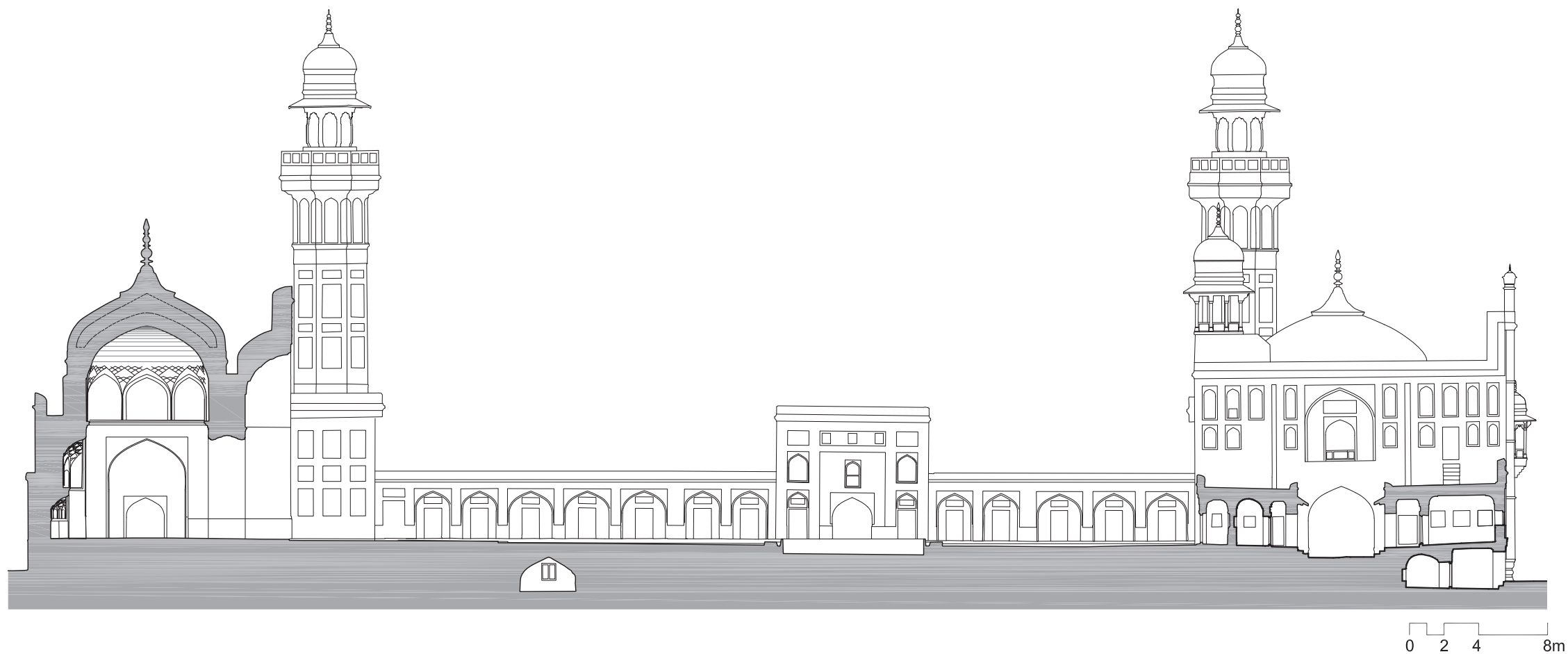
On the northern side is the elevation of the north row of hujras with pavilion placed on an axis line in the centre of the lower, square part of the courtyard (see key plan, left).

Whilst the base of the north-eastern minar is incorporated in the volume of the Calligraphers Bazaar, that of the north-western minar is clearly visible from the courtyard.

THE NORTHERN PAVILION AND THE NORTH-WEST *MINAR*
BASE - DETAIL WITH PHOTO-ORTHORECTIFICATION

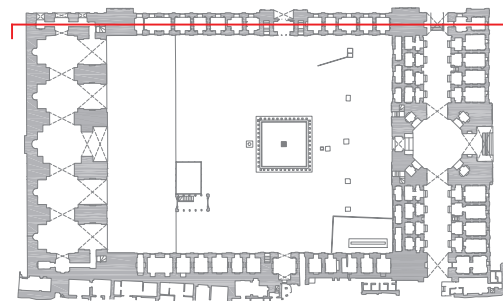


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SECTION AA' LOOKING NORTH

This is similar to the previous section. However, the plane of the section slices through the Calligraphers' Bazaar on the south side of the dewrhi, showing the relation between the Calligraphers' Bazaar street, the individual shops and their external transitional spaces, and the shops underneath which open out into the Chowk.



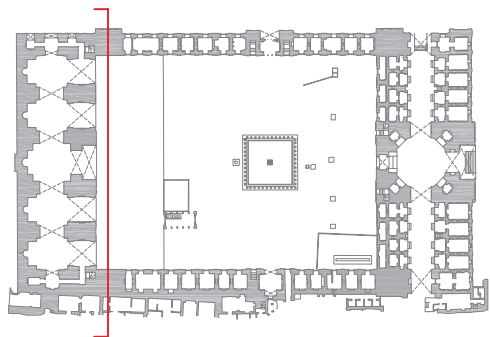
SECTION GG LOOKING SOUTH

This section cuts through the northern row of hujras, the northern pavilion, the original shops at street-level below and the northern minars (western and eastern). On the east side, the section cuts through a shop at the level of the Chowk, above which is a shop accessed from the Calligraphers' Bazaar with transitional space and steps leading up. The passageway of the Calligraphers' Bazaar is at a lower level, above which is the pavilion to the east of the north-eastern minar.

On the west side of the section is the prayer chamber with the section cutting through the different levels of small rooms on the northern side of the prayer chamber.



0 2 4 8m

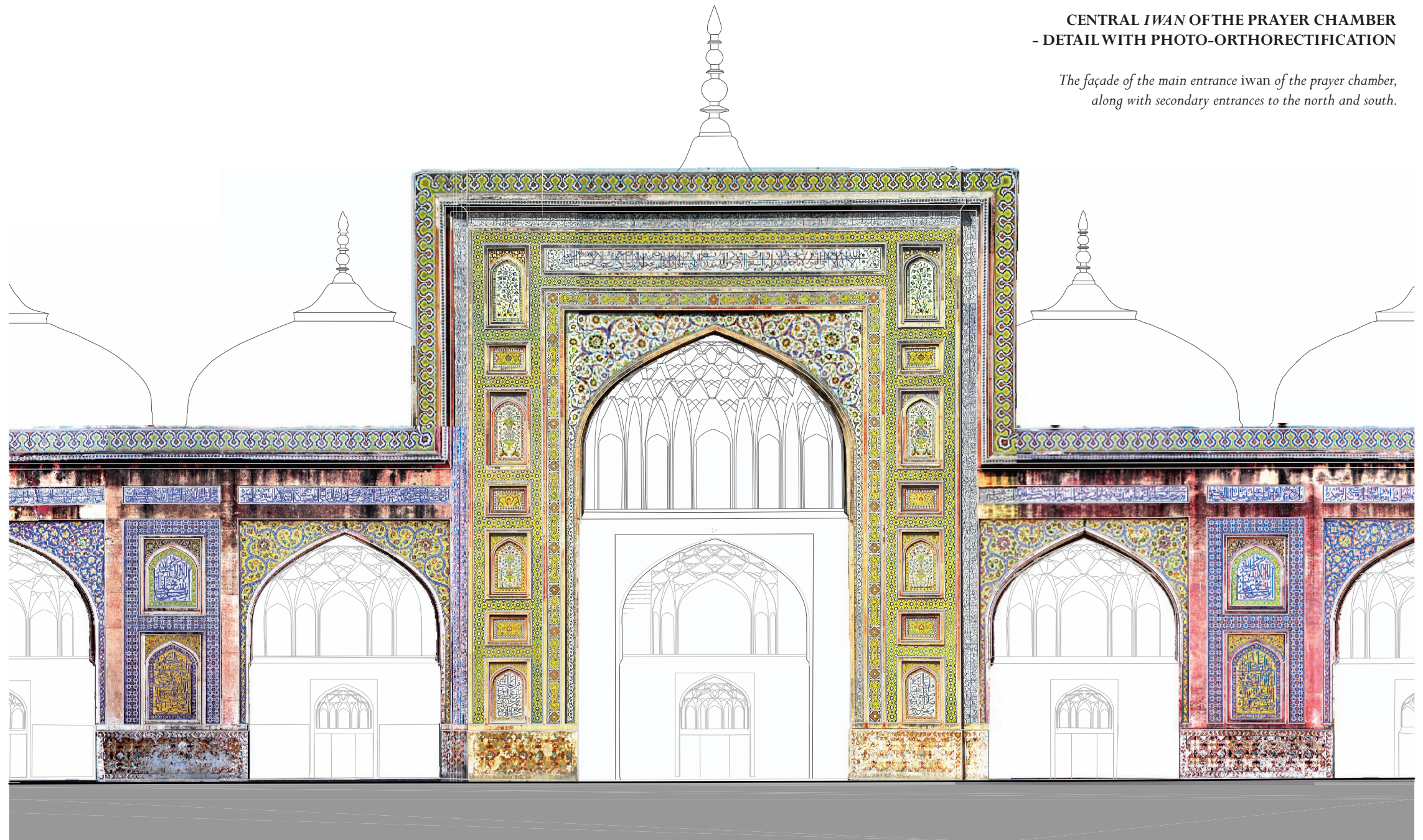


SECTION BB LOOKING WEST

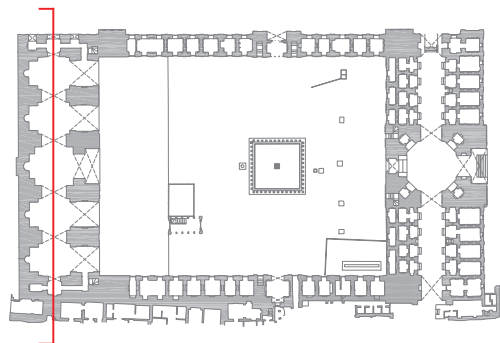
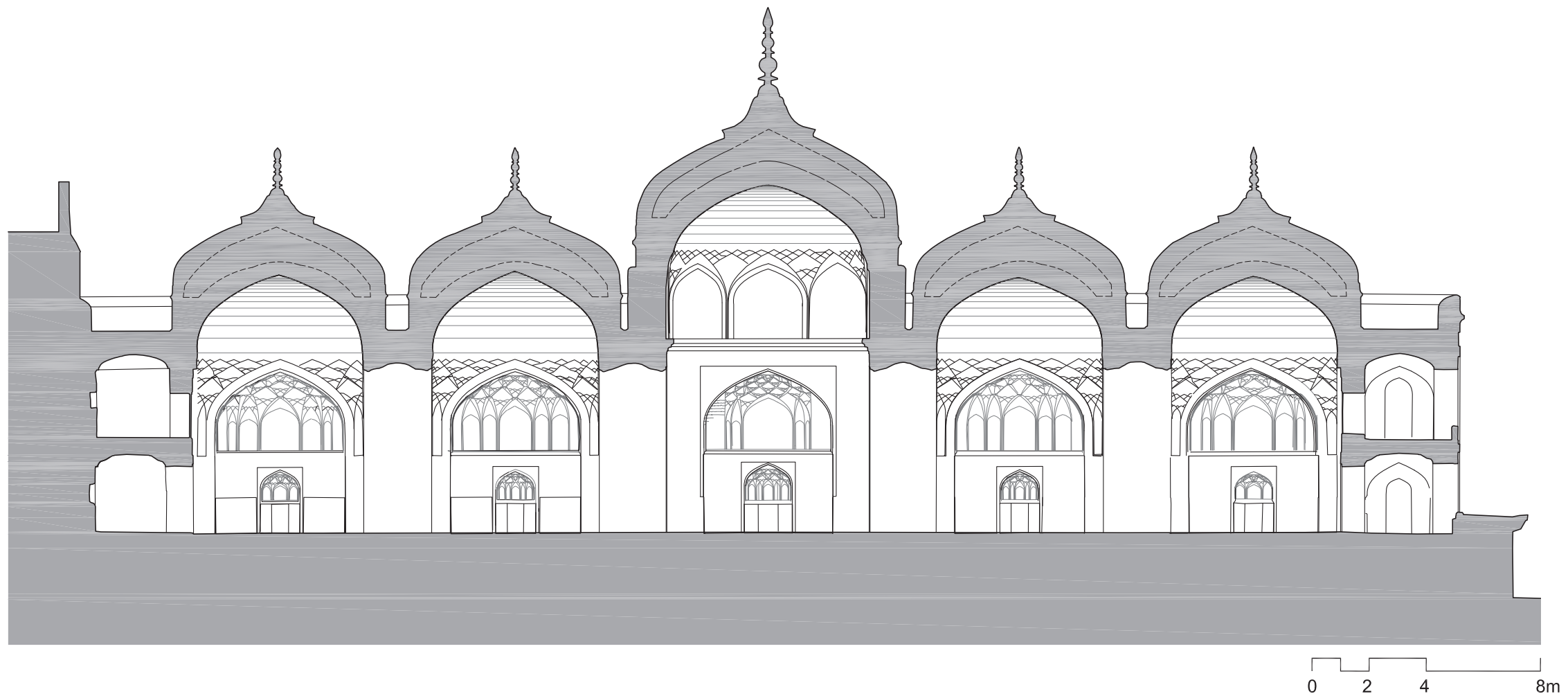
This is a sectional elevation looking west towards the prayer chamber and cutting through the western minars (southern and northern). The elevation shows the façade of the prayer chamber with the central iwan and two smaller archways on either side with their corresponding domes.

**CENTRAL IWAN OF THE PRAYER CHAMBER
- DETAIL WITH PHOTO-ORTHO RECTIFICATION**

*The façade of the main entrance iwan of the prayer chamber,
along with secondary entrances to the north and south.*

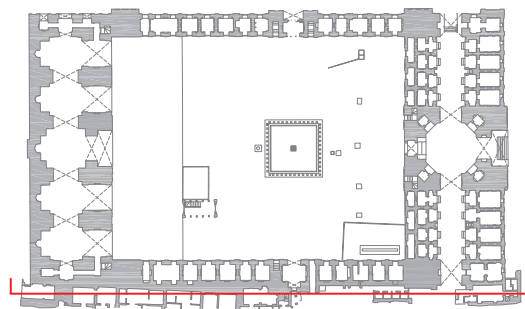


0 1 2 4m



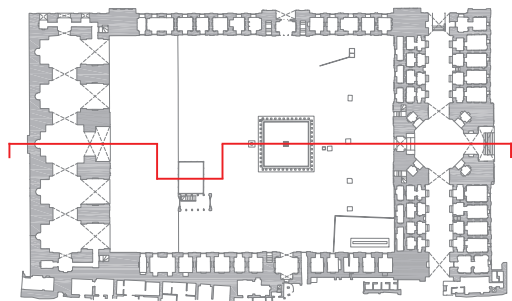
SECTION DD LOOKING WEST

This is a section through the prayer chamber. Shown on the north and south of the chamber are smaller rooms at two levels. The relative height of the mosque courtyard with respect to the Kotwali Bazaar street-level is shown. Residential properties abut the mosque on its south-western corner.



SECTION HH LOOKING NORTH

This sectional elevation cuts through the properties abutting the structure of the monument in the southern residential neighbourhood of the mosque, with the elevations of the prayer chamber dome, the south-western minar, and southern pavilion partially visible. Where no properties are abutting the mosque's southern wall, the base of the south-eastern minar and the south entrance to the Calligraphers' Bazaar are visible, together with the dome of the dewrhi.



SECTION AA LOOKING SOUTH

This sectional elevation cuts through the entrance iwan, courtyard and prayer chamber, also the central ablution pool and the sub-surface shrine of Ishaq Gazruni in the south-west of the courtyard with its pavilion above and the low wall enclosing the cenotaph on the floor of the courtyard.

On the western side of the mosque is a street separating it from the residential neighbourhood, and on the southern side residential properties rise above the level of the hujra roofs.

THE SOUTHERN PAVILION AND THE SOUTH-WEST *MINAR*
BASE - DETAIL WITH PHOTO-ORTHORECTIFICATION





Panel C



Panel A



Panel B



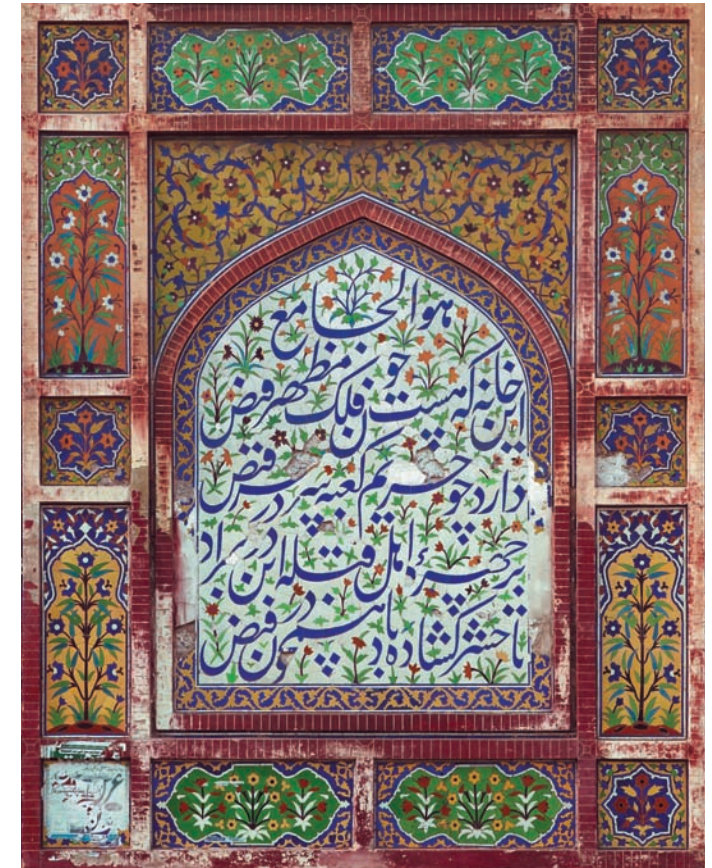
Panel E



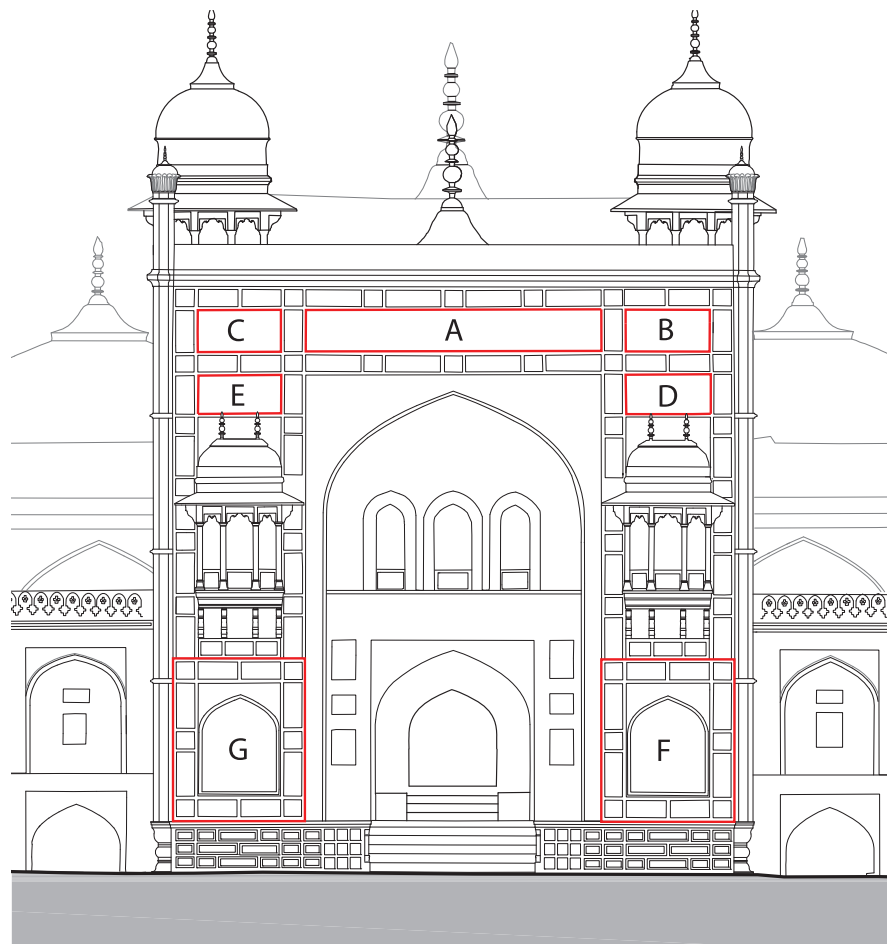
Panel D



Panel G



Panel F



0 2 4 8m

CALLIGRAPHY ON THE EAST FACING FAÇADE OF THE ENTRANCE IWAN

The calligraphy on the iwan facing the Chowk is heraldic in intent and nature. In the 17th century the 8 metre long central panel containing the Kalima-e-Tayyab accosted the person who entered the jilau khana with a powerful first announcement. This is supported by four smaller tablets, two on each side, placing the building in its historic context. The date is stated both in numerals and in a chronogram. The verse on the right side of the entrance is a panegyric verse in praise of this jami' masjid. The verse on the left exhorts the faithful to prayer and righteousness. This verse is signed by the calligrapher Muhammad Ali.

5.2 CALLIGRAPHY

The following description sequence and all references to the calligraphy, its content, its translations, and references to calligraphers are drawn from Abdullah Chaghatai.¹⁰ Where the text has been borrowed *verbatim*, it has been placed within quotation marks.

The display of verses on the walls of the Wazir Khan Mosque stretches from its main entrance to the rear-most wall of the prayer chamber. This decorative scheme of the Wazir Khan Mosque is displayed as an integrated whole over the entire fabric of the monument and is a fine specimen of Islamic calligraphy harmonizing with the general scheme of the decoration of the mosque.

The façade of the main eastern gateway's central part over the central arch bears the Kalima in *nastaliq* style along with the date A.H. 1045 (1635 AD) when the mosque was finally completed. On its right and left, the rectangular panels bear the name of Emperor Shah Jahan, during whose reign this mosque was built and the year of its foundation is embedded in chronogram in Persian text. There are other rectangles below on the right and left which bear Persian text explaining that the mosque was built by Wazir Khan. There are two Persian quatrains too on the right and left wings of the porch which have been very artistically calligraphed in bold *nastaliq* script by the calligraphist Muhammad Ali. These may be translated as follows:

On the right: *"The edifice, which like the sanctuary of heaven is a source of bounty. Has like the temple of Ka'ba for its object the benefit of mankind. To the congregation may its gate ever remain open with prosperity until the day of resurrection."*

On the left: *"In the corn-field of this world, O well conducted man, whatever is sown by man is reaped by him in the world to come. In your dealings, then, have a good foundation in the world. For all have to prove their way to heaven through this gateway at last."*

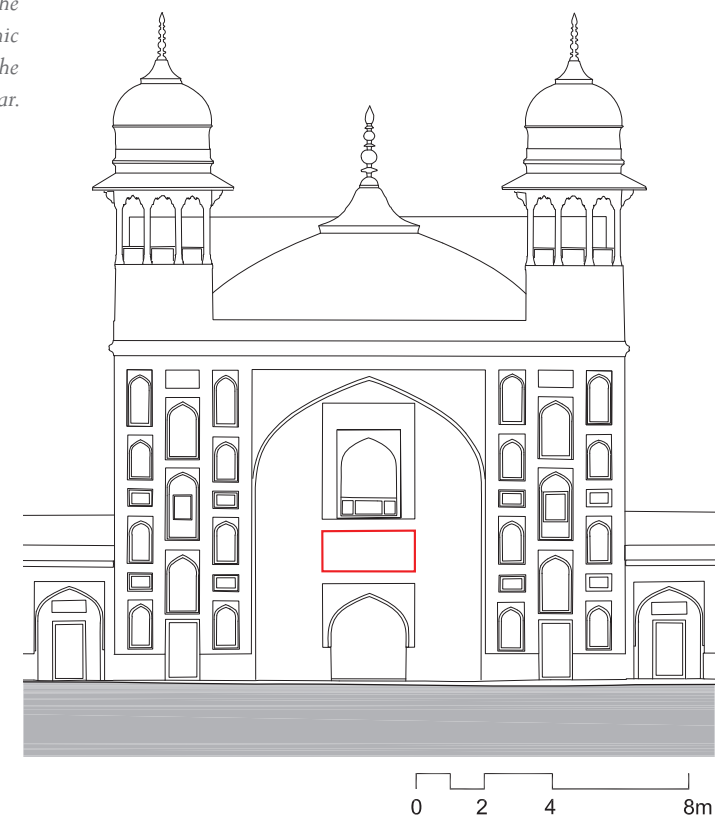
Through this main *iwan*'s vestibule, we enter the courtyard of the mosque. Just over the arch of the entrance towards the east, we find that the panel has been decorated in the best style of *kashikari* which bears a popular Persian couplet and it has been calligraphed in dark blue on a yellow ground. It says:

*"Muhammad of Arabia is the honour of both the worlds,
He who is not the dust of his threshold,
let dust be thrown over his head."*



CALLIGRAPHY ON THE WEST FACING FAÇADE OF THE ENTRANCE

The westward facing façade of the entrance to the courtyard has the following single calligraphic panel above the archway as you exit back into the Calligraphers' Bazaar.





0 1 2 4m

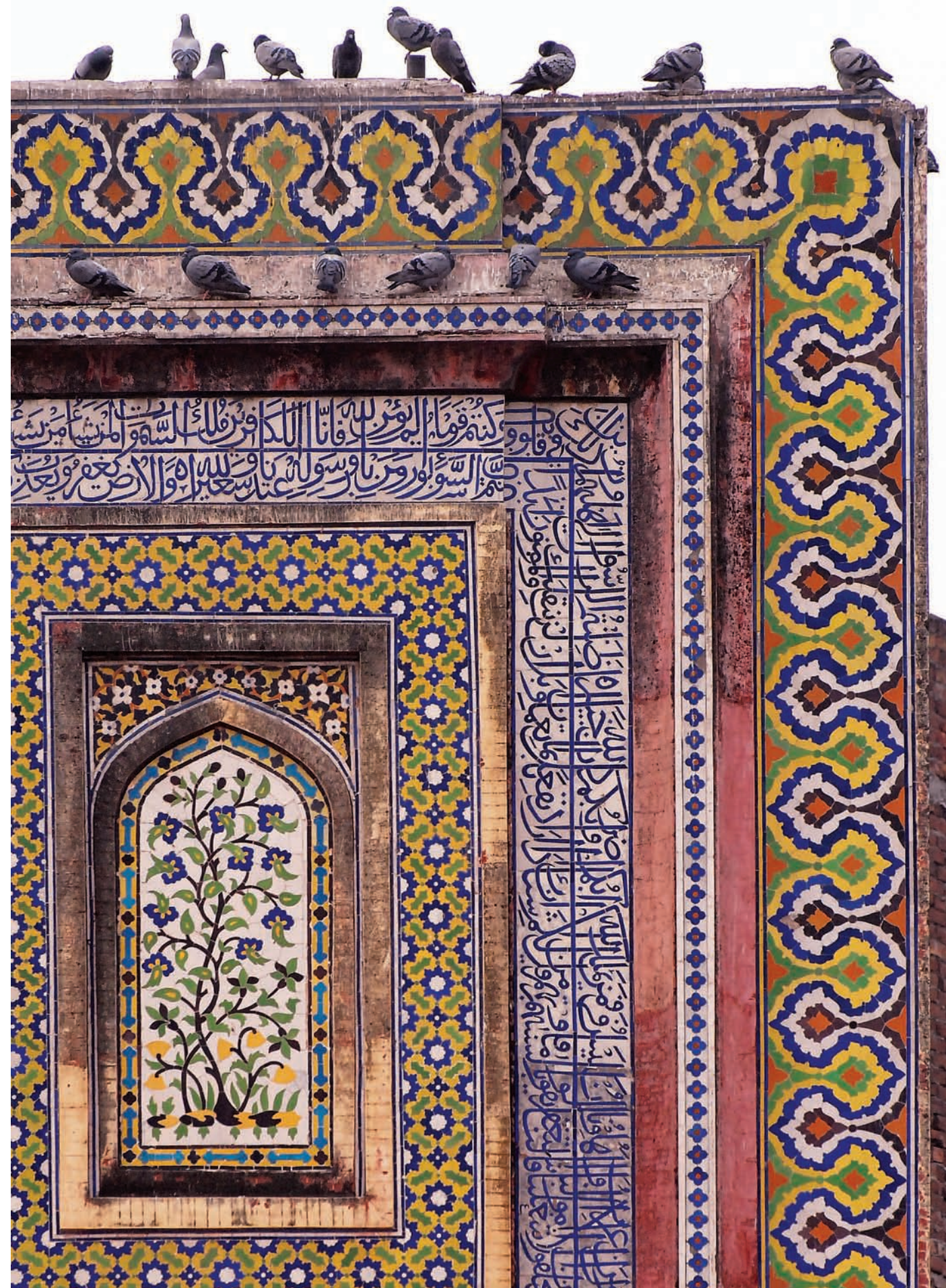
Except for narrow bands of faux brickwork in *tazakari*, the entire façade of the prayer chamber on the other (western) side of the courtyard is completely and profusely decorated with *kashikari*. This façade has five *iwans*, the central one of which is broader and higher than those on its right and left.

The decorative scheme of the central *iwan* comprises a series of concentric frames. The square containing the overall scheme of the central *iwan* confines an inner vertical rectangle which contains the main arch. The outer most border of this frame comprises a crenellated cornice in *kashikari* with an inner *dori* (ribbon), which turns along the roof line horizontally, extending to the end of the façade on the north and south. Inside this outer crenellated frame and separated yet again by a plaster panel, is a calligraphic scroll which runs on three sides of the *iwan*—a rendition in blue and white glazed calligraphy of the Surat al Fath¹¹ in exquisite *thuluth*.



Opposite: Part-elevation of the main façade of the prayer chamber, showing calligraphic panels on the central *iwan*.

Above and right: The outer most calligraphic band on the central *iwan* carrying the Surat al Fath.





Panel B



Panel C



Panel D



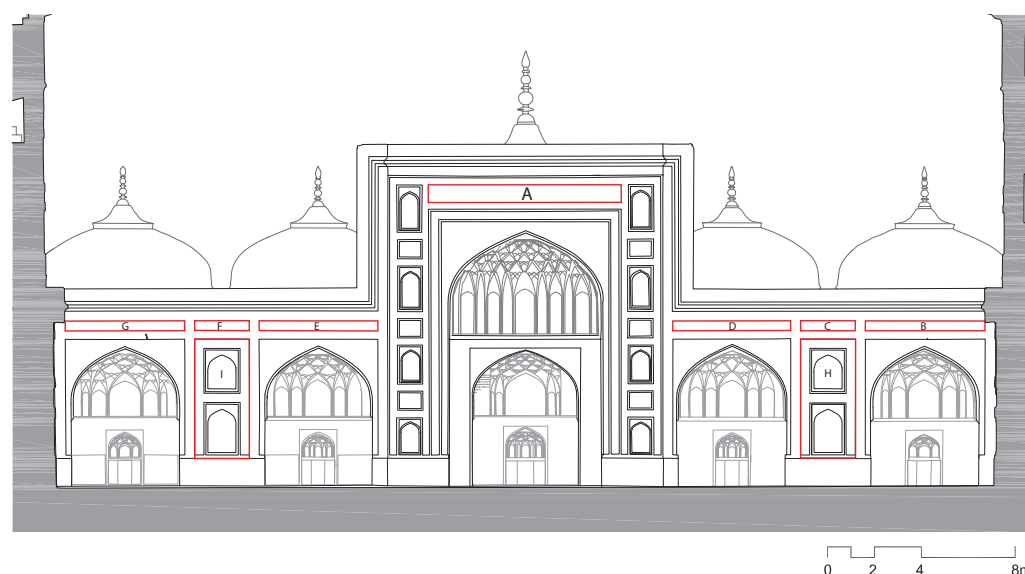
Panel E



Panel F



Panel G



CALLIGRAPHY PANELS ON THE EAST FACING FAÇADE OF THE PRAYER CHAMBER

The calligraphic panels illustrated on this and the following two pages are referred to their location on the façade as lateral rectangles in the key drawing on the left. The principle horizontal panel (A) contains the Ayat al Kursi shown on the opposite page at the top. This calligraphy is signed by Muhammad Sharif (see opposite for an enlargement of this signature).

The calligraphy on the panels over the arches on either side of the central iwan is signed at the end of the southern most panel by the calligrapher Haji Yousef Kashmiri and dated 1044 Hijri.



Panel A

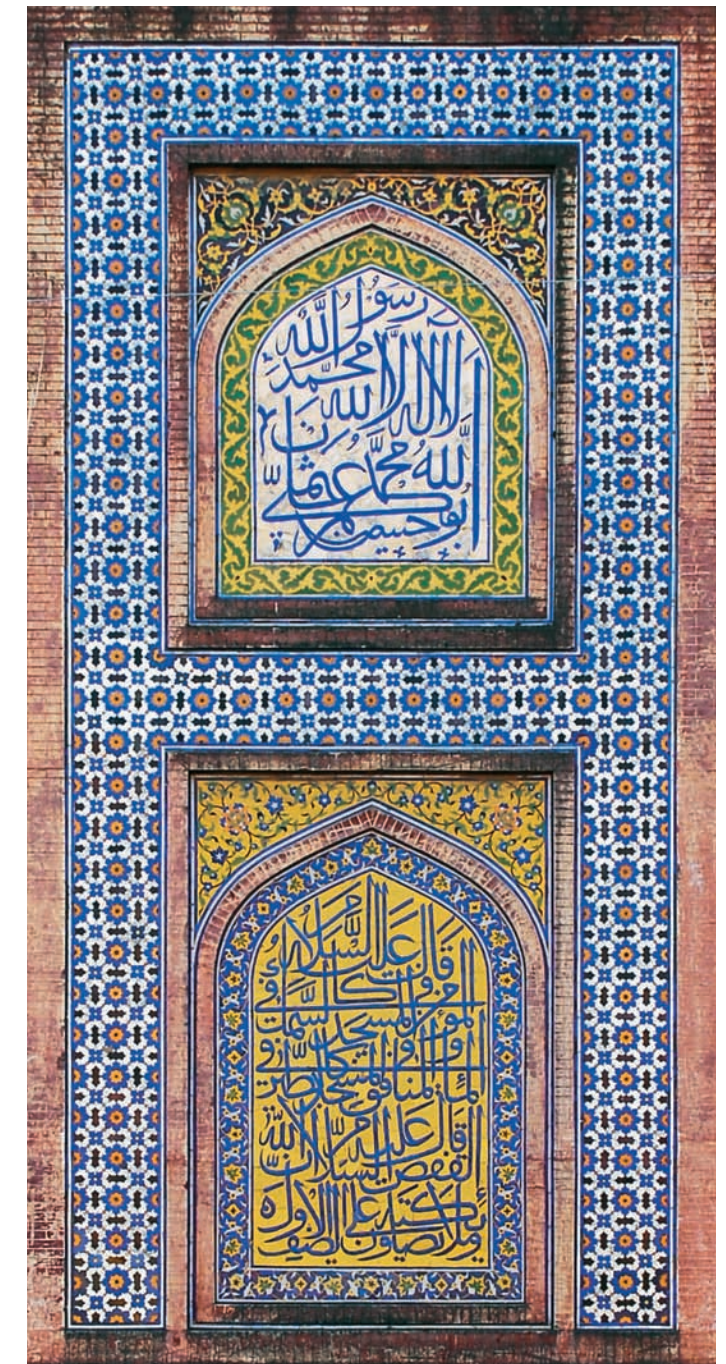
Below the horizontal band of this frame and running the full width of the arch and its outer frame, is a rectangular tablet containing the Ayat al Kursi (Surat al Baqr, 255), also in *thuluth*, forming the principle epigram on the face of the mosque. The signature of the calligraphist Muhammad Sharif appears at the end of this band.

On both sides, the vertical space between the calligraphic scroll containing the Surat al Fath and the rectangle containing the arch is divided into a series of smaller rectangles, aligned vertically and horizontally, that form the frames for *kashikari* work containing calligraphy in the lower two oblong rectangles, one on either side, and pictorial *kashikari* tree-of-life interpretations and other motifs from the decorative vocabulary of the period. The calligraphy in the lower two panels just mentioned is in the form of stylized *thuluth* compositions. The spandrels of the main arch contain *kashikari* in flowing tendrils interspersed by floral motifs.

The smaller arches on the north and south of the central *iwan* also carry *thuluth* calligraphy in rectangular horizontal bands of blue and white *kashikari* above the crown of the arch. These bands contain the following verses of the Quran: Surat al Baqr (verses 125, 127, 144), Surat al 'Imran (verses 96, 97), the Surat Tauba (verse 18) and Surat Tauba (verses 108, 109). Some verses in the southern half of the façade repeat those that appear in the northern half. The name of the calligraphist appears at the end of the last rectangle above the southern-most wall, Haji Yousuf Kashmiri, with the year 1044 AH. The intervening wall space between the smaller arches in the northern half of the façade contain two *kashikari* panels. The upper one of these contains, in stylized *thuluth*, the Kalima-Tauhid and the names of Allah, Muhammad (PBUH), Abu Bakr, 'Umar, 'Usman, 'Ali and Hassanain. The larger lower panel contains also in stylized *thuluth tughra* style, the popular tradition: "the believer in a mosque is like a fish in water; the hypocrite in a mosque is like a bird in the net." The corresponding panel on the southern side contains another popular tradition.



Panel I



Panel H



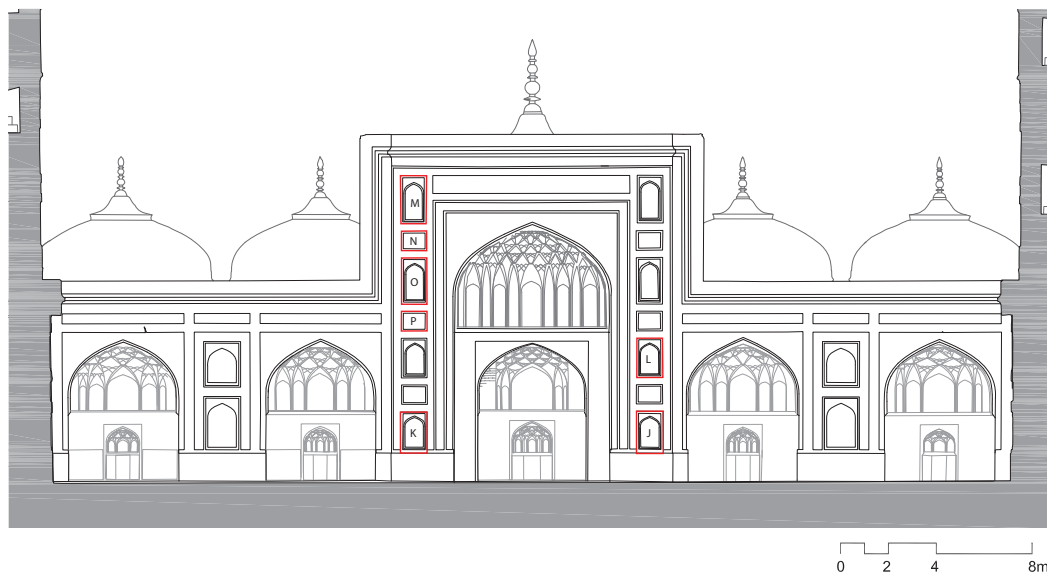
Panel K



Panel J

Inside the prayer chamber of the mosque, the walls have been completely plastered with a thick layer of lime which has been artistically embellished with frescoes, and enriched with various types of decorative motifs along with verses from the Quran, traditions of the Prophet (PBUH) and other sayings. Careful observation indicates that the upper square (of the transition to the dome) bears the sacred Quranic text of the Sura (64) al Taghabun in stucco style written in relief. It is calligraphed in a perfect *thuluth* style of calligraphy. At its end it also bears the name of the calligraphist Hussein. In the same stucco style in relief there are other panels which also contain holy texts and they have been written in the best *thuluth* style of writing.”

Those who have signed their names to the calligraphy work in the Wazir Khan Mosque are the calligraphers Muhammad Ali, Muhammad Sharif, Haji Muhammad Yousuf and Mulla Hussain.



CALLIGRAPHY ON THE EAST FACING FAÇADE OF THE PRAYER CHAMBER (CENTRAL IWAN)

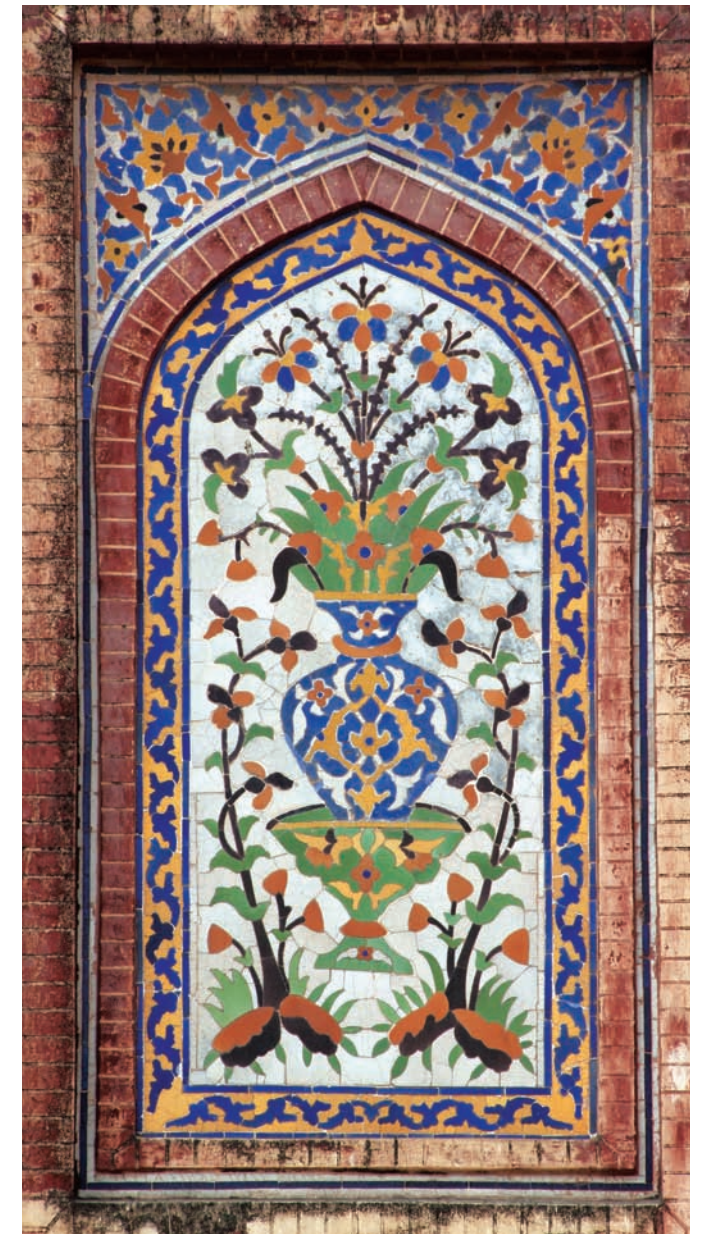
Within the outer frame containing the Surat al Fath (described on page 65) are the pair of calligraphic panels on this page, shown at locations K and J in the key drawing on the left.



Panel L



Panel M



Panel O

OTHER DECORATIVE KASHIKARI PANELS ON THE EAST FACING FAÇADE OF THE PRAYER CHAMBER

In combination with the calligraphy on the east facing façade of the prayer chamber, the main panels of kashikari work framing the iwan are of floral and arboreal designs. Horizontally, the two corresponding panels on either side of the iwan are identical in both colour and design, the variation occurring between each panel as you move up the façade vertically. The predominant colours are yellow, blue, orange and dark brown foliage on white backgrounds in the larger panels, or on yellow in the smaller panels.

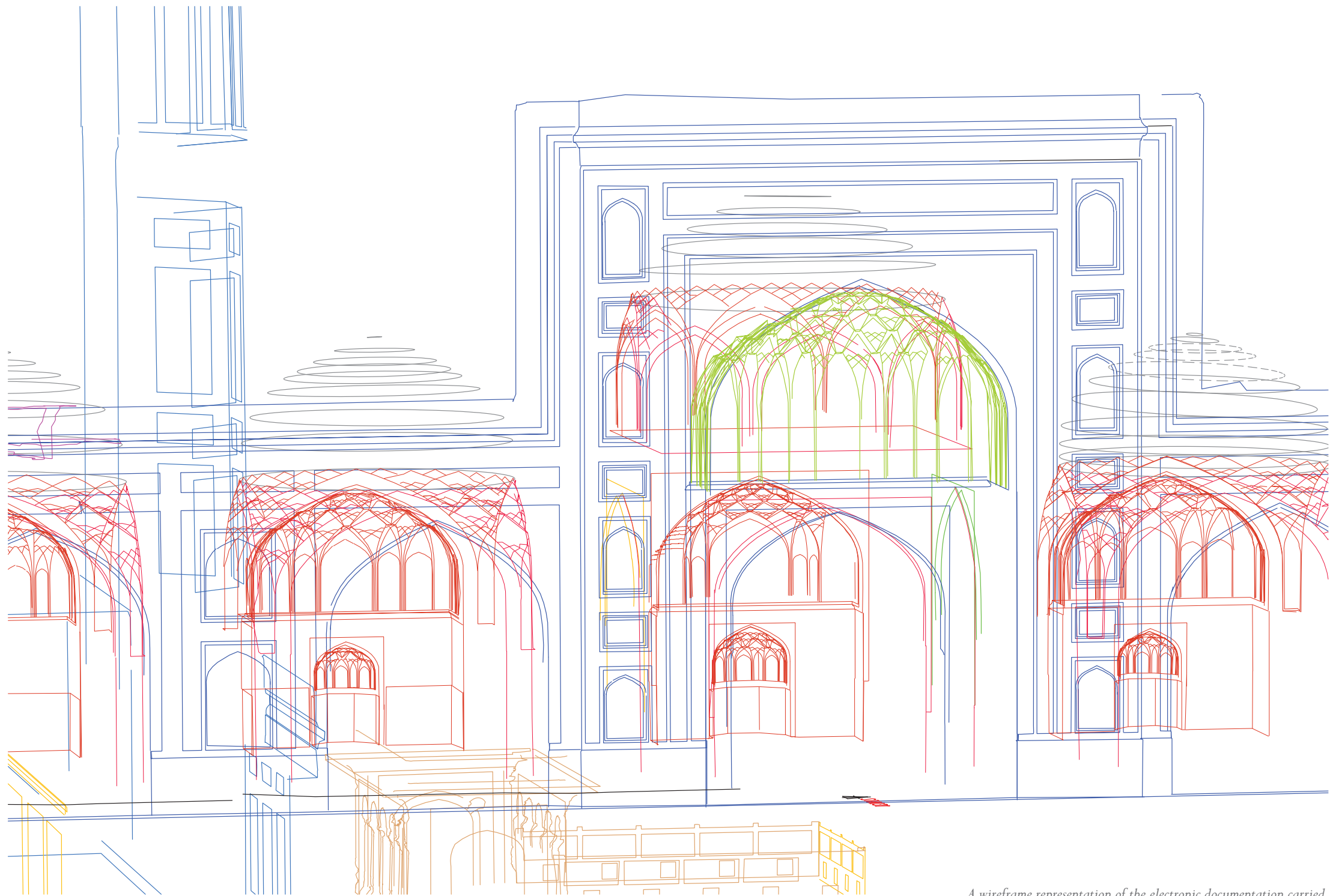


Panel N



Panel P





A wireframe representation of the electronic documentation carried out of the exterior and the interior of the prayer chamber.



6 NEIGHBOURHOOD CONTEXT

The assessment of the issues faced by the neighbourhood in which the mosque is located has been greatly helped by the availability of detailed surveys carried out as part of the planning initiatives for the LWC as a whole undertaken by the AKTC / Government of Punjab partnership. This survey was augmented by detailed documentation of several elements of the neighbourhood context: private residential buildings, small monuments, encroached areas in public spaces etc.

6.1 CHOWK WAZIR KHAN

The angular movement path across the Chowk from the Chitta Gate to the gateway (leading to Kotwali Bazaar) in the north-western corner of the Chowk is an inherent morphological characteristic of the square and poses important issues of its treatment in terms of both an open space and in terms of traffic. As a result of this configuration, this path tends to be occupied by vendors who have historically consolidated their occupation of this public space in repeated confrontations with authority.¹² The current result of this is the Chowk having been transformed into a bazaar, distorting the space of a quadrangle and dividing it into two parts.

On the perimeter of the square, a detailed survey (and the establishment of the ROW by Revenue Department officials in February, 2010) has revealed that most of the shops and houses fronting the square on its eastern and northern sides have encroached into the space of the Chowk, leaving some remaining fragments of the historical perimeter with its arched structures embedded deep inside the new structures. As a result of these transformations, the historical openness of the square has been seriously sacrificed to low value structures. Increasing presence of the heavy commercial activities of the last four decades have resulted in ill-maintained shops and structures which have ultimately distorted the form of the open space and the monumental environment.

The current urban conditions and the current use of the Chowk are unacceptable, and the project of the conservation and presentation of the mosque itself will be severely compromised if these conditions are allowed to continue. Views of the mosque, in particular of the detail of its decoration, are obscured by the illegal

occupation of public space. Fabrication of steel products in shops which are part of the monument and in shops owned by others in the square creates an unfriendly and noisy environment, besides being a major potential threat to the building fabric of the mosque.

6.1.1 Small Scale Monuments in the Square

These monuments comprise the Chitta Gate, Dina Nath's Well and the Kotwali Gate, which are protected monuments under the federal legislation.¹³ Once integral and prominent features of the urban ensemble of Chowk Wazir Khan, the present conditions prevailing in the Chowk have severely damaged the wholeness of these small monuments and have broken their physical relation with the Chowk and the mosque.

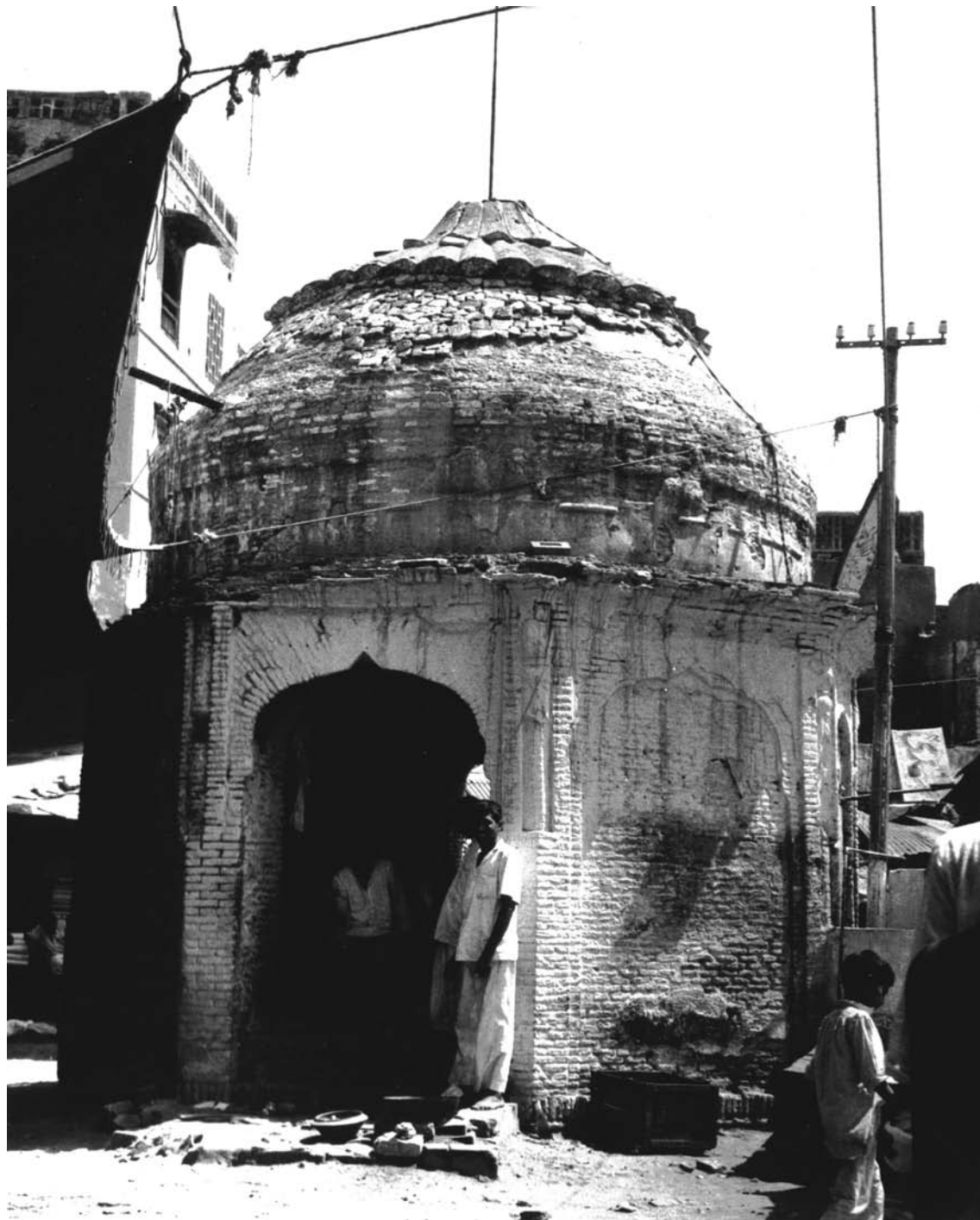
Chitta Gate, which provides the main entrance (including vehicular access) to the Chowk from Delhi Gate, is in a ruinous condition. Most of the old and original building fabric has been lost and damaged and the remaining structures are vulnerable to natural and man-made threats. The old façades have been heavily encroached upon by shopkeepers and private owners of neighbouring properties, and the gate has almost entirely lost its physical appearance due to these encroachments and its conditions of neglect and ruin. A total of 37 shops have been built into the fabric of this historic structure, which must be removed in order for the building to be properly restored. Similarly, the old well of Dina Nath on the north-eastern side of the Chowk is seriously damaged and encroached upon.

Right Top: Kotwali Gate has lost most of its visual impact due to the shops lining the angular movement path across the Wazir Khan Chowk and shops built within the gate structure on either side of the passageway.

Right: A metal worker outside a shop at the level of the Chowk on the eastern façade of the mosque.

Opposite: View from the entrance iwan looking east across the Chowk. Chitta Gate is completely obscured by the Syed Suf Shrine, and only a small proportion of Dina Nath's Well is visible - the rest is hidden behind the shops on the angular movement path - recognisable by the orange Ufone advertising.



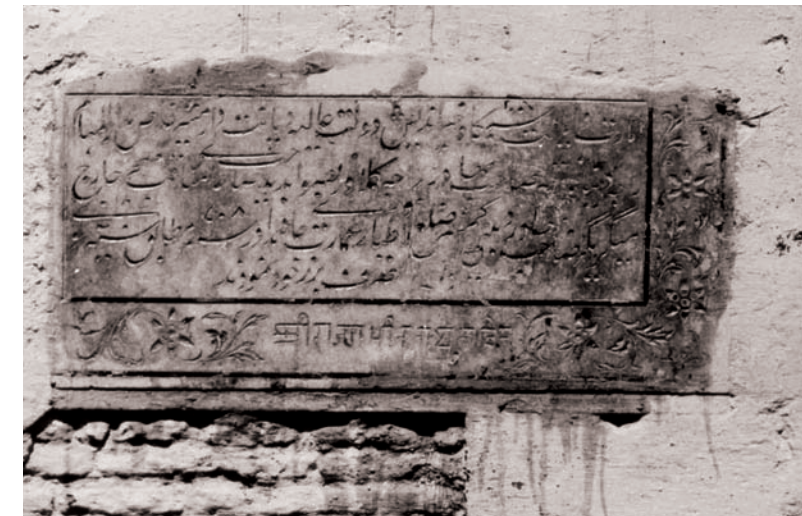


The spatial relationship of Chitta Gate with the main entrance *iwan* of the Wazir Khan Mosque was altered in 1852 when the original grave of Syed Suf was covered with a small domed structure which began to partly obstruct the mosque façade. This old shrine structure was demolished, rebuilt as a larger structure and expanded into a small mosque in 1990.¹⁴ There is evidence to suggest that no significant structure existed on the grave of Syed Suf prior to the construction of the domed shrine in the mid 19th century.¹⁵ According to Mohammed Latif, the domed structure that existed until 1990 was built by Sheikh Muhammad Sultan, contractor, upon the suggestion of a certain Major George MacGregor, the Deputy Commissioner of Lahore District, in 1852.¹⁶

MacGregor's name also appears on the marble plaque on the well¹⁷ of Dina Nath as having encouraged Raja Dina Nath, Raja of Kalanour, to build the dome covering the well almost identical in style and size to the dome that was to be built the following year just yards away on the grave of Syed Suf. This well of Dina Nath still exists although it is completely shrouded by a ring of shops that have been allowed to be built against the fabric of its structure.

While the well of Dina Nath has by now acquired a certain historical and heritage value, the new shrine of Syed Suf, which also includes a sizable mosque built on the space formerly occupied by a Persian well,¹⁸ is of indifferent architectural value. Its large dome and base structure, and the shops that have been built into it, almost completely obstruct the historic, axial vista of the mosque from the Chitta Gate, an important part of the 17th century urban design with which the mosque is associated. It is clear that as a result of the enlargement of the shrine, the cult of Syed Suf has grown strong and a large number of devotees pay regular visits. Consequently, substantial income appears to be generated by this establishment and shared by multiple beneficiaries. However, the presence of a new mosque yards away from the historic *jam'a masjid* of Wazir Khan raises questions of appropriateness. A number of small shops

now girdle the 1990's structure on its eastern and northern sides and have become a spatial extension of the illegal bazaar on the diagonal movement path from Chitta Gate to Kotwali Gate. This suggests that this shrine and the economic activity associated with it appear to be part of the same system of rent seeking. The present structure of the shrine of Syed Suf not only hides the main eastern façade of the Wazir Khan Mosque from Chitta Gate but its enlarged footprint has usurped a substantial area of the Chowk. In a crowded commercial and production zone, tiny public toilets built into the body of the shrine structure provide the only public utility. A more sensitive treatment of this entire situation is clearly needed



Top: Dina Nath's Well in the morning before shop opening time.

Above: The historic inscription on Dina Nath's Well in Persian and Hindi. This inscription no longer exists or is hidden behind the abutting shops. This photo was found in one of the mosque's hujras and dates from the 1970's.

Opposite left: Photo of Dina Nath's Well from the 1970s's. This photo was found in storage in one of the mosque's hujras.

Opposite right: The well in 2011, almost entirely hidden behind shops. Only the entrance on the northern side remains relatively clear.



Above: Study of Chitta Darwaza, by A.H.H. Murray, 1891, reproduced from Chaghatai, (1975) 'The Wazir Khan Mosque, Lahore: History and Architecture', Lahore.

Left: View through Chitta Gate in 2011, with the multitude of shops that line the gate and the angular path leading to Kotwali Gate in the north-western corner of the Chowk.



Right: The ruinous state of Chitta Gate. This photo demonstrates that when passing through the gate from east to west, the view of the Wazir Khan's iwan, which constitutes one of the main elements of the introductory space of the jilau khana, is blocked by the enlargement of the Syed Suf Shrine.

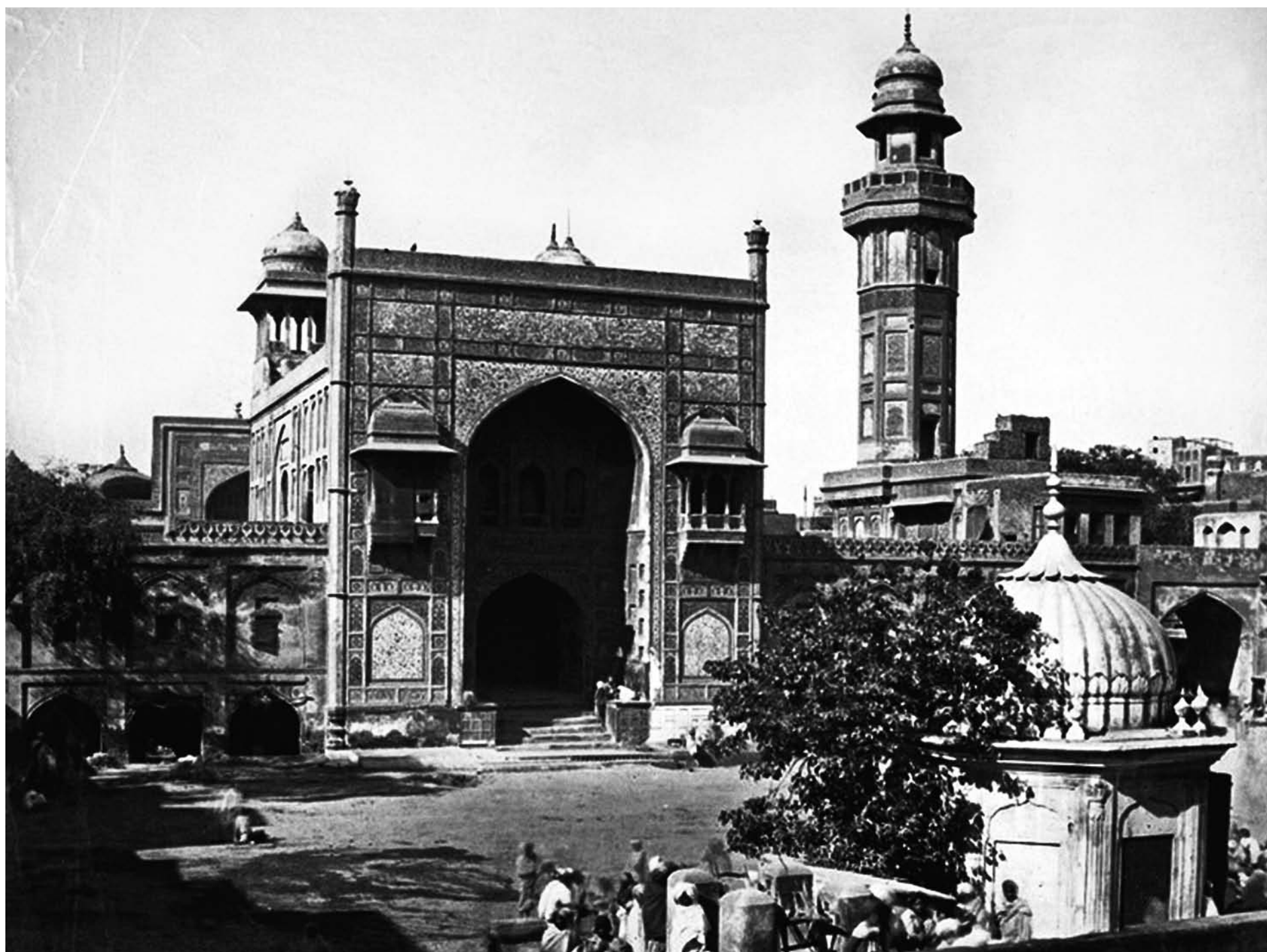
Above: The condition of the underside of the gate's dome. Some fresco work is visible.

Overleaf left side: View of the Chowk clearly showing encroachments and the enlargement of the Syed Suf Shrine. Kotwali Gate is partially hidden by awnings.

Overleaf right side: 1880's photograph of the Chowk showing the original dome of the shrine dating from the 1850's. It is almost identical in style and proportion to the structure of Dina Nath's Well, and its size means that little of the mosque's iwan would have been blocked from view as one entered the Chowk through Chitta Gate. Kotwali Gate on the extreme right in the photograph is a prominent feature of the Chowk. (Source: British Library Online Gallery).









6.1.2 Poor Quality of Surrounding Buildings

Most of the buildings fronting the square are of poor quality. Some historic structures in the Chowk of considerable architectural merit are losing their charm and appearance under tremendous commercial pressure, and as a result of indifferent repairs carried out by their owners. The diagonal bazaar connecting Chitta Gate to Kotwali Bazaar has distorted the appearance of the square and divided the old square into two parts.

6.1.3 Parking in the Square

In addition to encroachments in the square, most of the time the rest of the remaining open space is occupied by cars, rickshaws and motor bikes which have transformed the Chowk into a parking lot.

6.2 BUILDINGS OF HISTORICAL AND ARCHITECTURAL MERIT WHICH ARE NOT LISTED

Most of the old buildings fronting the Chowk have now been transformed into contemporary buildings (constructed in cement concrete) with the old building fragments still embedded deep inside the ground floors of shops. Two buildings, which are not listed or protected under any act, are important to mention here and will play an essential role in the rehabilitation of the Chowk.

Located on the east of Gali Kharadian on the southern side of the Chowk, building H-1088, which appears to have been built in the mid- or late 19th century, displays traditional and old carved wooden elements. The old wooden balcony on its first floor¹⁹ has been dismantled and replaced recently with cheap concrete work. The three storey building (H-687) on the south-west corner of the Chowk shows the influence of colonial architectural elements. Although the plane of the façades of these two buildings conflicts with the likely historical limits of the Chowk, they possess enough architectural merit to suggest that they are to be retained and appropriately dealt with.

6.3 BUILDINGS ABUTTING THE MOSQUE COMPLEX ON THE NORTHERN SIDE

The illegal construction of shops adhering to the historic fabric of the mosque on its northern side has contributed considerably to damage and deterioration. According to a document from the Auqaf Department, the original 12 shops on the northern side which were built to generate funds for the maintenance of the mosque, have now increased to 32 shops all of which are built illegally against the façade. This has:

- i. Resulted in the obstruction of the northern *iwan*;
- ii. Damaged the historic character of the northern façade of the mosque;
- iii. Resulted in structural damage and a significant loss of the façades' surface decorations caused by incompatible structural elements such as reinforced cement concrete slabs and extraneous brickwork inserted into the fabric probably by means of making chases in the original masonry work;
- iv. As a consequence, laid the historic fabric open to rain water penetration;
- v. Prevented access to the façade for maintenance and upkeep;
- vi. Generally resulted in the degradation and debasement of the monument.

The historic drain that ran along the base of the mosque on its northern side has been closed for about two decades. Owing to the presence of the new shops built against the façade, it has not been possible to determine whether the drain was merely filled up or whether its blockage was achieved through a design process. It is also not known whether any storm water or waste water connections to this drain were completely truncated.²⁰ The blockage of the drain in question was linked to the 1990 sewer laid along the centre of the street width, into which the rain water thenceforth was supposed to drain. It may be reasoned that a certain amount of water continues to find its way into that old drain system and seeps down into the ground alongside the structure. Serious repercussions of these drainage problems ensued later in the form of seepage and settlement of the courtyard floors as waste and storm water from the courtyard was not able to find its way out. This has also led to an increase in dampness in the shops and upper structure.



Above: Looking east down Kotwali Bazaar, on the mosque's northern side.

Opposite: Concrete slabs inserted into the mosque's fabric constitute the roofs of the extended shops on the north side.



6.4 BUILDINGS ABUTTING THE MOSQUE COMPLEX ON THE SOUTHERN SIDE

The area on the southern side of the mosque complex deserves special attention, as it is the site of the greatest and longest institutional indifference. This area is said to be the zone where the wells and open areas of land which were once part of the endowment existed. According to the *waqf* deed as reproduced in Latif,²¹ several open and identifiable pieces of land were attached to the endowment. There is a strong likelihood that a significant part of this open land lay to the south of the mosque. Kanhaiyya Lal²² implies in his description of the mosque written in the 1880's that in his time, the area to the south of the mosque complex comprised one large open precinct or *ahatta* associated with the well which was the source of water for the mosque. One of the wells is documented in the 19th century drawings contained in Abdullah Chaghatai's book²³ as well as in the 1907 cadastral map shown on page 10 of this report; its location has now been occupied by a house built in the early 20th century.

In being mostly residential in terms of land use, the conditions along the exterior of the mosque on the southern side are different from those on the northern side. But these conditions also pose serious hazards for the mosque. While the construction of residential buildings in the (originally *waqf*) open land on this side should not have happened, the houses built on this side appear to have been formerly separated from the mosque by a well established pathway running in an east-to-west direction, as is evidenced from careful documentation of the houses built under institutional management.²⁴ Today, the private houses and their allied facilities are very close to, if not actually abutting and structurally supported by, the historic fabric of the mosque, posing a serious structural threat to the monument. The conditions on the southern side are also characterised by poor water related interventions described in the next section. An example is the ill constructed and badly maintained concrete water tank just next to the eastern half of the row of *hujras* on the southern side which continuously leaks water into the foundations of the monument.

Currently, six private houses abut the mosque's southern wall. The wet areas (bathrooms and kitchens) of these private houses are located right next to the old wall of the mosque and have created serious threats to the historic wall and the adjoining *hujras*. These

private interventions with ill maintained drainage systems have also badly affected the double storey pavilion in the centre of the southern row of *hujras*.

An examination of the urban morphology and oral history of the area to the south reveals that some of these buildings are even now in the ownership of the Auqaf Department, who are the institutional inheritors of the *waqf*. Almost all the houses abutting the southern perimeter of the mosque (west of the mausoleum of Imam Gammo) are known to be either still owned by the Auqaf Department or were once owned by the Auqaf Department. These houses bear property numbers H-629/3; H-629/1; H-629/2; H-628/2, H-628/1, and stretch all the way to the western edge of the mosque property projecting on to the street west of the complex. The number sequence of these houses suggests that they were once part of a larger plot of land.

An interesting feature of the plan form of these houses is the existence of small courtyards of a similar size and arranged in a linear series on the immediate south of the mosque perimeter. This morphology is evidence of the former existence of a street that has now been covered over and incorporated into the houses. This needs to be further investigated. The street could have existed at the time the houses were first built providing the needed separation from the southern wall of the mosque, but was later incorporated into the body of the houses, except for the small courtyards.

In addition to the houses described above there are other buildings which are said to be owned by the Auqaf Department, and which have occupied areas which were part of the open area associated with the *waqf* prior to 1907.

These buildings include:

- a. The mausoleum of Imam Ghulam Muhammad bin Muhammad Siddique (d. 1244 AH; 1829 AD), popularly remembered as Imam Gammo (property SE-05-X1);²⁵



Opposite: A house abutting the south-western corner of the Calligraphers' Bazaar. It is impossible to ascertain where the original boundary of the mosque was.

Above: The same house on the south-western corner as seen from its western side. A heavy steel girder has been inserted directly into the fabric of the pavilion at Level 2 of the Calligraphers' Bazaar.

Additionally, the occupants of the house are disposing of their household waste on the roof of the mosque. By the pattern of marks on the wall, it would seem that they throw their waste out of the open window, with little regard for sanitation, and without considering what happens to the rubbish in the long term.



- b. The house immediately to the north of the mausoleum abutting the southern wall of the mosque which bears the same property number as that of the mausoleum; the overhead water reservoir in this house is partly supported by the historic exterior wall of the mosque.
- c. House number H-655, which is the house occupying the former footprint of one of the wells;²⁶ this house did not exist in 1907.²⁷
- d. House number H-654, which presently contains a series of toilets on the ground floor used by the Auqaf staff also did not exist in 1907.
- e. House number H-650; this property comprises two portions, one of which was next to the south entrance of the Calligraphers' Bazaar and has now been demolished. The other portion was, in 1907, at a small distance from the southern wall of the mosque; public latrines built into this structure now abut the wall.
- f. House number SE-05-X2 which abuts the south-eastern corner of the mosque complex and is visible from the Chowk Wazir Khan. This house actually uses the walls of the mosque complex for foundation support.

From the above one can pose the likelihood that the pieces of land that were once part of the *waqf* endowment, have been allowed to be alienated and are currently occupied by the houses mentioned above. These houses and the other Auqaf owned properties that abut the mosque buildings with or without Auqaf authorization raise the following issues:

- As a result of the properties abutting the mosque perimeter, there is a lack of access to the outer perimeter of the mosque building from the southern side, preventing any maintenance or conservation activity;
- The absence of any proper disposal of rain water from the roof of the mosque structures on the southern side;
- Consequent water penetration into (i) the fabric of the mosque; (ii) the fabric of these houses themselves; and (iii) the foundation structures of the mosque;

- The structural conditions of the mosque, the conditions of the building fabric of the mosque and the conditions of its use and the urban setting of the mosque are all regrettably affected. The manner in which *waqf* properties have been allowed to be used as private or semi-private premises appears to be a major issue to be dealt with in the conservation of the mosque. The present condition of occupation and use of *waqf* properties affect the functioning of the city in the immediate environs of the mosque, thereby affecting its setting, presentability, maintenance and upkeep.

6.5 PUBLIC UTILITIES SERVING THE MOSQUE COMPLEX

Public utilities have been constructed on the southern side of the mosque, presumably to save the interior of the complex from the wear and tear of public use. The washrooms and latrines, used by the public as well as by officials of the Auqaf department, are poorly planned, of low quality and badly maintained. Large amounts of water leaking from these facilities is causing structural damage to the mosque and water ingress into the foundations of the monument has caused serious harm to it. These facilities exist in two locations - the first on the northern side of House H-650 where a small open passage services 4 latrine stalls. Of these only one is functional while the remaining three are abandoned and/or locked up, evidently due to prolonged blockages. Large PVC water reservoirs are perched unceremoniously on the roof of the concrete latrine structure. There is constant and profuse leaking of water from these tanks, all in all creating a wet environment. The second facility, mainly used by the officials of the Auqaf Department, has been built into the body of houses H-654 and H-655. There are a total of four latrines in here as well. There is leakage of water from a concrete overhead reservoir here, with considerable seepage of water into the fabric of both these houses. In this location the faucets and other plumbing fixtures also leak constantly. Both these facilities generally suffer from poor maintenance and repair.



Above: View of the southern residential neighbourhood from the roof of the Calligraphers' Bazaar. Housing quality is poor, and solid waste management is minimal. The 3-storeyed building to the right of the photograph is built on the footprint of the original Persian well which supplied water to the mosque through the southern pavilion.

Opposite: View of the entire south side of the mosque. Water tanks are visible on the eastern side of the pavilion, while the houses on the western side of the pavilion are abutting the southern wall and to some extent are encroaching upon the roof of the hujras.



7 INFRASTRUCTURE CONDITIONS AROUND AND WITHIN THE MOSQUE COMPLEX

At the neighbourhood level the condition of the infrastructure has been a perennial cause of damage to the fabric of the mosque complex. Construction of houses on the open spaces on the south side of the mosque complex (as discussed above) has put additional pressure on the ill maintained infrastructure of water and sanitation. The raising of the original street-levels due to the accumulation of historical detritus or due to deliberate interventions has made it impossible for smooth drainage of storm water from the streets and from the courtyard of the mosque through the original points of water egress. Periodic settlements of the floor of the courtyard at several locations are indicative of the huge problem of water ingress into the foundations and sub-strata of the mosque.

7.1 ELECTRICITY

In all likelihood electricity was introduced to the mosque complex along with the electrification of the Walled City as a whole. Until the late sixties domestic service in many residences in Lahore still used direct current (DC) supply. Photographic evidence from the repair work carried out in the 1970's suggests that modern alternating current was introduced earlier than that decade. The manner of introduction of electricity was not always sympathetic to the fabric of the mosque or to the surface decorations, and appears to be characterized by *ad hoc* workmanship and arbitrary detailing.

Presently electricity to the Wazir Khan Mosque is delivered from the 132 KV Mochi Gate grid station through the Delhi Gate 11 KV feeder. A 200 KVA transformer at Chowk Kotwali and one of 100 KVA rating in Chowk Wazir Khan step down the supply and power is delivered to two energy meters installed on the north façade of

the north-western *minar* of the mosque, near Chowk Kotwali. The conditions of the connected loads vary seasonally. In the winter the loads are in the range of 6 kilowatts, but in the summer they rise to a total of about 13 kw. The connected load spikes up by a factor of 5 on ceremonial and festive occasions such as Eid-e-Milad un Nabi.

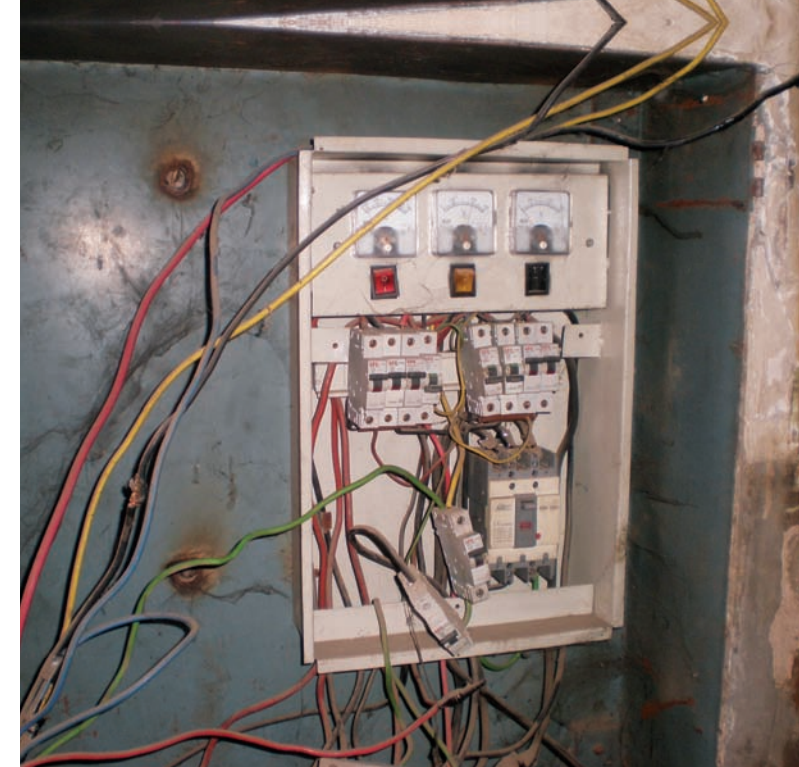
The electricity distribution system in the mosque is inadequate, to say the least. It has been installed by chasing grooves for the conduiting, and hacking away spaces in the historic walls in a quite arbitrary fashion for the installation of distribution boards, socket boxes etc. In all cases cement mortars have been used to fill in the grooves and gaps after such installation. One of the two distribution boards, each installed in the *hujra* adjacent to the north-west and south-west *minar*, is inactive. Both distribution boards are without covers, and have inadequate numbers and capacity of circuit breakers. The distribution circuitry is inadequate and has been introduced from time to time on an *ad hoc* basis. The scores of socket outlets are unprotected against water ingress and are a grave threat to the safety of the *namazis* and small children.

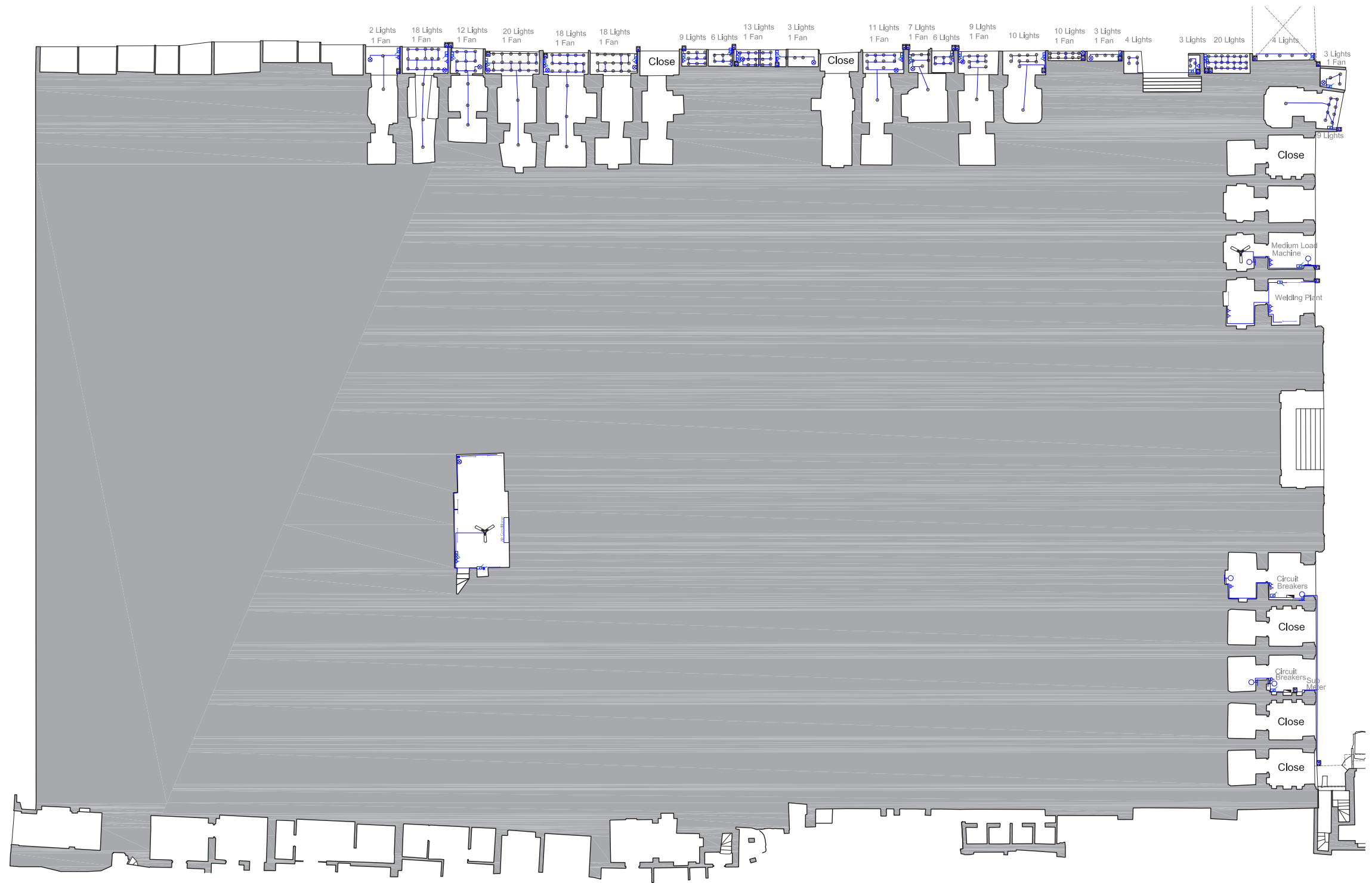
This is not a satisfactory state of affairs and the electrification system for the mosque has to be redesigned *ab-initio* in order to bring it into a state in which it can co-exist harmoniously with the historic monument as well as satisfy international engineering standards and safety codes.

Right, top: Electricity distribution board located in the western-most hujra on the northern row.

Right: A poor attempt at camouflaging sockets in the prayer chamber at the southern end. The plastic has been painted over with a continuation of the fresco design during recent restoration/repainting work, yet black cabling is left loose and unconcealed in front.

Opposite: Spot light fixed on the roof of the southern row of hujras, with little concern for safety or concealment of wires.





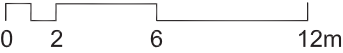
LEGEND					
S.no.	Symbols	Description	S.no.	Symbols	Description
1.		Energy Meter	9.		Electric Point
2.		Distribution Board	10.		Switch Board
3.		Chandelier (Damaged)	11.		4 Small Speakers
4.		Hanging Energy Saver	12.		Loud Speaker
5.		Spot Light (Not Functional)	13.		Bracket Fan
6.		Spot Light	14.		Exhaust Fan
7.		Small Spot Lights (temporary)	15.		Wall Mounted Light bulb
8.		Power Sockets (2 Pin Local)	16.		Loud Speaker

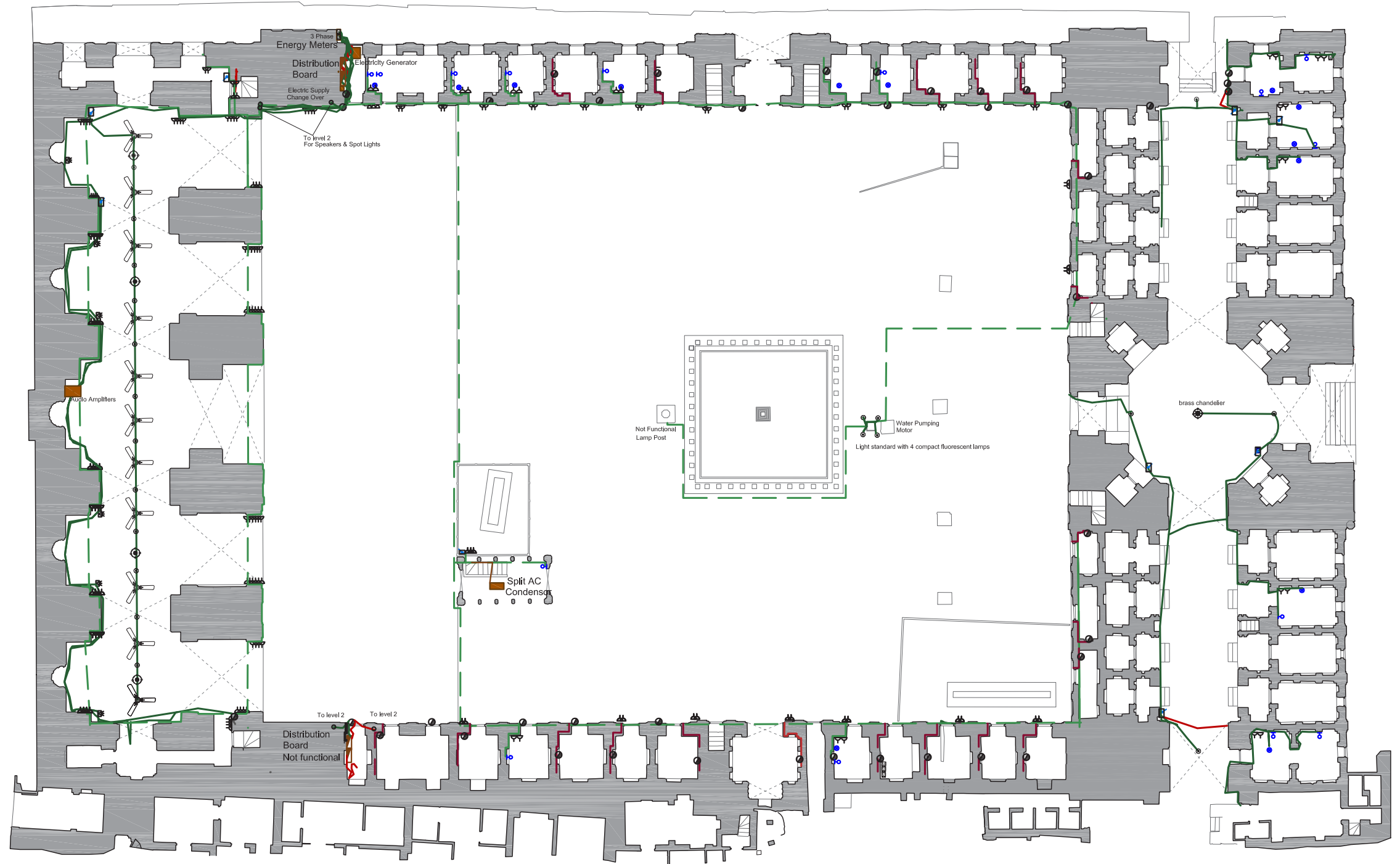
- Power Cable Open (Functional)
- Power Cable Open (Not functional)
- Power Cable in Conduit (Functional)
- Power Cable in Conduit (Not functional)

Note:

- There are dangerous open connections of live wires
- Insulation of electrical wires are damaged at a number of places
- High risk for short circuiting & fire
- No water proofing of electrical installations located in the open
- Most of the sockets are damaged

EXISTING ELECTRIFICATION (LEVEL 0)





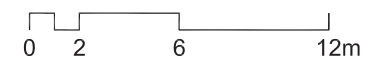
LEGEND					
S.no.	Symbols	Description	S.no.	Symbols	Description
1.		Energy Meter	9.		Electric Point
2.		Distribution Board	10.		Switch Board
3.		Chandelier (Damaged)	11.		4 Small Speakers
4.		Hanging Energy Saver	12.		Loud Speaker
5.		Spot Light (Not Functional)	13.		Bracket Fan
6.		Spot Light	14.		Exhaust Fan
7.		Small Spot Lights (temporary)	15.		Wall Mounted Light bulb
8.		Power Sockets (2 Pin Local)	16.		Loud Speaker

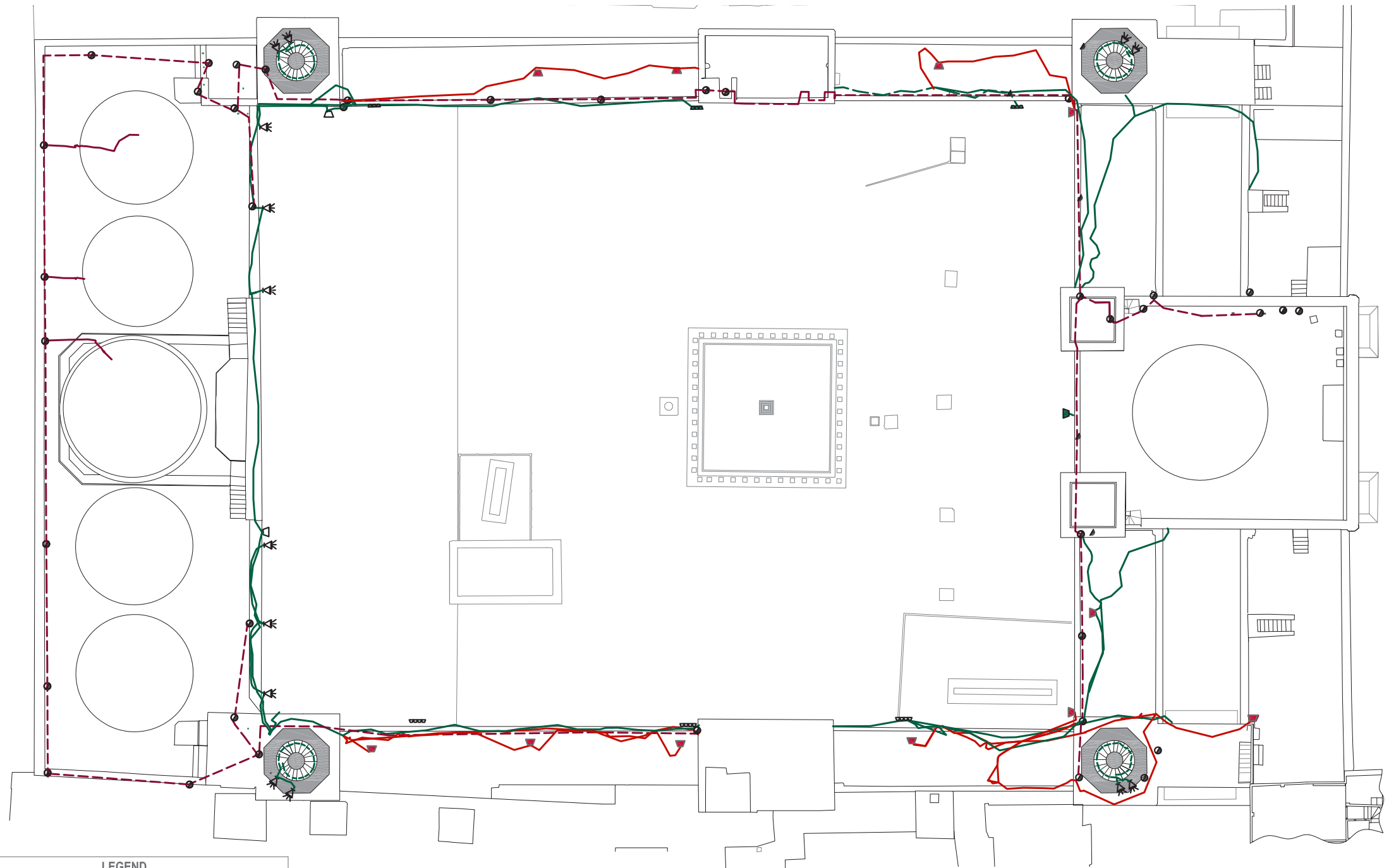
- Power Cable Open (Functional)
- Power Cable Open (Not functional)
- Power Cable in Conduit (Functional)
- Power Cable in Conduit (Not functional)

Note:

1. There are dangerous open connections of live wires
2. Insulation of electrical wires are damaged at a number of places
3. High risk for short circuiting & fire
4. No water proofing of electrical installations located in the open
5. Most of the sockets are damaged

EXISTING ELECTRIFICATION (LEVEL 1)





LEGEND

S.no.	Symbols	Description	S.no.	Symbols	Description
1.		Energy Meter	9.		Electric Point
2.		Distribution Board	10.		Switch Board
3.		Chandelier (Damaged)	11.		4 Small Speakers
4.		Hanging Energy Saver	12.		Loud Speaker
5.		Spot Light (Not Functional)	13.		Bracket Fan
6.		Spot Light	14.		Exhaust Fan
7.		Small Spot Lights (temporary)	15.		Wall Mounted Light bulb
8.		Power Sockets (2 Pin Local)	16.		Loud Speaker

- Power Cable Open (Functional)
- Power Cable Open (Not functional)
- Power Cable in Conduit (Functional)
- Power Cable in Conduit (Not functional)

Note:

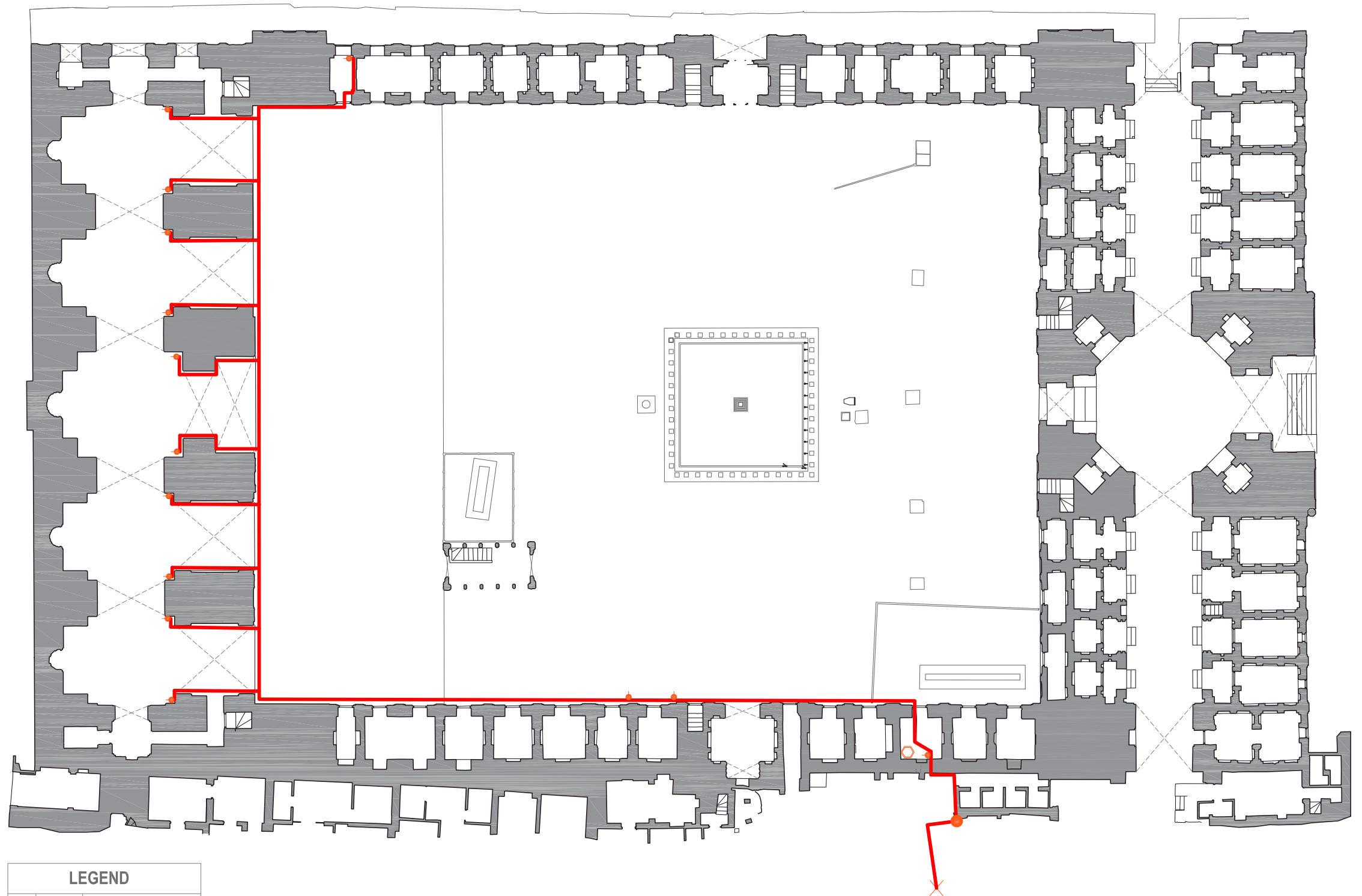
- There are dangerous open connections of live wires
- Insulation of electrical wires are damaged at a number of places
- High risk for short circuiting & fire
- No water proofing of electrical installations located in the open
- Most of the sockets are damaged

EXISTING ELECTRIFICATION (LEVEL 3)

0 2 6 12m



The hujra in the south-eastern corner of the mosque containing the water pump, water cooler and geyser.



LEGEND		
S.no.	Symbols	Description
1.		Point
2.		Gas Pipe 19mm Ø
3.		Water Heater
4.		Main Inlet
5.		Gas Meter

GAS SERVICES (LEVEL 1)

0 2 6 12m

7.2 GAS

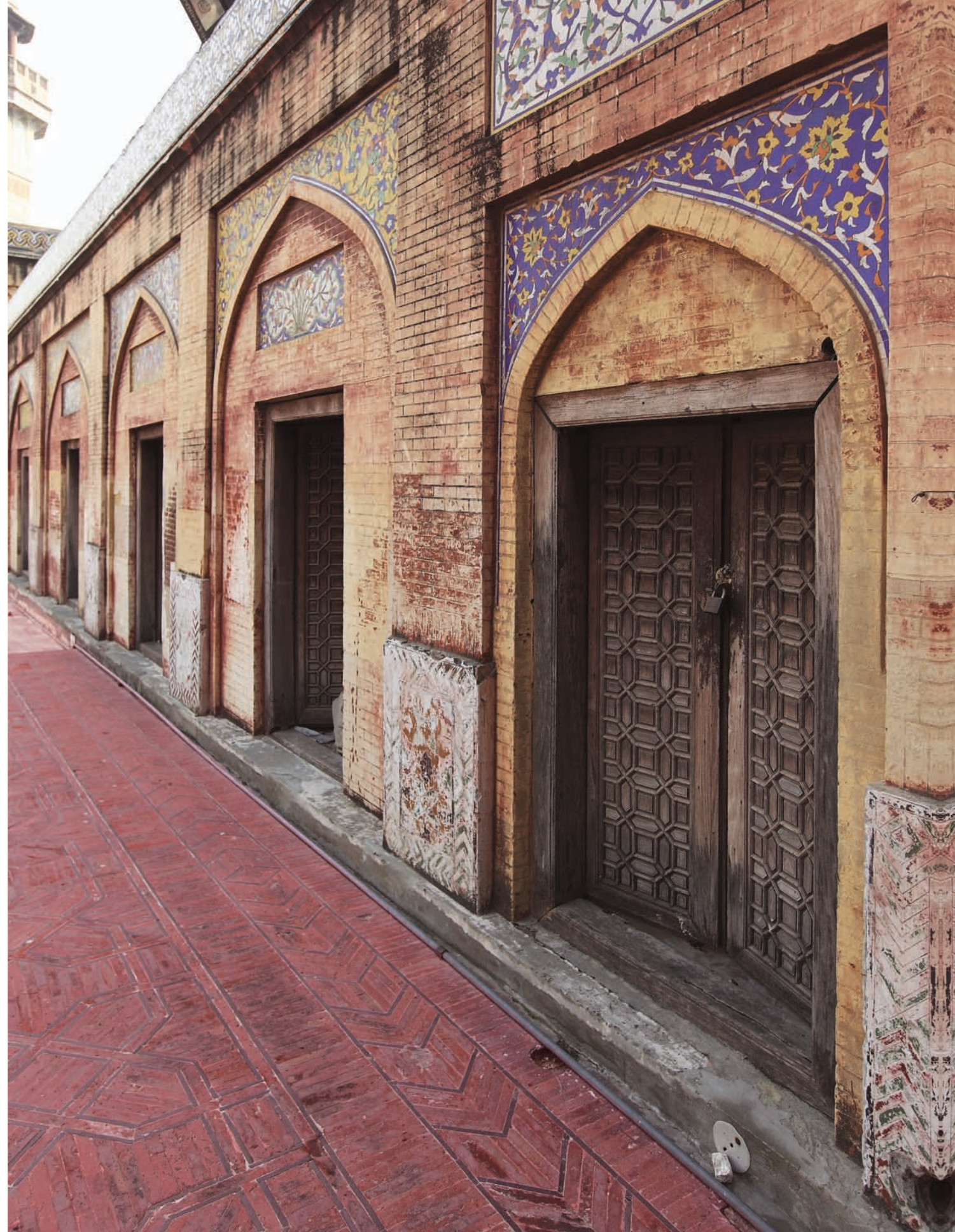
The mosque is supplied with natural gas, mainly for purposes of heating the prayer chamber during the winter months. The gas supply taps into the gas mains on the southern side of the mosque. The 19mm diameter gas supply pipe enters the courtyard at the southern wall of the third *hujra* from the east on the southern row of *hujras*, and then runs horizontally westwards, attached to the base of the buildings (the southern *hujras* and the axial pavilion) which constitute the southern side of the courtyard. The pipe enters the prayer chamber at its southern most limit.

A total of fourteen gas points have been recorded within the limits of the mosque. Of these, twelve gas points are used for gas heaters. These are functional in winters. For each of the five bays of the prayer chambers, there are two gas points serving direct fire radiant heaters. The remaining two are intended for heaters in the western most *hujra* on the northern row of *hujras* and the third *hujra* from the east on the southern row of *hujras*.

Of the remaining two gas points, one is intended for the water heater, which is located in the third *hujra* from the south-east side of courtyard, while the other gas point is used for a power generator capable of being operated by natural gas as well as on petrol which is located inside the first *hujra* from the north-west side of courtyard. The natural gas system as described above is connected to a gas meter mounted on the wall of the latrines located on the south side of the mosque complex.

The natural gas bills are paid by the Mosque Management Committee from its own funds and from donations from the local community.

*Gas pipe running along the southern row of
hujras, supplying the prayer chamber.*





7.3 WATER

Water supply into the ablution pond in the courtyard was supplied originally from an ox driven Persian well on the south side of the mosque. Fragments of a raised platform abutting the exterior wall of the central pavilion in the southern *hujra* series are still visible. Water was led from the well to this raised platform which forms part of a delivery channel system ending in the cascade inside the central pavilion and into the ablution pond via a channel in the floor of the courtyard.

Electric motors (documented in the 1970's) appear to have replaced the animal driven Persian wheels during British times.²⁸ At some time this use of the well was discontinued, and a residential building using the structure of the well for foundations was built. Water supply is currently connected to the pressurized water supply grid of the Walled City. There are no tube wells installed specifically for the mosque.

Water supply to the public toilets and ablution areas located in the south of the mosque is ill-designed and appears not to be effectively managed and supervised. The need for overhead reservoirs (present in the case of both sets of latrines) is indicative of the poor pressure obtaining in the municipal water supply system, which could be alleviated as part of the new water supply programme for the city. Leaking water tanks and leaking faucets, valves and joints are endemic.

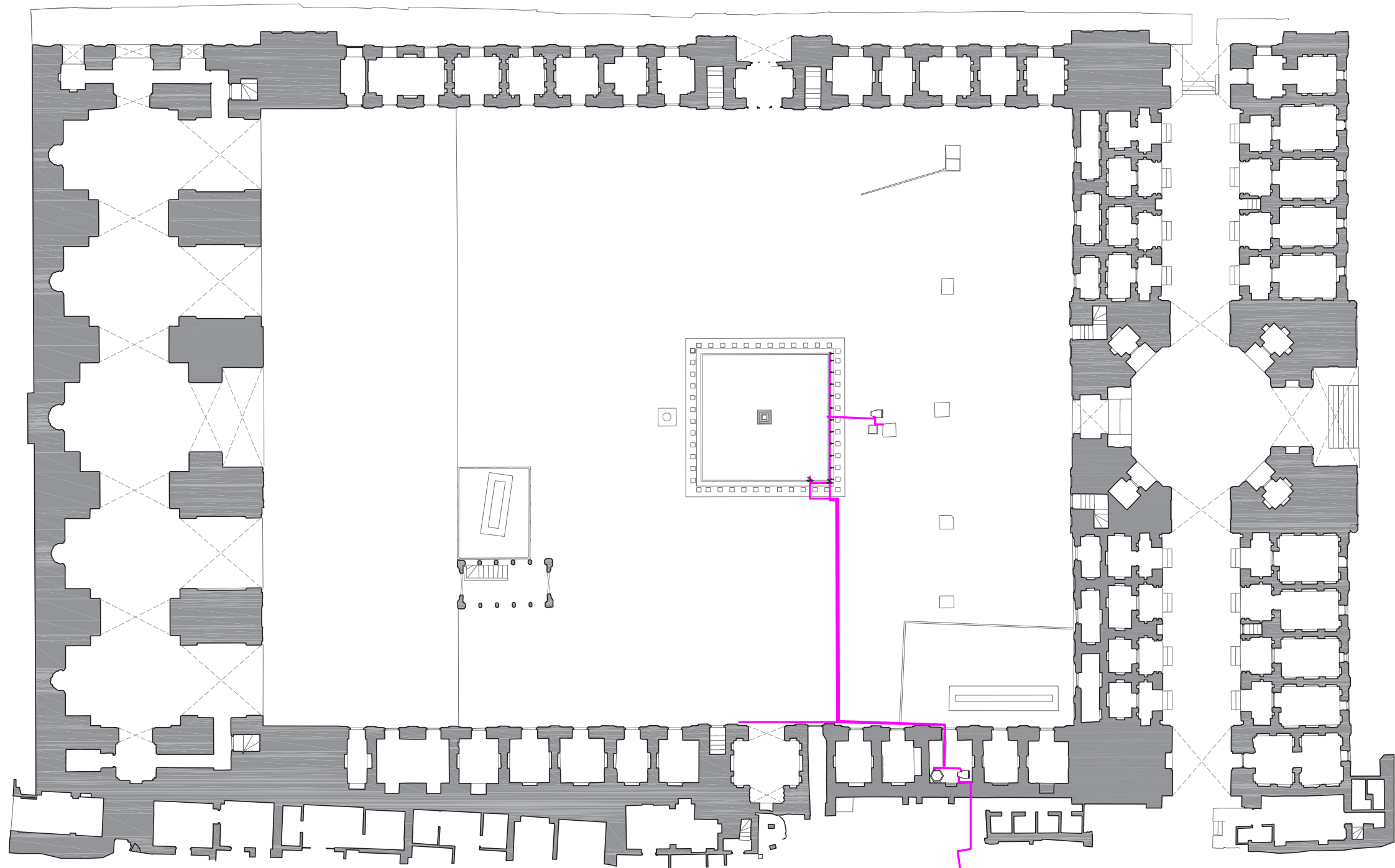
There is an urgent need for the design and realization of a modern and efficient toilet and ablution facility for the mosque. The design of this facility, its location, means of access and control, and its surveillance, supervision and maintenance should be thought of integrally with the overall strategic planning and design for the conservation of the mosque.

The ablution tank in the centre of the main courtyard was rebuilt to a modified design not conforming to the original. This should be restored to its original design for which there is ample photographic evidence. However, the water supply and drainage system of this ablution pond needs to be thought of integrally with the larger infrastructure design, and as part of the conservation and restoration of the courtyard as a whole.



Above: Water supply pump positioned on the east side of the ablution pool - one of the first things visitors are confronted with on entering the courtyard from the entrance.

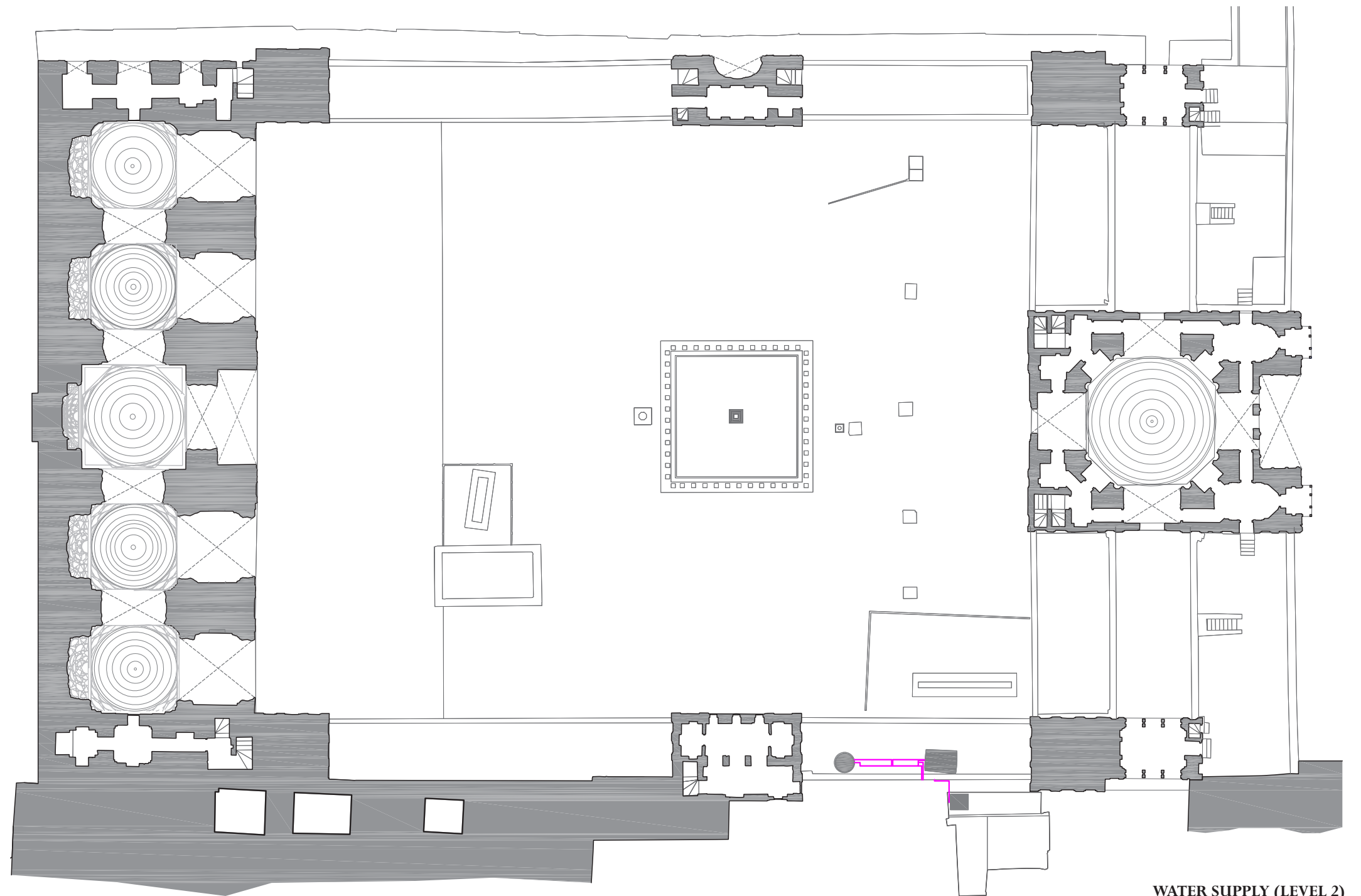
Opposite: Subsidence and inspection chamber lids in the south-east corner of the courtyard.



LEGEND		
S.no.	Symbol	Description
1.		Tap
2.		Valve
3.		Pipe Line
4.		Water Pump
5.		Water Heater

WATER SUPPLY (LEVEL 1)

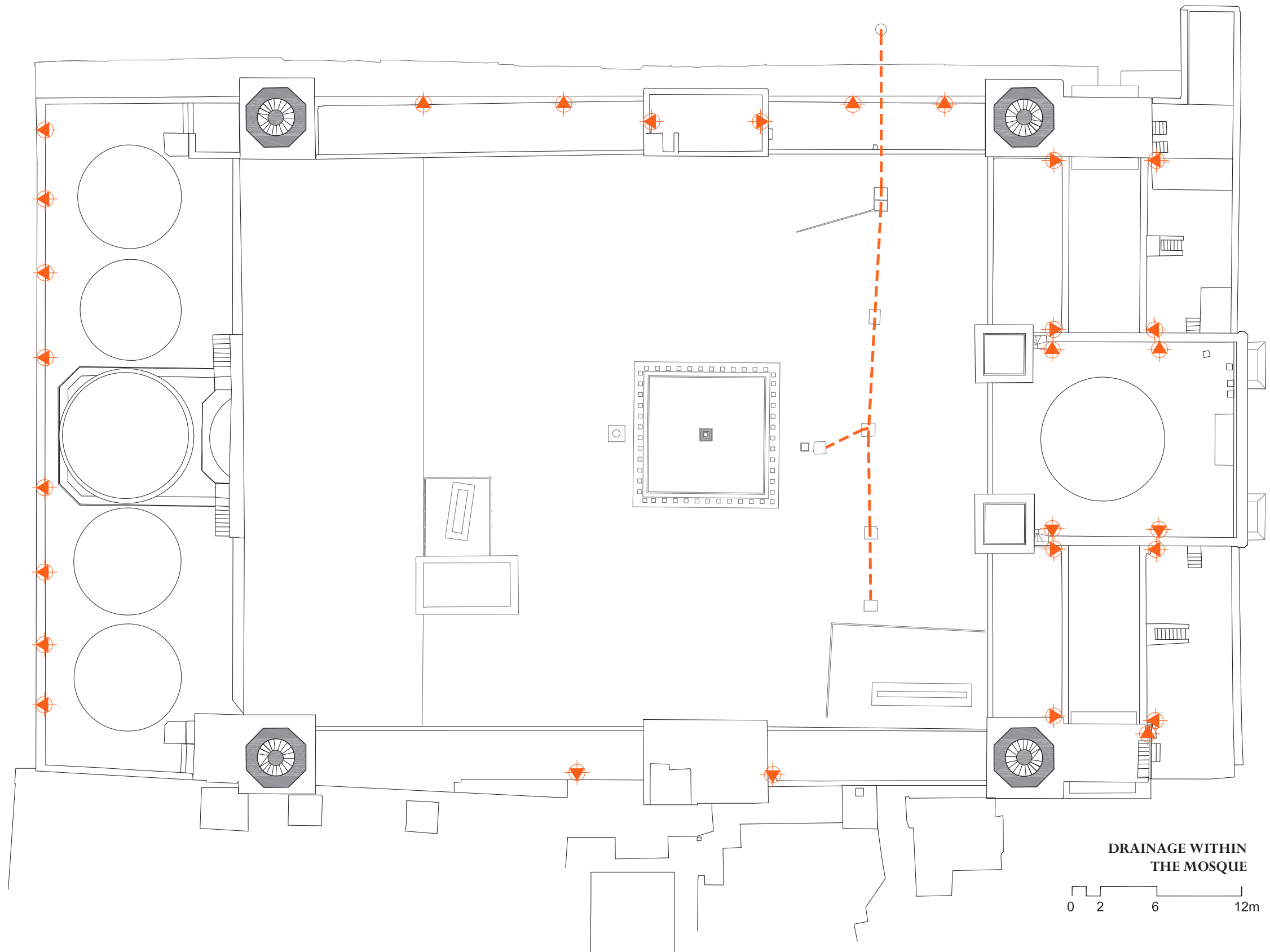
0 2 6 12m



WATER SUPPLY (LEVEL 2)



LEGEND		
S.no	Symbols	Description
1.		Water Pipe Line
2.		Water Reservoir in P.V.C
3.		Reservoir in concrete



7.4 DRAINAGE

- a. The open drain running along the northern perimeter of the mosque was closed down in the late 1980's, and the rain water now collects in the street and finds its way into the new sewer that was laid in the main bazaar. The decommissioning and filling up of the open drain has been occasioned by, as well as led to the consolidation and construction of *pucca* extensions of the shops, whereas previously these had been temporary constructions, their *tharas* projecting out on to the street.
- b. The open drain on the western side of the bazaar lane to the west of the mosque now flows into the main sewer running along Kotwali Bazaar and into Chowk Wazir Khan. Water in this open drain is slow moving with a tendency to dam up with floating solid waste. It is uncertain²⁹ whether there is any sub-surface percolation of the water under the street and whether such percolation could be affecting the foundation bearing strata of the soil on the western side of the monument. Most roofs drain out to rooftop rainwater receptacles which are led out into flat drains built in plaster render on the external face of walls. These in turn drain into the ground abutting the building façade. It is not known whether a system of collecting rainwater from these flat drains existed at the plane of the ground surrounding the mosque. Archaeological investigations of the original ground might reveal such a system if it ever existed.
- c. There are crucial locations where rainwater collecting on the roofs is not properly expelled from the roofs. At one location it appears to simply disappear into the fabric of a house abutting the mosque structure on the southern flank, and seems to find its way into the substructure below the house. The possibility of this water seriously affecting the foundation structure of both the house and the mosque cannot be ruled out.
- d. Storm water collecting on the galleries of the *minars* does not have any proper way of discharge, and flows along the tile surface of the octagonal façades of the *minars*.
- e. Courtyard: the rainwater which falls into the courtyard is drained away by a series of gratings built along a sub-floor drain that exists at the beginning of the eastern fifth of the courtyard space. This drain flows northwards and finds its way into a discharge chute that exists in a shop/*hujra* corresponding to the third *hujra* from the east on the northern (south facing) façade of the courtyard. There is evidence that a drain existed in the lower part of this *hujra*, at the level of the bazaar that linked the flow of the collected rainwater to the main drain that flowed along the northern flank of the mosque. This drain is now connected to the main sewer built in the 1970's that flows eastward down the centre of the Kotwali Bazaar.
- f. It is reported³⁰ that originally, the north-south drain in the eastern part of the courtyard was divided into two drains each flowing either northwards or southwards, thus dividing the rainwater collected into two halves. However, the southern drain was disconnected when the level of street system on the south³¹ was raised due to the construction of residential properties on that side.
- g. According to the information board displayed at the entrance to the mosque,³² the drainage of the courtyard of the Chowk was historically made possible by *gharqis* (soak-wells).
- h. Drainage and waste water disposal from the ablution pond in the main courtyard is connected to the storm water disposal system of the courtyard described in the paragraphs above.
- i. Drainage and waste water disposal of the public toilets located in the south of the mosque are linked to the disposal system of the residential neighbourhood in that location.



Top: Drainage grate at the level of the courtyard.

Above: Cover is lifted to expose drain and water supply pipes.



8 PROBLEMS AND ISSUES PERTAINING TO THE MOSQUE COMPLEX

8.1 HISTORY OF DAMAGES AND REPAIRS

Most of the Mughal monuments in Lahore were brutally vandalized under the Sikh and British rules.³³ The most precious elements from these monuments were deliberately removed and reused in private and public buildings. A majority of monuments were converted into very *ad hoc* functions like storage, ammunition depots, stables and residences. Badshahi Mosque and Maryam Zamani Mosque are examples of this, with the former used as an ammunition depot. Fortunately, and apparently due to a particular event during the rule of Ranjit Singh,³⁴ the Wazir Khan Mosque survived the vandalism of those years.³⁵

Due to the lack of documentation and unavailability of many people associated with past restoration efforts, it has been difficult to establish a complete and thorough chronology of building damages and repairs. The available information on the damage history here is based primarily on oral accounts and the research carried out on published literature. According to M. Abdullah Chaghatai, the 1905 earthquake significantly damaged the mosque's structure. Although the extent of damage is not clear, he states that the cupola structures of the *minars* were rebuilt by replacing the collapsed brick masonry columns with red sandstone columns.³⁶ In the absence of any available documentation of the damage caused by that earthquake, one might associate the first cracks and tilting with this specific earthquake.

In 1971 a conservation cell was established under the provincial Auqaf Department³⁷ in order to carry out the restoration of five monuments³⁸ in the Punjab, financed by the Cess Fund³⁹ for the restoration of major monuments in the province. The Wazir Khan Mosque was one of the monuments included for repair and restoration activities by this conservation cell led by Muhammad Wali Ullah Khan. This cycle of conservation work ended in 1978 due to a shortage of funds. The work carried out included the conservation of the main façade overlooking the Chowk, selective conservation of surfaces and tile revetments in the courtyard, and the "restoration" of surface renders and decorations in the prayer chamber. The surface decorations on the *minars* and the north façade were not included. During this restoration phase the as-found

condition of the building, especially the surface decorations, were documented photographically. Some of these photographs were found in a deteriorated state during the current documentation process in one of the *hujras* on the northern side of the mosque which used to be the site office during the 1978 restoration.

In 1979 additional funding from the Auqaf Department enabled the conservation cell to carry out some more restoration work on the remaining sections of the mosque, but no further work was done on the *minars*. However, in 1984-85 the restoration of the surface finishes of the north-east *minar* was carried out. Observation of this *minar* indicates that fragments of old *kashikari* were incorporated with the new materials during the restoration in an elegant manner. Not so visible when seen from the ground, on close inspection it appears that a consistent method was used to differentiate and interpret the values of the old fragments in relation to new work. Except for the intensive conservation of the surface area of the *minar* that was dedicated to *kashikari*, it is not known on what basis of evidence the *minar* was covered with *tazakari* work. In December 1987, the conservation cell of the Auqaf Department was converted into the provincial Archaeology Directorate under the Information and Culture Department. This was the period when the main drain of the mosque running northwards in the eastern section of the courtyard and descending into one of the shops at the street-level in the north bazaar, was blocked by a tenant in the shop and the consequent water seepage into the foundations and floors resulted in the subsidence of the north-east portion of the floor of the courtyard. The impact of this water percolation was extensive and appears also to have resulted in the subsidence of a portion of the north-west side of the courtyard. The restoration efforts in the late 1980's and early 1990's primarily focused on repairing the floor of the courtyard damaged due to heavy penetration of water as a result of this blockage.



Above: Subsidence and floor repair in the north-west corner of the courtyard has created different levels with badly finished edges.

Opposite: The north-eastern minar and portion of the entrance iwan, as seen from the hujra roofs on the south side of the courtyard.



The restoration and repair efforts in the 1990's and 2000's were more focused on the entrance portal and the calligraphers'/book binders' bazaar. Initially, the floor of the Calligraphers' Bazaar was repaired in 1994-95 and since then two efforts have been made to restore the northern and southern sections of the bazaar. In 2003 a grant from the American Embassy enabled the department to restore the north section of the Calligraphers' Bazaar. The south section of the bazaar was restored later in 2005-06. Lack of a comprehensive problem analysis, inadequate attention to roof drainage issues and the possible use of inappropriate materials (such as marble powder and white cement) has contributed to pronounced efflorescence caused in the main by rain water percolation in the walls in the primarily *tazakari* work carried out with this funding.

The failure of past restoration efforts to address all issues related to the building structure, its surface decorations, the problems of drainage and issues pertaining to the neighbourhood context is evident in the manner in which these problems have grown over time. While there may be several reasons for this including organisational inadequacies and lack of technical know how, one would be amiss if the absence of a comprehensive, all encompassing survey and analysis is not pointed out as the most significant cause of this failure.

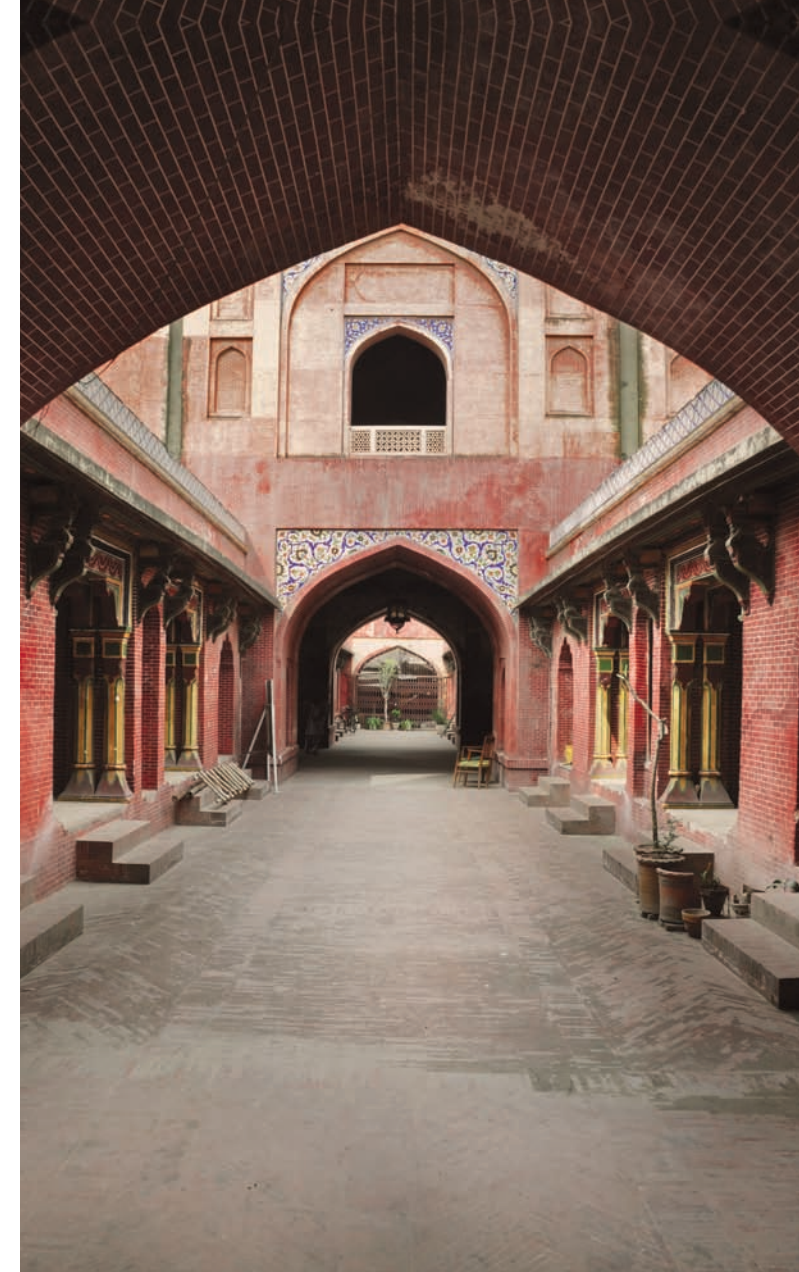
Presently, inadequate care and maintenance threatens this world class monument in a variety of ways. A preliminary review of the condition of the mosque leads to the conclusion that its physical fabric has been inadequately protected from the elements and has been subject to unavoidable natural threats, such as earthquakes, causing certain structural impacts. However, it also appears glaringly evident that the present damage in the mosque is caused significantly by man-made factors. The mosque has never been as exposed to the pressures of rapid development in its immediate surroundings as it is at present. These pressures range from the immediate and long term impacts of inappropriate activities and the building of unauthorized structures to contain them, to environmental factors like the pollution generated by vehicles in the cramped physical environment of the Walled City. Additionally, lack of sophistication in the appreciation of the heritage, of architectural scholarship, of adequate technical and interpretive skills in the care and maintenance of the monument and the regulation of its use, and the deliberate vandalism of the structure are also main contributors to the damage.

The absence of a professionally qualified team and lack of regular maintenance procedures greatly threaten the mosque complex with further deterioration. The non-permanent and periodic interventions in both the structure and the building fabric in the past have contributed little to safeguarding the architectural fabric of the mosque and to enhancing the appeal of its decorative craft techniques. The absence of a permanent mechanism for maintenance during these past efforts has significantly contributed to damages sustained by the mosque complex.

8.2 UNDESIRABLE USES

The inappropriate and undesirable uses to which certain parts of the mosque are currently being put fall into four distinct categories:

- i. Undesirable uses of shops on the east façade at the street-level: these shops are currently rented out mainly to steel⁴⁰ fabricating businesses. This involves the conduct of fabrication operations on large pieces of steel - operations which involve cutting, hammering and welding. The handling and manipulation of long steel sections and bars on the mosque's eastern side is a major threat to the structure of the mosque. The fabrication of steel products in these shops not only destroys the overall ambience of the mosque's front and creates noise, pollution and occupation of the public square for production activity, as many of the steel products being made have unwieldy dimensions. The small shops which were not originally planned for such use have little capacity to accommodate the nature of the steel fabrication activity conducted in them and are thus vulnerable to structural and fabric damage by vibration and shock impact caused by the use and storage of heavy tools and steel products.
- ii. Use (or lack of appropriate use) of the original shops in the northern façade: here the problem emanates chiefly from the fact that over the course of the centuries the street-level has risen (by less than 1 metre along the Kotwali Bazaar and up to 1.2 metres on the side of Chowk Wazir Khan) above the floor of the original (and historic) shop spaces. This



Above: The Calligraphers' Bazaar, which was the focus of much of the restoration works during the 1990's and 2000's.

Opposite: Metal work being undertaken outside the shops in the south-west corner of Wazir Khan Chowk - the southern-most 3 shops on the east facing façade of the Wazir Khan Mosque.



has resulted in new structures (that respond to the raised street-level) to be built on the face of the historic structure, relegating the original spaces intended to be used as shops instead to function as storage dumps or not to be used at all.

- iii. Certain other shops at the street-level, as well as many historic *hujras* at the courtyard level are used as storage accommodation, and have been locked up for years. Some of this storage contains debris and junk building material from previous repair and maintenance operations. Still other *hujras* are locked up and/ or are in use by members of the mosque committee or their surrogates.
- iv. Certain parts of the roof are used for processing hospital waste such as recycling plastics and other materials. This activity is conducted by janitorial staff associated with the Auqaf Department dispensary run in the Calligraphers' Bazaar.

In the mosque itself, a large number of rooms contain a lot of junk materials (discarded building material, junk items etc.) and therefore are never maintained for any productive use. (See Appendix A for documentation of the uses for which the different parts of the mosque are being put).

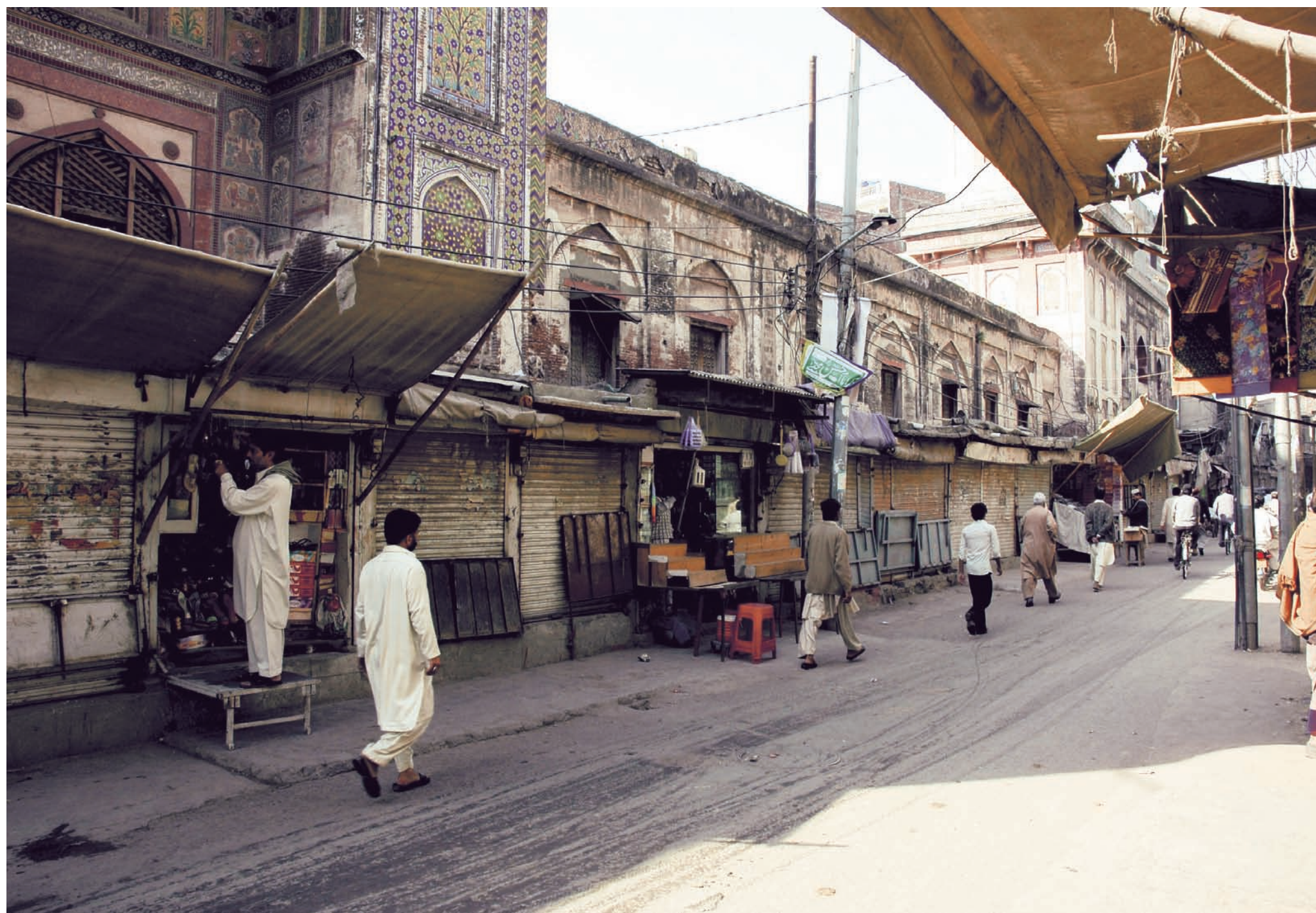


Far Right: The height of wall damage corresponds to the height of the pedestal fans being stored. In this instance, it is a small room on the southern side of the prayer chamber.

Right: Medical waste being stored on the roof of the Calligraphers' Bazaar.

Opposite: Use of hujras on the southern side of the courtyard as storage space for the prayer mats which are laid out in the courtyard.





Generally, the condition of the building fabric of the Wazir Khan Mosque is relatively more satisfactory as compared with most other monuments of the period under the care of the Auqaf. While this may be attributed to the greater intensity of public use, to the scrutiny and public surveillance that the mosque has always received, and the conservation operations carried out in the past, the credit for this also goes to the materials with which the mosque was constructed, which are consistent and coherent.⁴¹ The thickness of the brick wall and the dimensions of the arcuated structural elements such as domes, vaults, arches and *muqarnas* elements, vary from small rooms to the domed spaces, depending on the span of the space. Most of the walls are covered with surface renders and decorations on the exterior and in the interior of the mosque prayer chamber. The only visible sections of the brick masonry are the west façade and the masonry on the *minars*.

The architectural and structural fabric of the superstructure of the mosque is threatened by several factors, most of them of human provenance. Of these the most important are:

- Poor roof drainage and the penetration of rain water into the historic architectural fabric. The drainage is affected primarily by lack of roof cleaning and ill considered interventions;
- Lack of maintenance;
- Poor and ill considered interventions for a variety of utilitarian needs, e.g., interventions for electrification; conduiting for electrification, intervention for running water, etc.

There is considerable and serious damage in almost all parts of the mosque owing to structural damage caused by seismic movement over a prolonged period of nearly four centuries, and by water ingress into the structural fabric. In the Calligraphers' Bazaar and the mosque courtyard, the damage is generally manifested as cracks, subsidence and leaning. In the prayer chamber on the western side of the mosque the cracks in the main arches adjacent to the two *minars* have a direct relationship with the leaning pattern of the *minars*. Although it is not confirmed when these cracks developed, their

existence is noted on the record pertaining to major restoration activities carried out between 1971 and 1978. As a result of rising damp and water ingress, the most common type of damage to the roof and the walls is the erosion of surface lime plaster render.

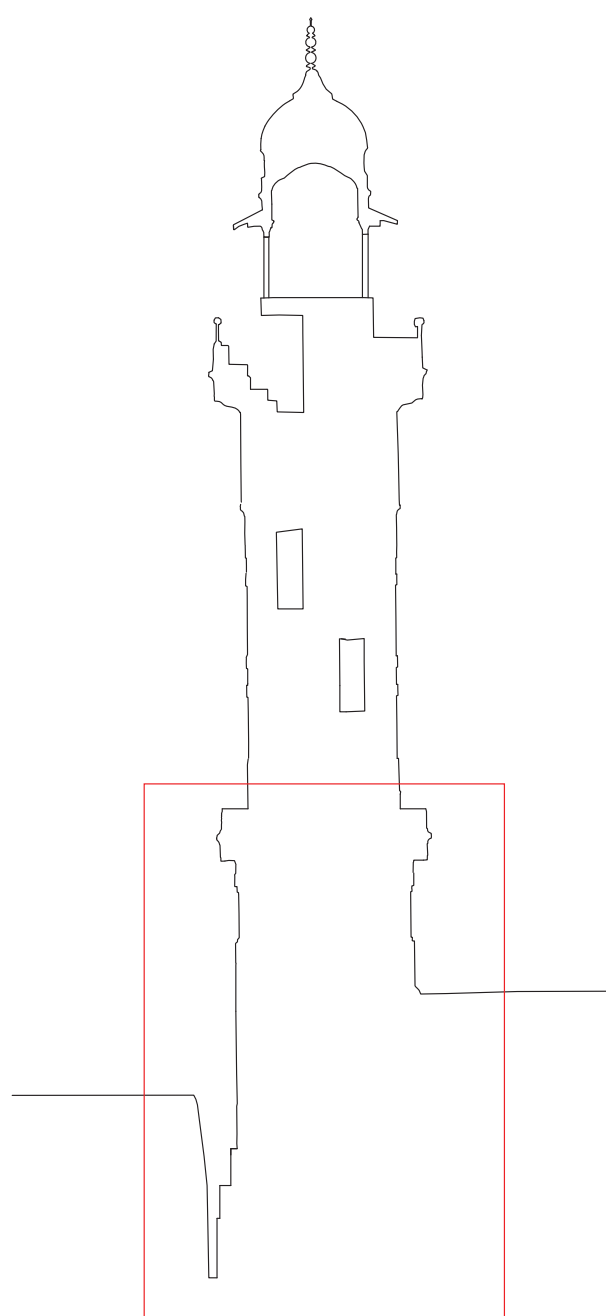
The repairs and “conservation” work carried out intermittently has withstood the test of time in some cases. The remainder of these interventions have unfortunately succumbed to the several causes of water related damage mentioned above, and to the use of inappropriate materials and methods, or a combination of both.

The major components of the building fabric such as the foundations, walls, roofs (flat and domed), floors, doors, windows etc. have various degrees of damage. Rising damp in the walls of shops at street-level (Level 0) and the *hujras* on Level 1 has damaged the surface lime plaster and has eroded the lime mortar constituting the masonry work in certain locations.

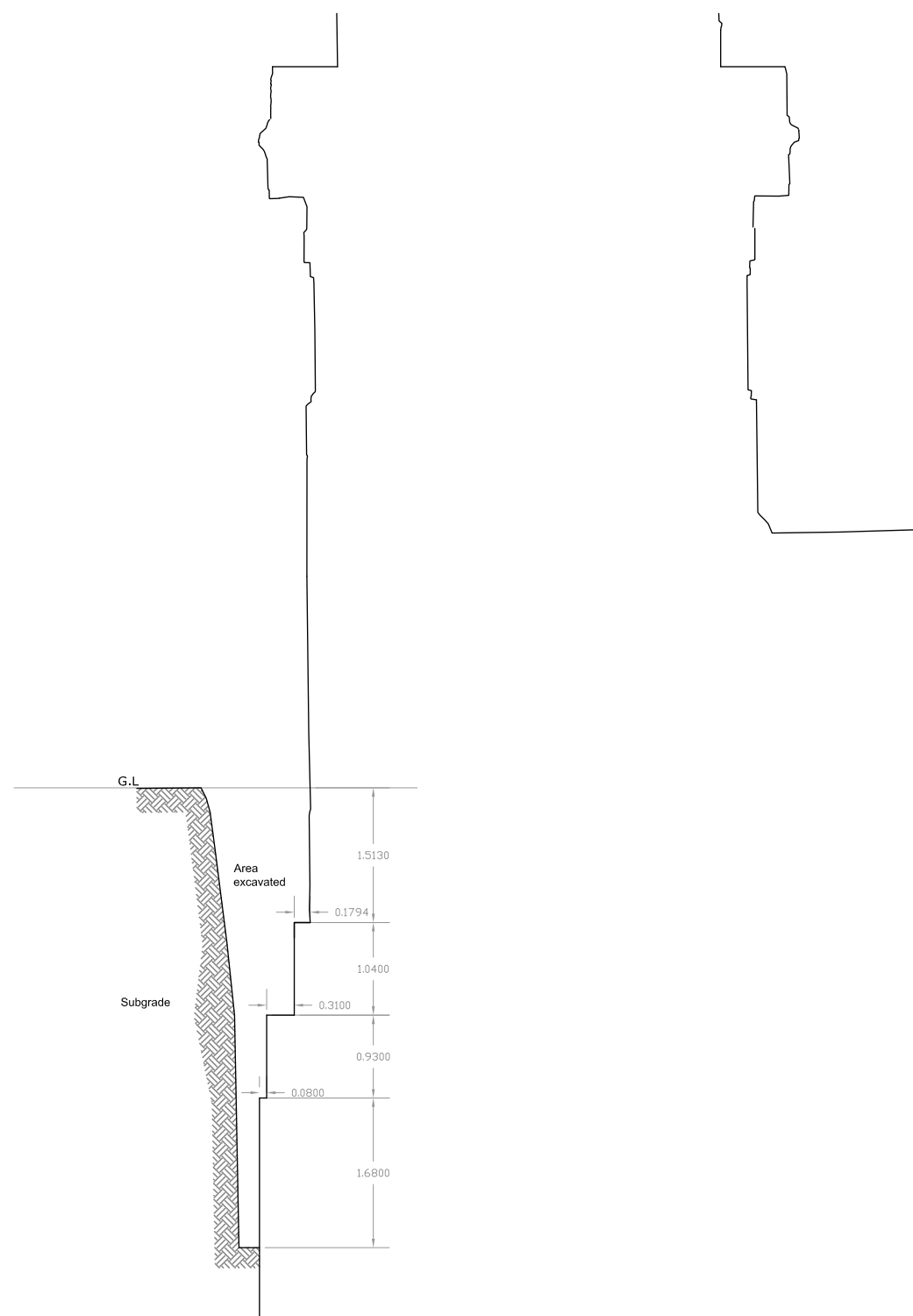
Considerable damage (mainly in the courtyard and the north and south wings containing the *hujras*) has occurred to the floors as a result of settlement caused by water ingress into the sub-grade structure and the superstructure, and as a result of interventions aimed at concealing service conduits in the floors.

The presence of toilets outside the south-eastern corner of the mosque has already contributed to damage to the courtyard floor and could further threaten the structure in the future. An old drain in this corner which used to remove the rain water from the courtyard is now blocked due to the rise in street-level outside, resulting in rain water accumulation in this corner. Excavations⁴² carried out to investigate the foundations of the south-eastern *minar* revealed that at a depth of 3 metres (9.84 feet) there is a layer of earth 2.3 metres (7.54 feet) deep completely saturated with water, evidently from these sources. The main (mixed sewage and storm water) drainage line of the street runs on the south side at a distance of 8 metres (26.24 feet). The later addition of an *ad hoc* ablution space in the south-eastern corner of the courtyard itself appears to have further saturated the sub-grade under the floor of the courtyard, resulting in the periodic settlement of the courtyard floor. The latest settlement was observed in March, 2009.

Opposite: Looking west along Kotwali Bazaar, showing the shutters of the shops abutting the northern façade of the mosque.



SECTIONS SHOWING EXTENT OF EXCAVATION CARRIED OUT AT THE BASE OF THE SOUTH-EASTERN *MINAR* AS PART OF THE GEOPHYSICAL INVESTIGATIONS



9.1 ASSESSMENT OF STRUCTURAL BEHAVIOUR

9.1.1 GEOTECHNICAL INVESTIGATIONS

The investigations carried out by geophysical engineering contractors⁴³ appointed by AKTC-AKCSP addresses mainly the condition of the bearing strata in the cultural fill and natural soil formations. According to the geotechnical investigations, the causes of the structural cracks in the super structure could be attributed to the succession of earthquakes the mosque has experienced over its life. Additionally, it has provided important information in respect to the depth and width of the foundations in different locations of the mosque. The final report is attached to this document as Appendix C.

It appears from the geotechnical investigations that the sub-grade is actually “cultural fill” material that goes down to about 7 metres (22.96 feet) from the level of the courtyard of the mosque. Natural strata start beyond that and are stated to be good foundation soil. The foundations of the leaning *minars* are borne by the natural soil strata below the cultural fill, and therefore the *minars* have been thought to not be under any threat from subsidence owing to the poor bearing quality of the cultural fill. It may also be stated that at the level of the natural bearing strata, there is no presence of water percolation as a result of the poor drainage of the land area surrounding the monument. Water saturation was found at superficial levels in the cultural fill up to a depth of 2.3 metres (7.54 feet) around the south-eastern *minar*, but this does not affect the natural bearing strata, as the ground water table is now deep enough as not to affect the bearing qualities of the natural strata in significant ways.

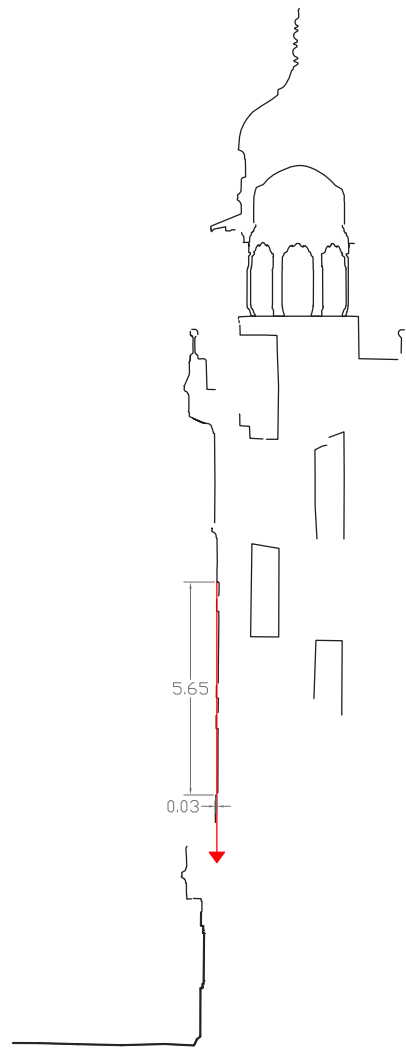
In order to ascertain the geometry of the foundation of the *minars*, a test pit and a drilling borehole were carried out. The test pit was excavated at the base of the southern wall of the south-eastern *minar* to a depth of 3.97 metres (13.02 feet) and an additional 1.68 metres (5.51 feet) with a manually operated auger. The total depth achieved with the combination of these two methods is 5.65 metres (18.53 feet), which is not the bottom of the foundation. Based on the stepped increments in the width of the foundation discovered during the excavation, the team suggested that the total width of the foundation in the bottom could be 9.05 metres (29.69 feet).

The bottom of the *minar* foundation was then explored by drilling a 10 metre (32.80 feet) deep angled borehole through the foundation masonry of the south-west *minar*. The depth of the foundation was determined to be 7.73 metres (25.36 feet) below the floor level of the courtyard, 0.73 metres (2.4 feet) below the depth of the cultural fill.

9.1.2 MEASUREMENT OF SUBSIDENCE AND DEFLECTION

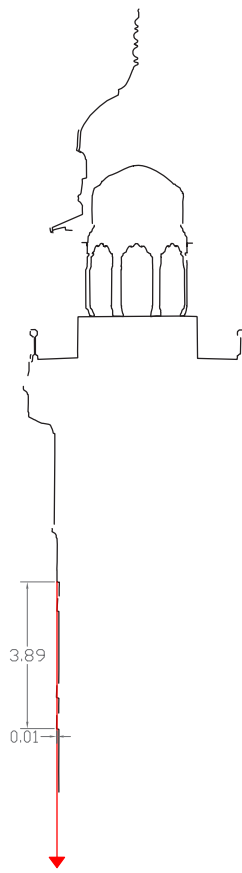
The EDM survey provides us with an opportunity to accurately fix positions of the various parts of the monument relative to certain fixed “control” points established at the start of the survey. The accuracy of the method has helped establish the subsidence and deflections from the absolute horizontal and vertical parts of the monument. Using this method, thus, it has been possible to accurately document the tilt in the *minars*, the effects and relation of this tilting with major cracks in critical locations like the arches adjacent to the western *minars*, and the major deflection of the part of the building containing the *hujras* on the southern side of the courtyard. Using the documentation process as a monitoring mechanism has enabled the tracking of the rate of structural damage such as cracks and deflections more generally, and helped us in identifying the extent and nature of the periodic settlement of the brick floor in the south-eastern corner of the courtyard and its effect on the eastern *minars*.

In respect of the *minars*, it was decided to draw four sections of each side of each octagonal shaped *minar*. In order to find the relation between subsidence and deflection in the structure, the information gathered with this survey was analysed in reference to the results of the geotechnical investigation of the cultural fill and natural sub strata of the mosque.



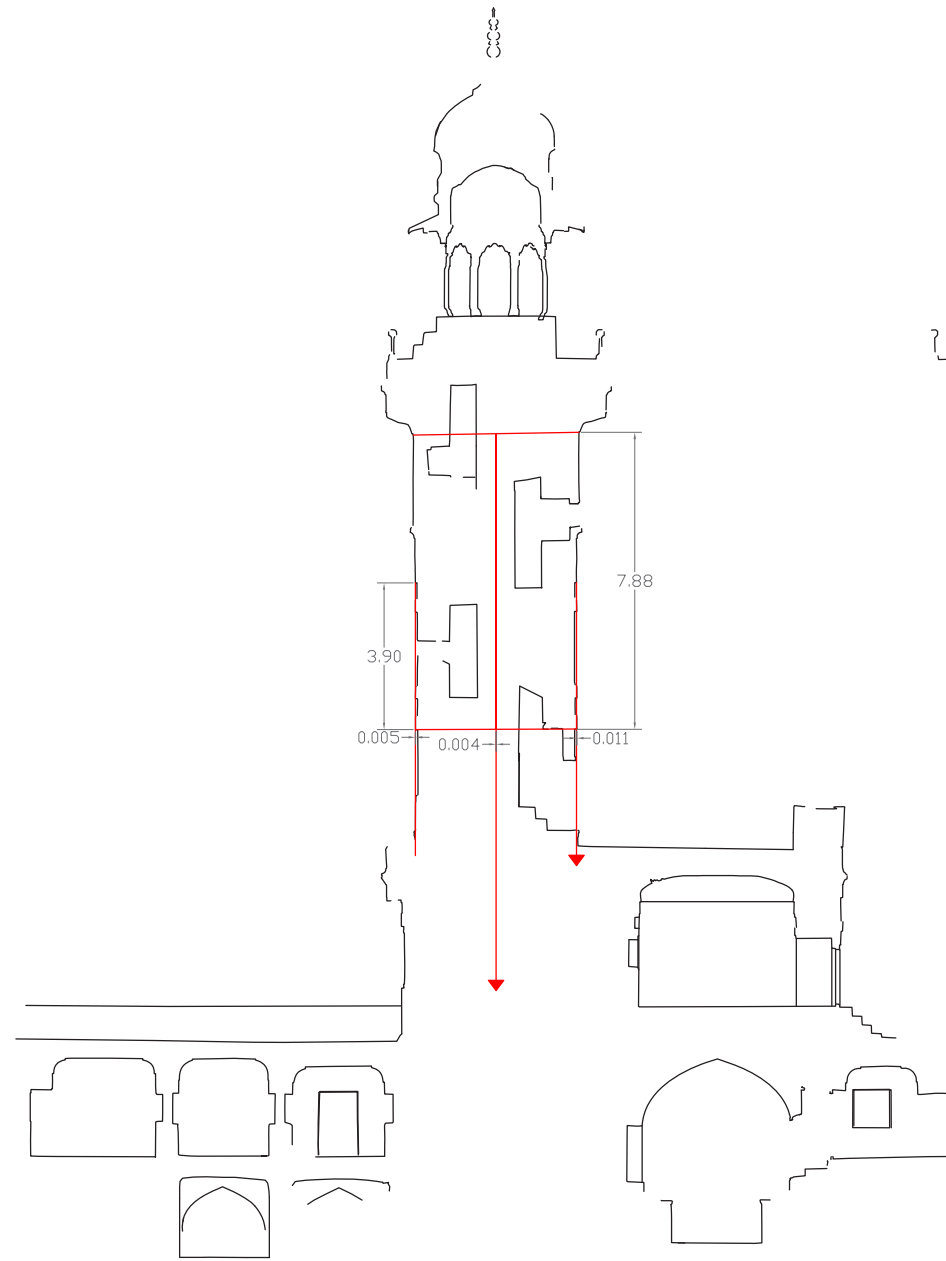
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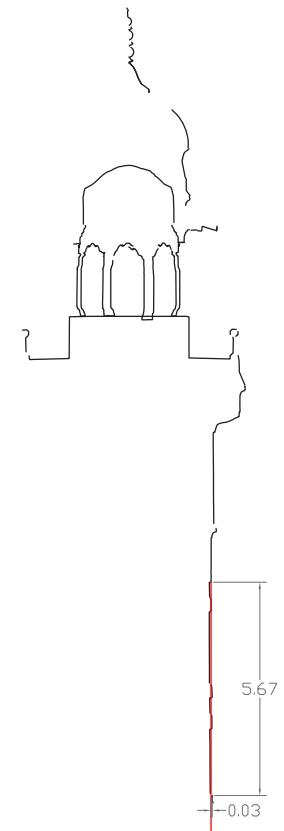
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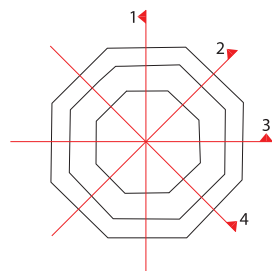
Section 3 (looking North)

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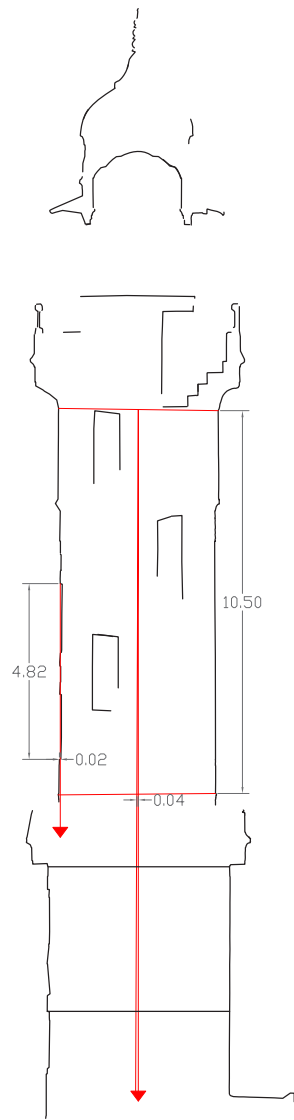


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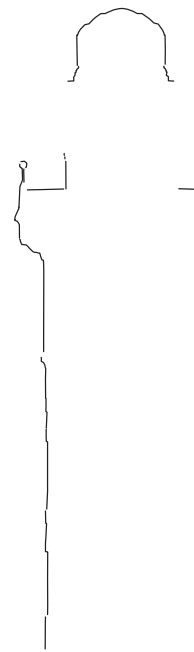
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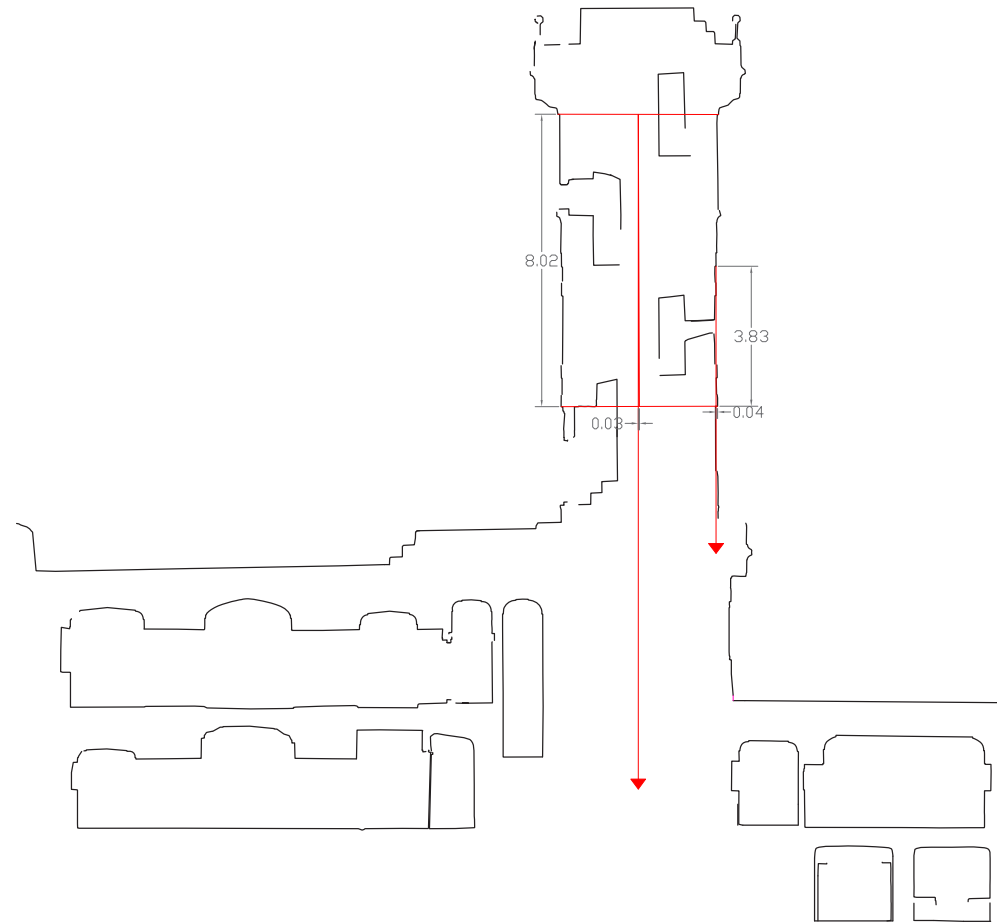
NORTH-EAST *MINAR*:
TILTING DOCUMENTATION



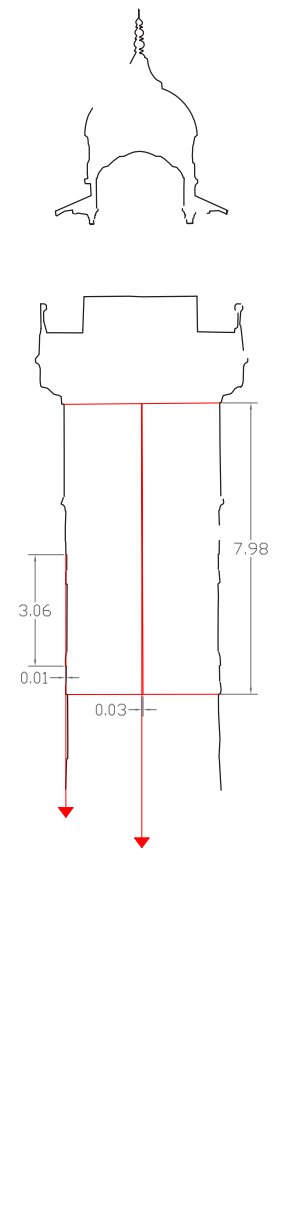
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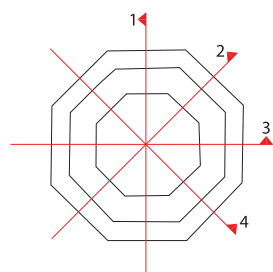
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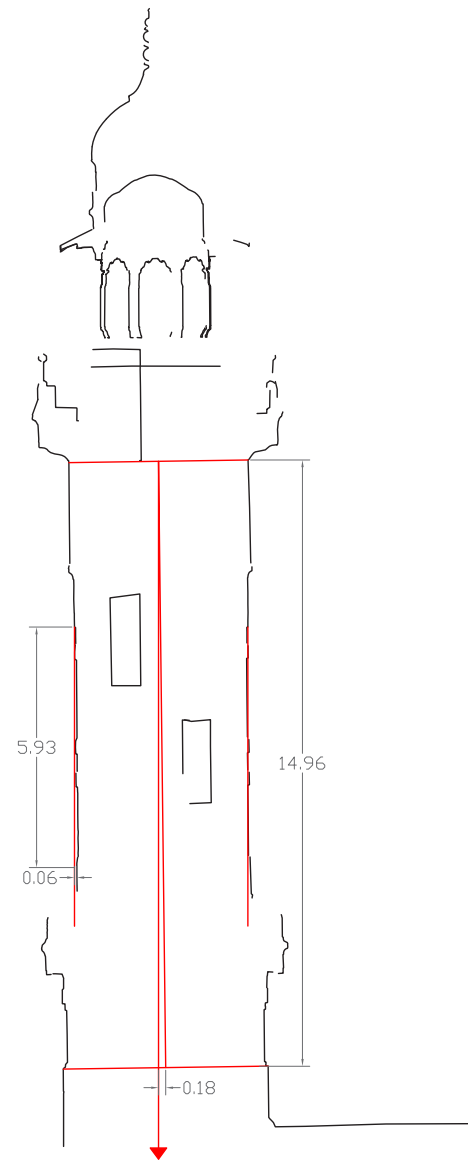
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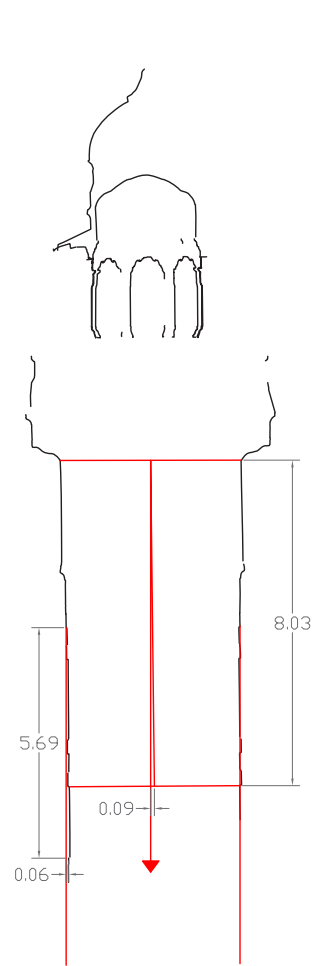
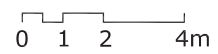
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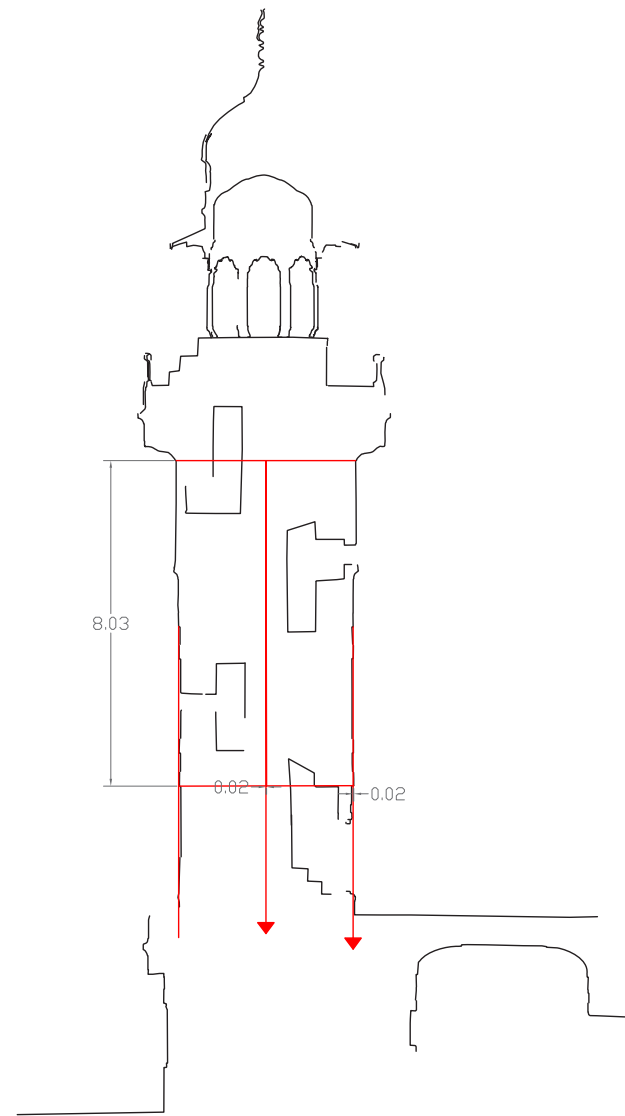
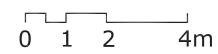
NORTH-WEST *MINAR*: TILTING DOCUMENTATION



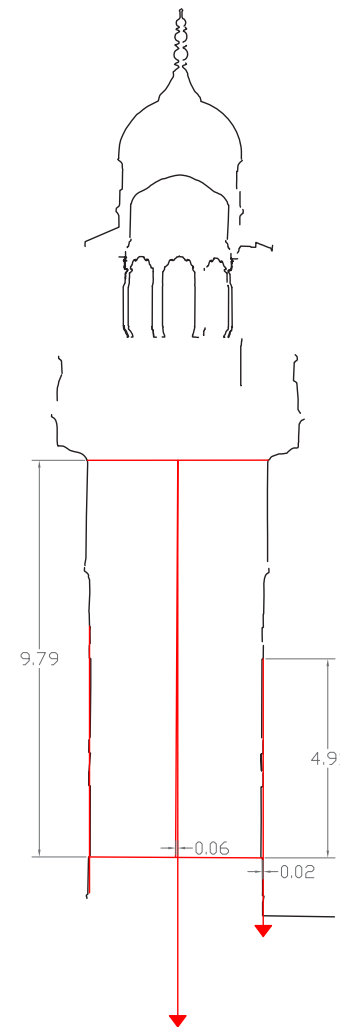
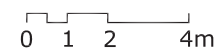
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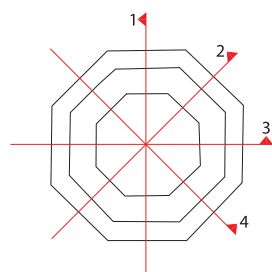
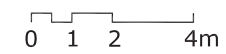
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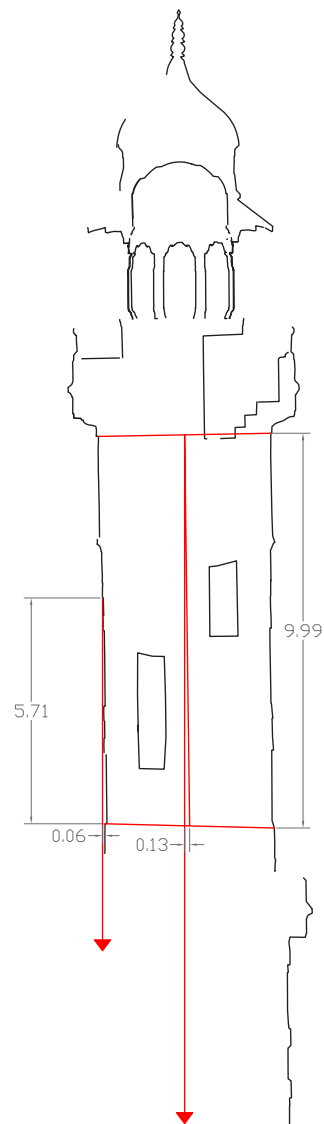
Section 3 (looking North)



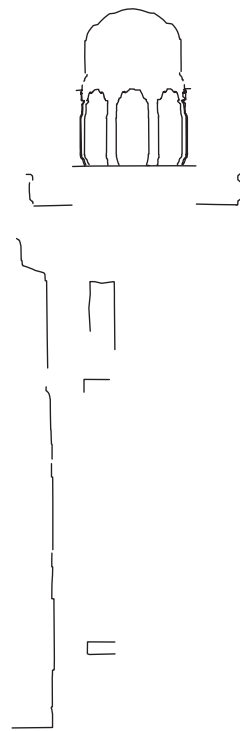
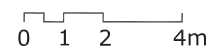
Section 4 (looking North-east)



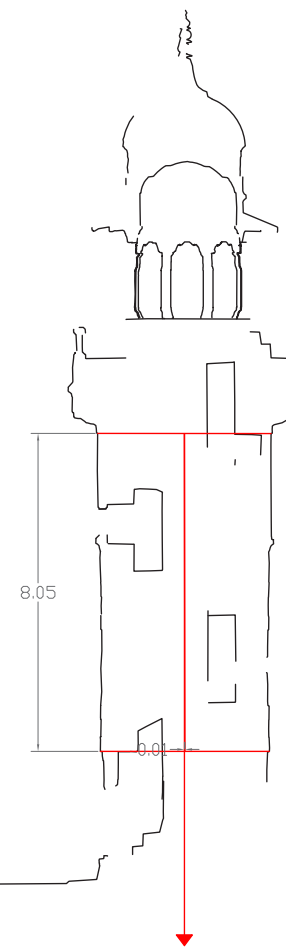
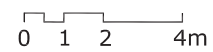
**SOUTH-EAST *MINAR*:
TILTING DOCUMENTATION**



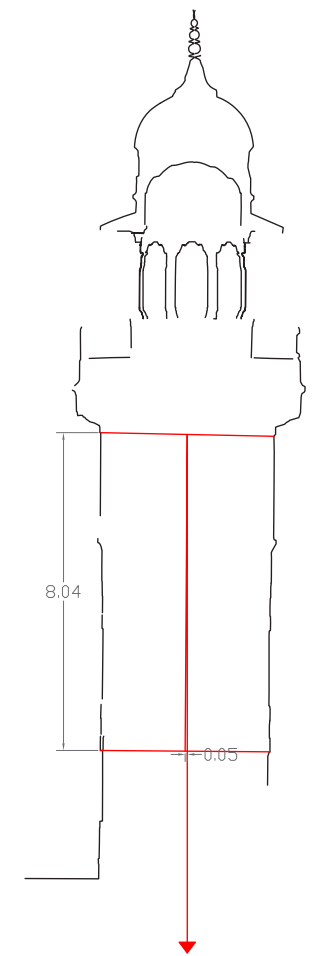
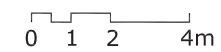
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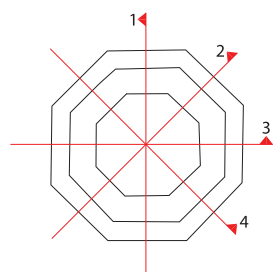
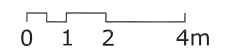
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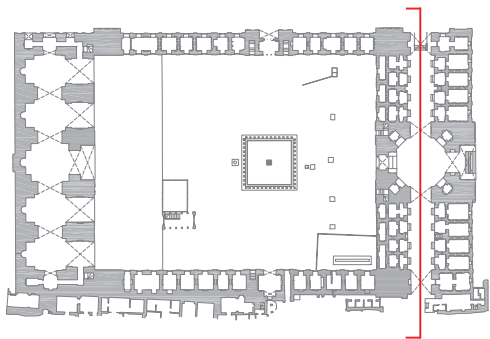
Section 3 (looking North)



Section 4 (looking Northeast)



SOUTH-WEST *MINAR*: TILTING DOCUMENTATION



**CRACK DOCUMENTATION IN THE
CALLIGRAPHERS' BAZAAR**

9.1.3 MONITORING OF CRACKS

The existing cracks in the critical areas of the mosque have been identified and monitored periodically with the help of total station theodolite measurements and Vernier digital callipers. The outward leaning of the western *minars*, which were recorded precisely, has produced some major cracks in the apex of the northern and southern arches of the main chamber. Major cracks were identified in six locations in the prayer chamber of the mosque and each location was later equipped with a group of three stainless steel studs in a triangular formation. A detailed monitoring scheme has been set in place where the distance between each stud is recorded with the help of callipers and which can be periodically compared with recordings done at a later stage.

The roof of the pavilion at the centre of the southern array of *hujras* shows a large crack, probably due to the precarious condition of its southern wall.

9.2 STRUCTURAL THREATS

9.2.1 FOUNDATIONS

One of the key objectives of the geotechnical investigations described above, and in the Appendices in this report, was to ascertain the physical characteristics of the foundations, which has never been done before. Although the focus of these investigations has been on the foundations of the *minars*, the investigations have provided us with an overall sense of the nature of the foundations of the mosque complex. The geotechnical investigations revealed that the foundation of the mosque is resting well on stable and firm natural bearing strata and therefore the cracks in the super structure have causes other than foundation failure, causes which can be attributed to dynamic loads sustained by the monument. This investigation also revealed that the subsidence in different locations of the courtyard is closely related with the amount of water that has found its way into the cultural fill as a result of inadequate drainage in the mosque.

Before conservation work is seriously begun on the monument, it is necessary to undertake further investigations on the relatively less loaded parts of the mosque such as the structures enclosing the courtyard on the southern side to determine the depth of foundations and whether or not these are founded on the cultural fill. These investigations will bear on the steps to be taken to consolidate these structures, in conjunction with steps to be taken for the removal and control of the sources of water ingress, which is significant in these areas.

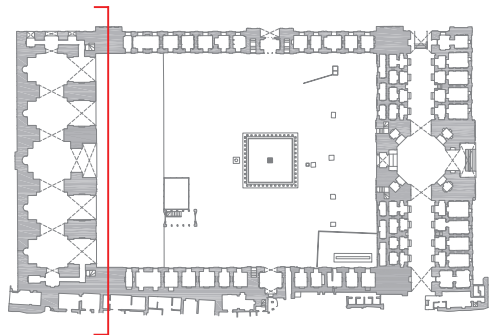
9.2.2 SUPERSTRUCTURE

While in structural terms the mosque appears to be generally robust, there are certain grave structural threats that need to be immediately addressed. Glaring structural cracks exist in the prayer chamber, and in the south-eastern corner of the Calligraphers' Bazaar fronting on the courtyard. There is no historical record available for the cracks in the prayer chamber, and expert opinion⁴⁴ has related this to an earthquake in the early 20th century.⁴⁵

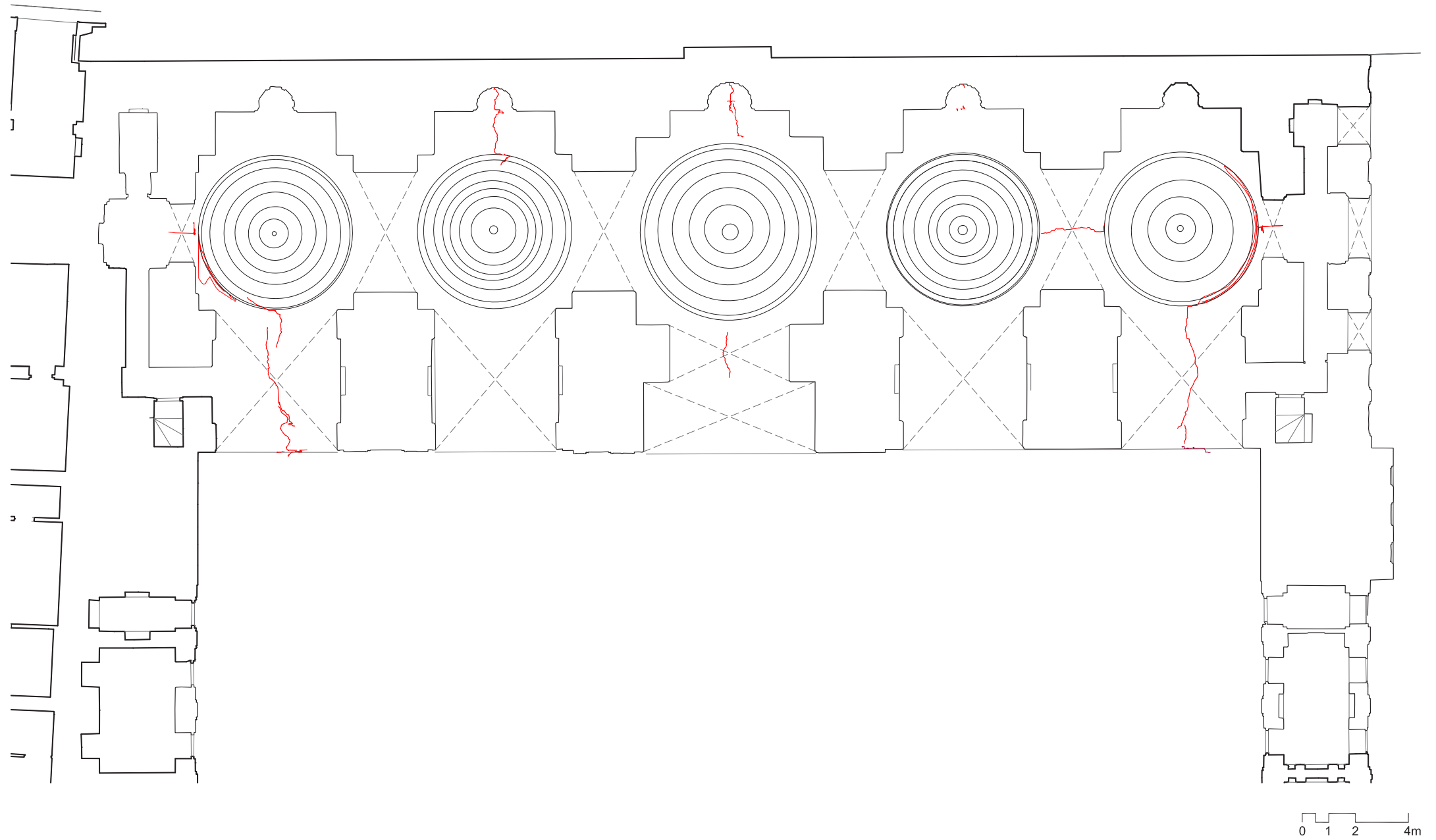
In order to facilitate the toilets and temporary ablution space in the south-eastern corner of the courtyard, many severely inappropriate interventions were made over the past several decades inside the rooms and on the roof. This has badly affected this portion of the mosque. Water tanks, water heaters and their related plumbing were introduced in this section with deleterious impacts on the historic building fabric. Leakages and the waste water from this facility have resulted in the settlement of the floor and increased the dampness in the rooms and roof. Over a period of time, the overflow of water from the storage tanks on the roof has weakened the roof and walls. During the documentation it has also been observed that some of the rooms in the mosque complex are rented out for a long time and never opened for maintenance.



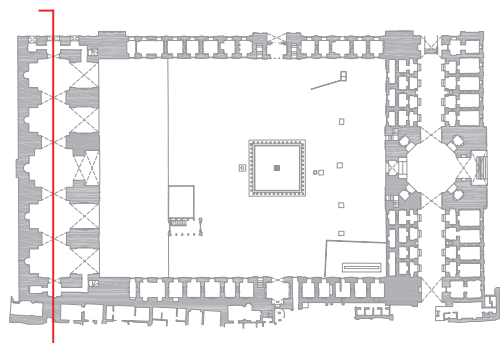
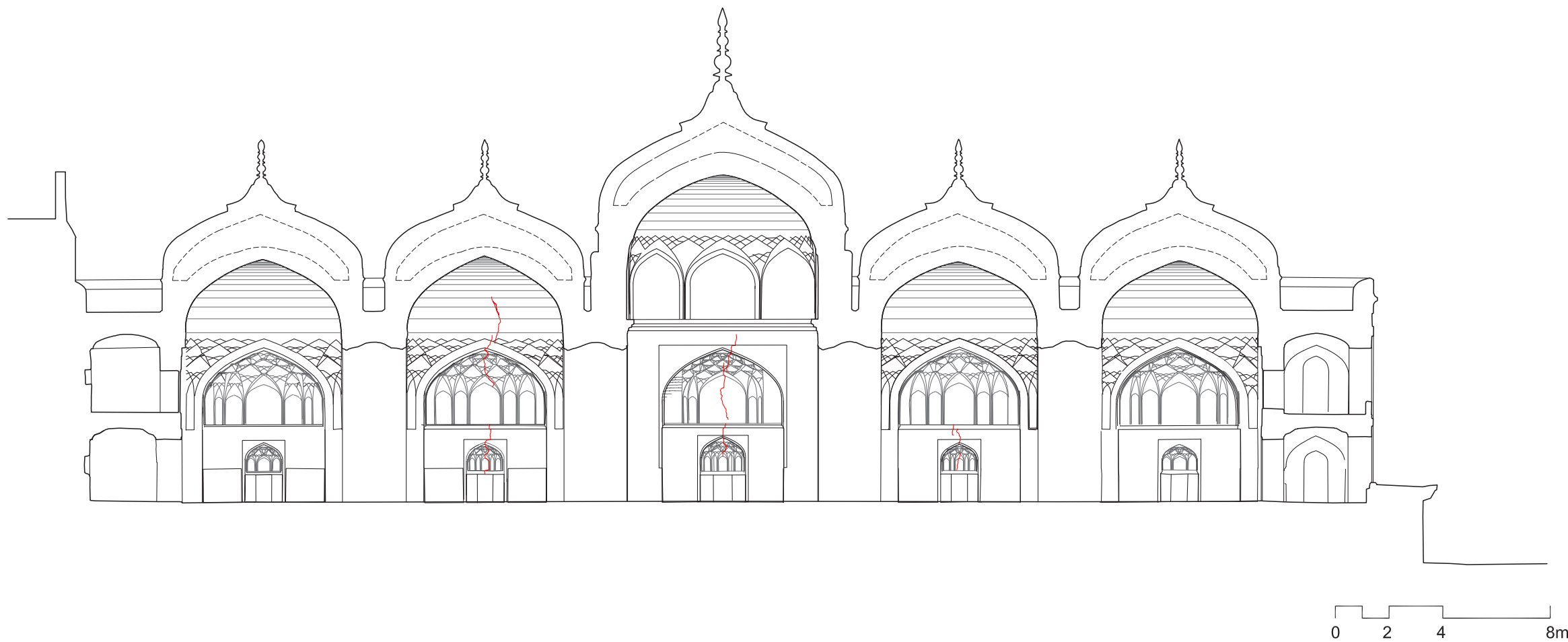
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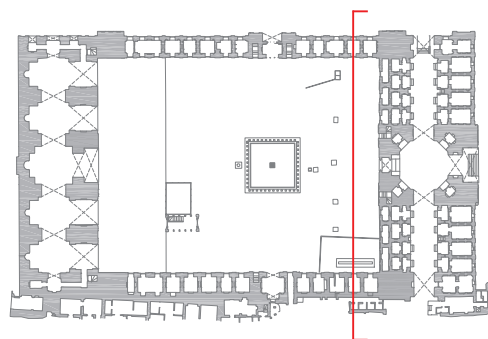
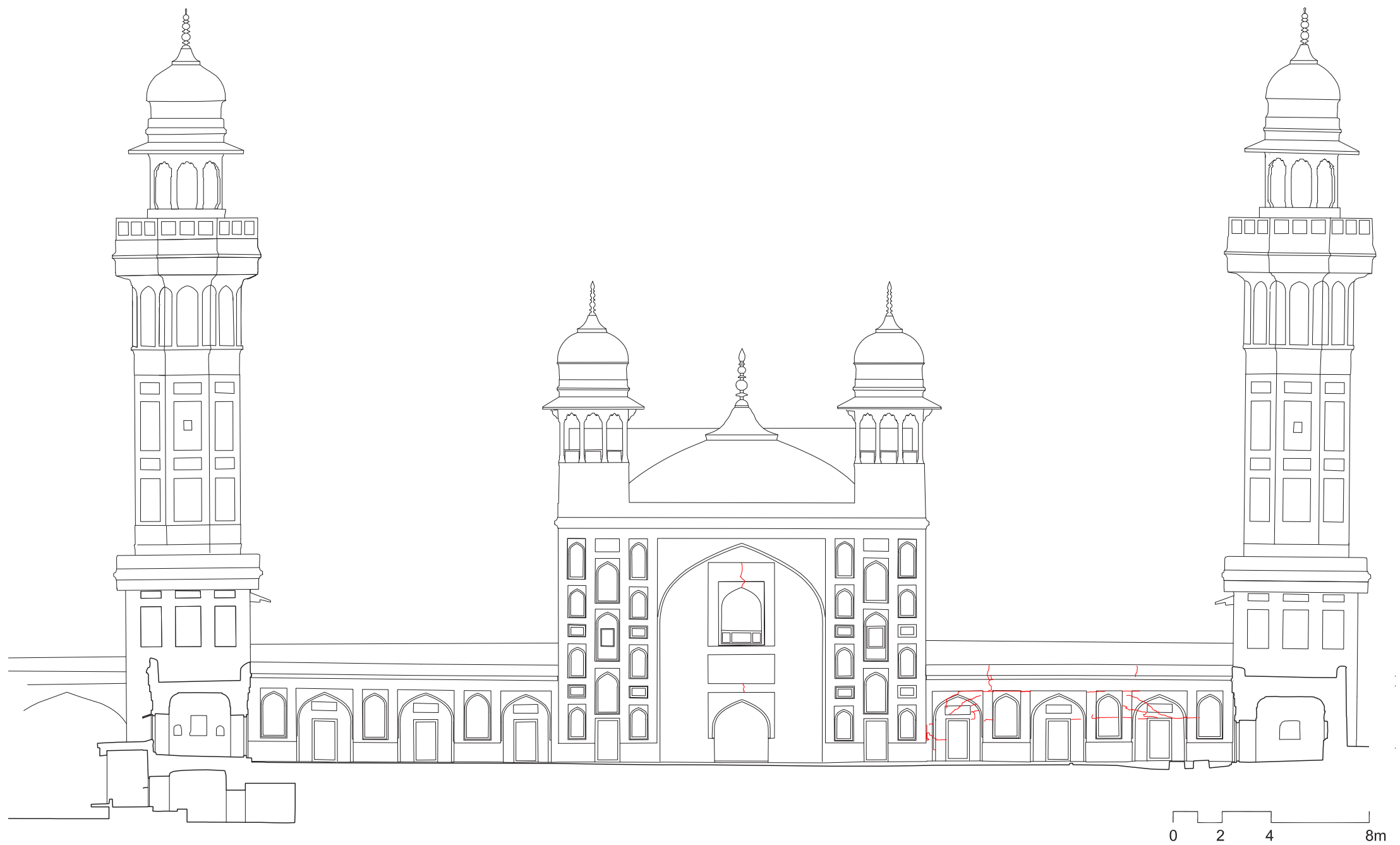
DOCUMENTATION OF CRACKS
IN THE PRAYER CHAMBER - EAST ELEVATION



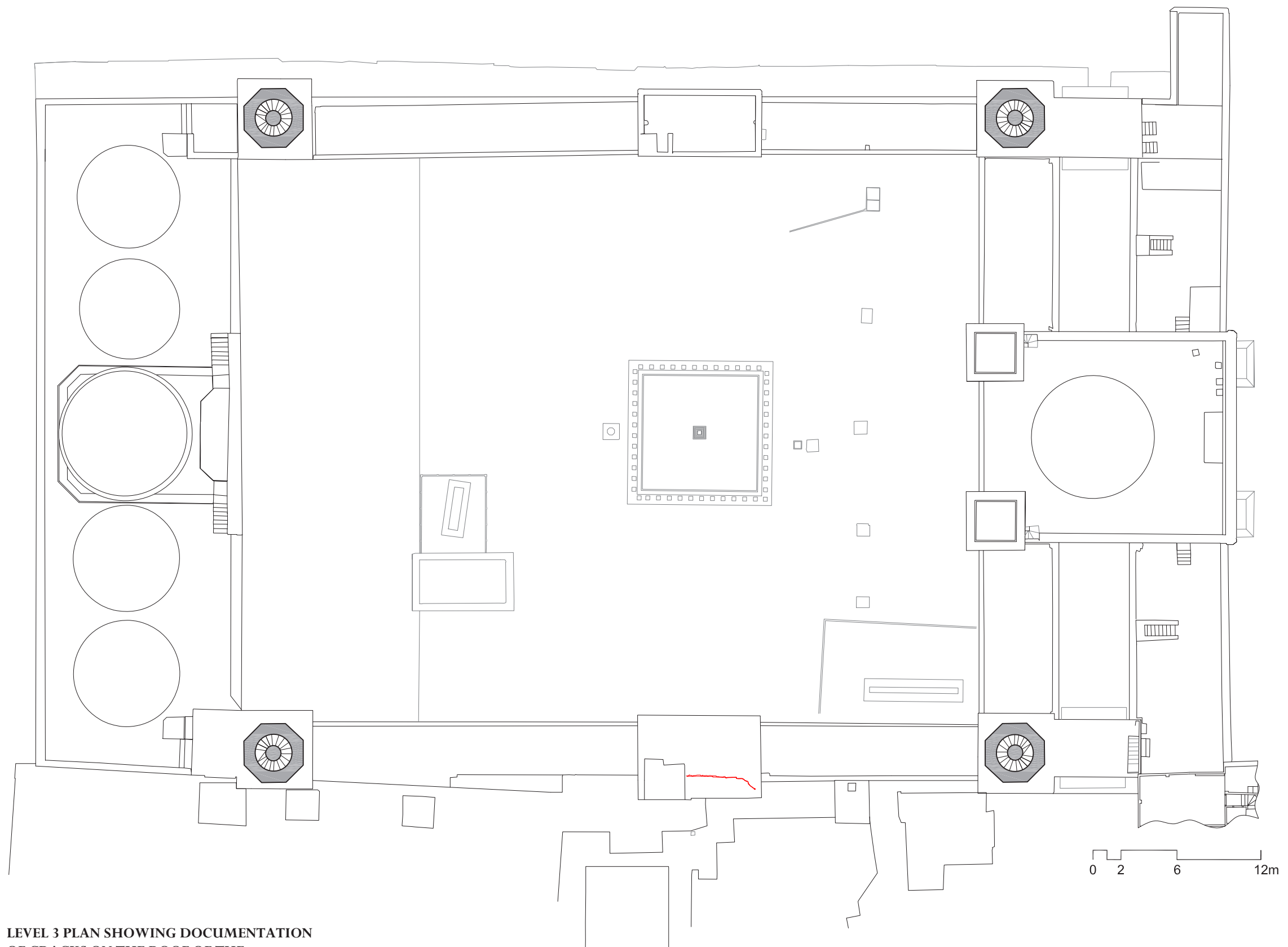
**DOCUMENTATION OF CRACKS
IN THE PRAYER CHAMBER - PLAN**



DOCUMENTATION OF CRACKS IN THE
PRAYER CHAMBER - SECTION



**DOCUMENTATION OF CRACKS IN THE
EASTERN FAÇADE OF THE COURTYARD**



**LEVEL 3 PLAN SHOWING DOCUMENTATION
OF CRACKS ON THE ROOF OF THE
SOUTHERN AXIAL PAVILION**

Lack of maintenance by the shopkeepers in the old shops on the northern side of the mosque have been and will continue to be a potential threat to the structure of the mosque if appropriate action is not taken. Similarly, the houses on the southern side of the mosque, which were constructed on the open space between the mosque and the residential area further to the south, have their wet areas (bathrooms and kitchens) abutting the south wall of the mosque. Since these houses are privately owned, it is difficult to monitor the many ways (water ingress, impossibility of maintenance, vandalism, etc.) in which the mosque's building fabric could be threatened.

In the paragraphs below the structural condition of the monument is described in terms of (i) the *minars*; (ii) the courtyard; and (iii) the structures on each of the four sides of the courtyard.

i. THE MINARS

The varying degrees of deformation in all the four *minars* is not alarming at this stage, as has been demonstrated by Dr. Fritz Wenzel in his report (Appendix B), in which structural issues and analysis related to the *minars* and their foundations have been dealt with.

Aside from the north-eastern *minar* which was restored in the 1970's, the rest of the *minars* have similar forms of damages and their causes. The most common damage to the glazed tiles is various forms of disintegration of the glazed tiles explained below. Lack of maintenance, aging and water are the main causes of this damage. It has also been noticed that rain water collecting on the top gallery of each *minar* is not led off at a single point. Each octagonal gallery has eight holes at the corner of the floor and the parapet to drain off the surface water and water egressing out of these runs off as sheet flow on to the surface of the glazed tile. The domed surfaces of the *chhatri* has entirely lost its glazed tiles. Water again seems to be one of the main causes of this damage.

ii. THE COURTYARD

The courtyard of the Wazir Khan Mosque is one of the most exposed and threatened elements of the complex. The current condition of the courtyard can be read as a chronology of historical interventions done so far, in an effort to accommodate basic building services to the mosque complex. The effects of past interventions

can be easily observed in the courtyard. One of the main agents of the damage is the poor drainage of water from the courtyard which has caused multiple settlements of the brick flooring at different locations in the courtyard. This damage was further augmented due to the construction of an *ad hoc* ablution space in the south-eastern corner of the courtyard.

The old surface water drain in the south-eastern part of the courtyard, which used to collect all the storm water from the courtyard, was blocked due to the construction of new building facilities which subsequently increased the level of the southern side of the neighbourhood outside the mosque.

Waste and storm water disposal cannot therefore happen according to the intended manner of the builders. The original water drainage system was altered several times in order to reroute the storm water and the waste water from the ablution tank. The introduction of electric conduits under the brick floor have destroyed the original brick patterns and introduced new materials.

iii. THE EASTERN WING

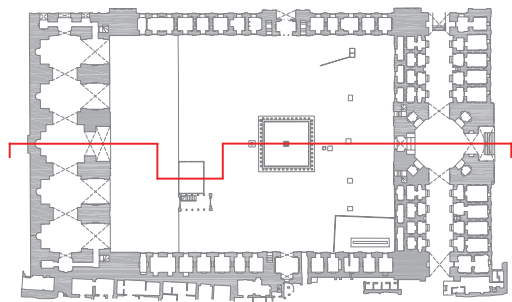
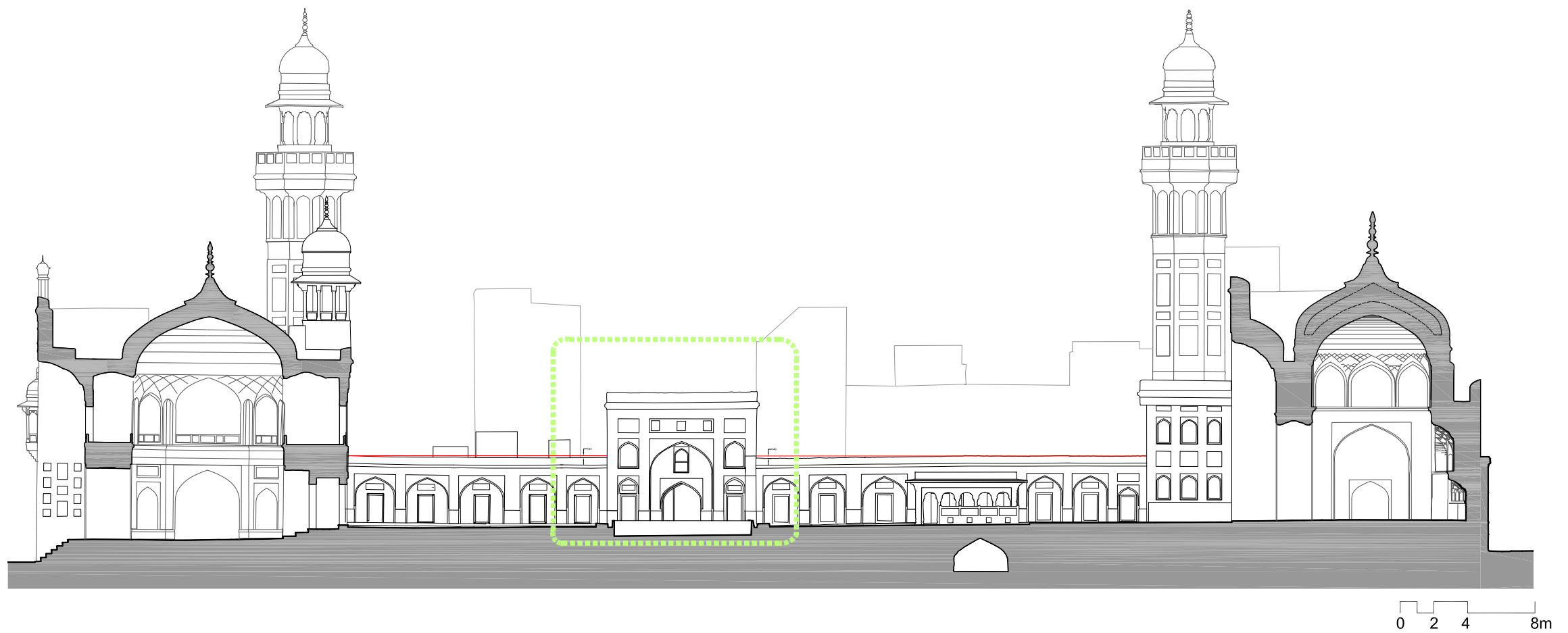
The eastern wing comprising the main entrance *iwan*, and the shops on its north and south overlooking the Chowk, and the Calligraphers' Bazaar is in a generally good condition, and being the most conspicuous part of the monument has been paid most attention in terms of repairs and maintenance. However, the roof drainage of this section is poor and water percolation from the roof into the building fabric at several locations is visible in the form of salt efflorescence even on new *tazakari* work carried out with US government funding into late 2007. Moreover the water ingress issues of the south-eastern part of the complex appears to have resulted in the numerous recorded structural cracks on the façade of the south-eastern part of the Calligraphers' Bazaar looking over into the courtyard.

Evidence of the roof being used for solid waste disposal was seen on one occasion. The source of this solid waste appears in one case (medical waste) to be the Auqaf dispensary being run in cells no. CB4 and CB5 of the Calligraphers' Bazaar (see Appendix A). In another case the solid waste is thrown out from the windows of the property abutting the southern edge of the Calligraphers' Bazaar.



Top: The crack in the apex of the arch forming the southern most entrance into the prayer chamber.

Above: A similar crack affecting the apex of the arch forming the northern most entrance. Both these are instances of the powerful lateral pull exerted by the respective minars.



SUBSIDENCE IN THE SOUTHERN ROW OF *HUJRAS*

Opposite page: detail of the southern hujras and the southern central pavilion. Note the subsidence experienced on this side. The two wings of the hujras on the south side of the courtyard have subsided as shown with respect to the central pavilion. Subsidence is shown in millimetres with reference to a horizontal line (in red) drawn from the point where the parapets end against the base of the south-east and south-west minars.



This residential property in the south-eastern corner has been built right up against the fabric of the southern extremity of the bazaar. The lack of regulative oversight and the crudeness with which the new construction invades the fabric of the monument is appalling.

As said before the inappropriate businesses operating in the shops at the street-level have caused damage to the outer renders, and are a source of vibration impacts to the structure. The precise extent of possible damage from this source is not yet visible.

iv. THE NORTHERN WING

The northern wing is affected by (i) poor drainage from the courtyard, (ii) the structural interventions from the construction of shops on the street-level against the monumental fabric, and (iii) installation of infrastructure on the monumental façade in a crude manner, approaching vandalism.

v. THE WESTERN WING (THE MOSQUE PRAYER CHAMBER)

This part of the mosque is affected by some major structural cracks which are visibly related to the inclination in the *minars*. This has caused the outer most section of the prayer chamber on its northern and southern side to tend to tear away from the mass of the base of the *minar*, appearing as identical crack systems on the two sides. Cracks appear on the apex of the arch of the northern most and southern most entrance arch in the main (eastern) façade of the prayer chamber, and travel upwards on both sides of the exterior (eastern) wall into the roof parapet. The cracks then travel westwards along the spanning system curving along the base of the two domes. Overall the cracks both horizontally and vertically

follow the same distribution patterns on both the northern and southern side. However, cracks on the northern side are more extensively developed. In general the cracks have affected the decorative frescoes and plaster renders underneath them with water penetration and salt efflorescence visible on the underside.

vi. THE SOUTHERN WING

As compared to the northern wing of *hujras* the part of the monument that encloses the courtyard on its southern side has far more structural damage. This may be in part a result of its historic association with water. The large well with its Persian wheel that is now the site of a house, was located on the southern side, and water was introduced into the courtyard and the ablution pond in its centre through a water cascade in the southern axial pavilion. The Persian wheel that worked the well was replaced with electric motors in the 20th century, which led to a series of interventions, including interventions that tampered with the historical drainage system of the courtyard and its ablution pond described above.

The poor quality of drainage on the outside of the southern wing, as described above, has resulted in considerable damage to the structure of the southern pavilion and to the wings of *hujras* on its sides. The pavilion appears to have subsided in a major way, and apart from suffering serious structural damage itself, has caused the entire section of the *hujras* to its west to list downwards by 15 cm (6 inches) from the horizontal. A similar subsidence has also occurred on the row of *hujras* on the eastern side, measured at a maximum of 16.3 cm along the length of these *hujras*. Damage on the southern side of the pavilion has occurred in the form of major roof cracks, loss of historic masonry and surface deterioration.

9.3 THE CONDITION OF SURFACE TREATMENT AND ARCHITECTURAL DECORATIONS

It is important to understand the causes and the extent of weathering and damage to the various types of materials and different decorative craft techniques used in the mosque. For this purpose, a detailed weathering and damage analysis is underway in order to map and quantify the damage, and to forecast the nature of future threats and estimate the quantum of interventions necessary. The materials—brick, lime, red sandstone, glazed terracotta tiles, terracotta *jalli* and wood—used in the construction of the mosque have been put together in a variety of decorative craft techniques in the form of *kashikari*, *tazakari*, *naqqashi* and patterned floor brickwork. Each of these building crafts have different implications for treatment of the damage and of the nature and extent of intervention that will be required.

The condition of the material not only depends on its own chemical and physical characteristics but also depends a lot on the materials in its neighbourhood. Therefore, it is important to analyze the interdependency and interaction of different building materials during this damage mapping exercise. For example, incompatibility of cement used with the old building materials in previous restoration efforts increases the extent of damage in the mosque. Intentional use of cement in faux brickwork (*tazakari*) now shows efflorescence, scaling and exfoliation in a variety of locations in the mosque. Similarly, the interaction of concrete slabs of encroached shops with the old brick masonry of the northern façade shows a variety of damages to the masonry, mortar and surface decorations.

9.3.1 THREATS TO THE EXTERIOR RENDERS AND FINISHES

The intricate and delicate surface embellishments of the mosque are vulnerable to weathering, and prone to damages caused by environmental and man-made factors. Most of the past restoration efforts were focused on the protection and conservation of these surface decorations.

Almost all surface decorations, except the frescoes in the prayer chamber, are directly exposed to the weather. These surfaces include a variety of treatments of plaster render, glazed tile

revetment, exposed brick revetment, and exposed brick surfaces in the courtyard. In general, the overwhelming cause of accelerated deterioration of plaster renders and other porous surfaces appears to be the absorption of water, the build up of algae and cyanobacteria and the consequent production of acidic chemicals and consequent salt crystallization which act on the porous material both on the surface and deep within the pores. A related cause is the presence of hundreds of pigeons in the mosque and the chemical effect of bird excrement and associated micro-organisms. The combination of these causes has damaged the north facing surfaces at a significantly higher rate than others: with shorter or no exposure to the sun, particularly during the winter months, these surfaces provide a hospitable environment for biological growth. The north facing sides of both the prayer chamber, the northern row of *hujras* and the southern row of *hujras* (despite the fact that on the courtyard side these have been the recipient of conservation and restoration work in the 1970's) along with the axial pavilions are therefore significantly more damaged than other exposures.

Along the Kotwali Bazaar, the north facing surfaces have been doubly vulnerable to damage as a result of the shops built against the monument and as a result of insensitive and aggressive insertion of metal brackets and other metal objects driven into the masonry which carry electrical and other utility cables. A large number of glazed tiles have already been lost completely on the spandrels and the rectangular panels above the windows of *hujras* on the northern façade.

Due to the illegally built shops adhering to the northern side of the mosque, the original rain spouts running in the wall of the mosque have ceased to function. As a result, water infiltrates into the renderings and the surface decorations of the façade. Again, their effect is extremely detrimental to the northern façade due to its comparatively reduced direct exposure to the sun.

Lesser natural causes are the exposure, or lack of it, to the sun, diurnal temperature changes and the temperature and moisture variations between seasons.

WAZIR KHAN MOSQUE
KASHIKARI PANELS CATALOGING AND RECORDING SCHEME

SE-1 (East Elevation)						
A	B	C	D	E	F	G
SE-1-CP201						
SE-1-CP202						
SE-1A-DP101	SE-1B-DP101	SE-1C-DP101				
SE-1A-DP102	SE-1B-DP102	SE-1C-DP102				
SE-1A-DP103	SE-1B-DP103	SE-1C-DP103				
SE-1A-DP104	SE-1B-DP104	SE-1C-DP104				
SE-1A-DP105	SE-1B-DP105	SE-1C-DP105				
SE-1A-DP106	SE-1B-DP106	SE-1C-DP106				
SE-1A-DP107	SE-1B-DP107	SE-1C-DP107				
SE-1A-DP108	SE-1B-DP108	SE-1C-DP108				
SE-1A-DP109	SE-1B-DP109	SE-1C-DP109				
SE-1A-DP110	SE-1B-DP110	SE-1C-DP110				
SE-1A-DP111	SE-1B-DP111	SE-1C-DP111				
SE-1A-DP112	SE-1B-DP112	SE-1C-DP112				
SE-1A-DP113	SE-1B-DP113	SE-1C-DP113				
SE-1A-DP114	SE-1B-DP114	SE-1C-DP114				
SE-1A-DP115	SE-1B-DP115	SE-1C-DP115				
SE-1A-DP116	SE-1B-DP116	SE-1C-DP116				
SE-1A-DP117		SE-1C-DP117				
SE-1A-DP118		SE-1C-DP118				
SE-1A-DP119		SE-1C-DP119				
SE-1A-DP120		SE-1C-DP120				
SE-1A-DP121		SE-1C-DP121				
SE-1A-DP122		SE-1C-DP122				
SE-1A-DP123		SE-1C-DP123				
SE-1A-DP124		SE-1C-DP124				
SE-1A-DP125		SE-1C-DP125				
SE-1A-DP126		SE-1C-DP126				
SE-1A-DP127		SE-1C-DP127				
SE-1A-DP128		SE-1C-DP128				
SE-1A-DP129		SE-1C-DP129				
SE-1A-DP130		SE-1C-DP130				
SE-1A-DP131		SE-1C-DP131				
SE-1A-DP132		SE-1C-DP132				
SE-1A-DP133						
SE-1A-DP134						
			SE-5D-DP116			
			SE-5D-DP117			
			SE-5D-DP118			
SE-6 (Section AA, looking north)						
A	B	C	D	E	F	G
SE-6A-DP101	SE-6B-DP101	SE-6C-DP101	SE-6D-DP101			
SE-6A-DP102	SE-6B-DP102	SE-6C-DP102	SE-6D-DP102			
SE-6A-DP103	SE-6B-DP103	SE-6C-DP103	SE-6D-DP103			
SE-6A-DP104	SE-6B-DP104	SE-6C-DP104	SE-6D-DP104			
SE-6A-DP105	SE-6B-DP105	SE-6C-DP105	SE-6D-DP105			
SE-6A-DP106	SE-6B-DP106	SE-6C-DP106	SE-6D-DP106			
SE-6A-DP107	SE-6B-DP107	SE-6C-DP107	SE-6D-DP107			
SE-6A-DP108	SE-6B-DP108	SE-6C-DP108	SE-6D-DP108			
SE-6A-DP109	SE-6B-DP109	SE-6C-DP109	SE-6D-DP109			
SE-6A-DP110	SE-6B-DP110	SE-6C-DP110	SE-6D-DP110			
SE-6A-DP111	SE-6B-DP111	SE-6C-DP111	SE-6D-DP111			
SE-6A-DP112	SE-6B-DP112	SE-6C-DP112	SE-6D-DP112			
	SE-6B-DP113	SE-6C-DP113	SE-6D-DP113			
	SE-6B-DP114	SE-6C-DP114	SE-6D-DP114			
		SE-6C-DP115				
		SE-6C-DP116				
		SE-6C-DP117				
		SE-6C-DP118				
SE-7 (Section AA, looking south)						
A	B	C	D	E	F	G
SE-7A-DP101	SE-7-CP201			SE-7E-DP101	SE-7F-DP101	
SE-7A-DP102	SE-7-CP202			SE-7E-DP102	SE-7F-DP102	
SE-7A-DP103	SE-7B-DP101		SE-7D-DP101	SE-7E-DP103	SE-7F-DP103	
SE-7A-DP104	SE-7B-DP102		SE-7D-DP102	SE-7E-DP104	SE-7F-DP104	
SE-7A-DP105	SE-7B-DP103		SE-7D-DP103	SE-7E-DP105	SE-7F-DP105	
SE-7A-DP106	SE-7B-DP104		SE-7D-DP104	SE-7E-DP106	SE-7F-DP106	
SE-7A-DP107	SE-7B-DP105		SE-7D-DP105	SE-7E-DP107	SE-7F-DP107	
SE-7A-DP108	SE-7B-DP106		SE-7D-DP106	SE-7E-DP108	SE-7F-DP108	
SE-7A-DP109				SE-7E-DP109	SE-7F-DP109	
SE-7A-DP110				SE-7E-DP110	SE-7F-DP110	
SE-7A-DP111				SE-7E-DP111	SE-7F-DP111	
SE-7A-DP112				SE-7E-DP112	SE-7F-DP112	
SE-7A-DP113				SE-7E-DP113		
SE-7A-DP114				SE-7E-DP114		
SE-8 (Section EE, looking east)						
A	B	C	D	E	F	G
SE-8A-DP101	SE-8B-DP101	SE-8-CP201			SE-8F-DP101	SE-8G-DP101
SE-8A-DP102	SE-8B-DP102	SE-8-CP202			SE-8F-DP102	SE-8G-DP102
SE-8A-DP103	SE-8B-DP103	SE-8C-DP101	SE-8D-DP101	SE-8E-DP101	SE-8F-DP103	SE-8G-DP103
SE-8A-DP104	SE-8B-DP104	SE-8C-DP102	SE-8D-DP102	SE-8E-DP102	SE-8F-DP104	SE-8G-DP104
SE-8A-DP105	SE-8B-DP105	SE-8C-DP103	SE-8D-DP103	SE-8E-DP103	SE-8F-DP105	SE-8G-DP105
SE-8A-DP106	SE-8B-DP106	SE-8C-DP104	SE-8D-DP104	SE-8E-DP104	SE-8F-DP106	SE-8G-DP106
SE-8A-DP107	SE-8B-DP107	SE-8C-DP105	SE-8D-DP105	SE-8E-DP105	SE-8F-DP107	SE-8G-DP107
SE-8A-DP108	SE-8B-DP108	SE-8C-DP106		SE-8E-DP106	SE-8F-DP108	SE-8G-DP108
	SE-8B-DP109	SE-8C-DP107		SE-8E-DP107	SE-8F-DP109	
	SE-8B-DP110	SE-8C-DP108		SE-8E-DP108	SE-8F-DP110	
	SE-8B-DP111	SE-8C-DP109		SE-8E-DP109	SE-8F-DP111	
		SE-8C-DP110		SE-8E-DP110		
		SE-8C-DP111		SE-8E-DP111		
		SE-8C-DP112		SE-8E-DP112		
		SE-8C-DP113		SE-8E-DP113		
		SE-8C-DP114		SE-8E-DP114		
		SE-8C-DP115		SE-8E-DP115		
		SE-8C-DP116		SE-8E-DP116		



i. Glazed Tile

There are 637 individual panels of glazed ceramic *kashikari* tile work in the Wazir Khan Mosque. The documentation and analysis work being described in this report has identified and catalogued each one of these panels, such that it carries a unique identification code. As each of these panels is recorded it is subjected to meticulous analysis and separation of the various kinds and degrees of damage. This is a considerable task, and is likely to be progressive work which will continue into the foreseeable future. However, the present analytic results will help set up a pilot conservation and restoration project, the success of which will guide us into more extensive stages of glazed tile conservation.

Further resources are needed to be applied until the work on documentation and analysis already started and completed for some eleven of these panels is completed. The ongoing work includes the following:

1. Photographing and orthorectifying the photographs: many panels particularly on the sides of the *minars* that look in directions away from the monument, and parts of the north elevation have yet to be photographed;
2. Drawing up precise closed vector polygons of each piece of tile that makes up a panel: this is carried out by tracing over each tile using a CAD /orthorectified photograph interface;
3. Analysing each tile panel and establishing the extent of the various types of damage;
4. Quantifying the damage and drawing up the total area of each type of damage;
5. Assessing each panel for the degree of intervention to be taken up, based on risk management criteria, on decisions relating to the intensity of damage already sustained and the degree of manageable aging and patina, and arriving at more precisely defined interventions in the tile mosaics.

The most common damage to the glazed tiles revetment is various forms of disintegration: layering, exfoliation, loss of bonding, etc. Aging, lack of maintenance, rain water, biological growth and bird excrement are the main cause of this damage. The degree of damages to the glazed tiles varies from location to location.

The threats and damage processes are of two basic types:

1. Disintegration of materials. This class of damage ranges across an array of conditions:
 - Exfoliation and partial loss of glaze,
 - Complete loss of glaze,
 - Spalling/pitting of terracotta base,
 - Breakout and complete loss of tile,
 - Detachment of tile and base mortar from the wall,
 - Complete loss of tile and base mortar.
2. Surface changes:
 - Discoloration of glaze,
 - Deposits of dust and biofilm,
 - Heavy deposits and encrustation of biofilm (lichen, algae, microspores, cyanobacteria etc),
 - Dampness on façade surface.

These conditions are illustrated in section 10.10 (p.143), using some of the panels that have been documented and analysed in detail. The painstaking and slow process of this documentation and analysis is an ongoing one, and will continue for at least one year, before all the areas with glazed tile revetment have been covered.

Concurrently with particular respect to the *kashikari* work, it is important to set up a monitoring programme which measures the rate of deterioration of the historic tiles. This monitoring regime should be made a part of the new institutional and maintenance regime to be set up for the post-conservation care and upkeep of the monument.

Opposite: Minar elevation indicating unique codes ascribed to each tile panel.



ii. Plaster renders and *Tazakari*

Plaster renders are especially vulnerable to the natural causes described above. Plaster renders that carry the decorative craft known as *tazakari* (incised faux brickwork) are susceptible to a combination of discoloration by rainwater, particularly washing away of pigment in poor quality red ochre used in the outer skin, and discoloration by biological causes. Beyond discoloration, the outer pigmented layer is the first to disengage, pointing to the need for effective keying and mechanical bonding and the degree of chemical bonding achieved of the coloured layer to the base layer. From this first exfoliative effect, the process of the loss of the two or three layers of the plaster render to the exposure of the base brickwork is seen in various stages in all parts of the mosque, and is shared by zones where the render is used without the *tazakari* work.

The recent use of materials such as white cement to accelerate the work process also activates the cement's salt content to effloresce in combination with water leaching from the roof and outer walls, resulting in ugly white patches on the under-surfaces of the domes and ceilings, where rainwater penetration is significant.



iii. Glazed tiles interlaced with unglazed terracotta lattices

This form of glazed tile work has suffered consistent damage in the form of the loss of the glazed tile elements, while the terracotta lattice or filigree work in which the glazed tiles are embedded has survived with lesser damage.

The main reason for this could be ascribed to the loss of bond between the tile and the mortar bed in which it is embedded. This in turn is caused by the lack of an effective seal between the glazed tile and the surrounding terracotta elements which allow rain water to penetrate into the mortar, causing chemical changes in the mortar over the long term, eventually leading to loss of cohesion and detachment of the tile. An added factor is the fact that the terracotta lattice work is relatively more porous than the glazed tile, and water interacting with salt ions can be retained for longer periods.

Left, top: Jalli work in the Level 2 southern pavilion of the Calligraphers' Bazaar.

Left: Broken pieces of jalli work discarded on the roof of the Calligraphers' Bazaar.

iv. Terracotta *jalli* work

Except for some instances of bio-film, the perforated terracotta *jalli* work is in relatively good condition on the parapet surrounding the ambulatory at the top of the *minars*. This may be on account of the airiness of the locations where it is used and its exposure to sun and good drying conditions. Elsewhere (in the axial pavilions and in the Calligraphers' Bazaar) its condition has been subject to weathering and wear and tear caused by use, repairs such as covering over with red ochre paint, and in the latest version of repairs covering over with white lime "*pucca qal'i*".

In the Calligraphers' Bazaar the *jalli* work is part of the balustrade looking into the *dewrhi* and in the openings from the central *dewrhi* building looking into the bazaars. This balustrade has been rebuilt in *pucca qal'i* and / or treated with *pucca qal'i*, turning its appearance into white. The pavilions at Level 2 at either end of the bazaar still contain original terracotta *jalli* work, but these have been generally poorly treated over the decades and in need of some cleaning up and reconditioning. Broken pieces of old or reordered terracotta screen work were found strewn over the roof of the Calligraphers' Bazaar (Level 2).

9.3.2 THREATS TO INTERIORS

Most of the damage to the interior spaces and surface decorations are due to neglect and lack of maintenance. Many of the *hujras* in the courtyard are not functional and have rarely been opened since their use as storage for junk materials associated with past restoration projects. Adapting these small rooms for the storage of unused building materials and discarded items of daily use has already damaged the building fabric and interior, and is likely to cause further damage. The majority of the threats to the interior finishes of the prayer chamber are directly related to the damages on the roof and domed surface of the structure.

The use of conduits on the roof of the mosque, laid when electricity was introduced, is the other threat to the interior. At many locations it can be observed that there is incomplete, inadequately designed, and badly detailed and executed conduiting. This has had many damaging effects on the fabric of the mosque.

i. Frescoes

Most of the interior, in particular of the prayer chamber in its entirety, is rendered in elaborate fresco, in calligraphic wall scrolls and in decorative floral and arboreal motifs, some of which have profound symbolological and connotative significance.⁴⁶ These have been repainted/restored several times and are now left with no visible original work. Use of cement-based grouts during past repair of structural cracks have provided a path for water to travel inside and have resulted in the presence of crystallized salts (efflorescence) on the surface of the frescoes. This process of the fragmentation of the lime renders and with it the deterioration of the fresco work could be surmised to be the historical reason for the abnormal high rate of fresco repairs and restoration and the consequent loss of authenticity seen in the interiors.

Mechanical threats like the puncturing of walls, chipping of corners, insertion of nails on decorative features and storing disproportionately large items in small spaces are the most common threats to the interiors and the building fabric of the mosque.

ii. Plaster Renders

In secondary areas of the mosque, such as the *hujras* and the shops below, there is considerable neglect of upkeep and the plaster renders, many of which bear traces of lost fresco work, are in various stages of disrepair and loss. The loss due to rising damp, including damp penetration caused by rain water or wash water splashing from the courtyard floor or damp penetrating the walls from the exterior, results in varying degrees of salt crystallization, exfoliation, disengagement and falling off to be seen in various places in the complex.

9.4 DAMAGE, WEATHERING AND DETERIORATION

An attempt has been made to arrive at a classification of the various types of threats and damage. This is illustrated in the following table. In each of the ensuing pages a particular class of threat or damage is illustrated by means of several photographs.



Above: Washing the floor with piped water under pressure, an activity unknown to the 17th century builders of the monument. Note the damp rising up the wall and the plaster render with the precious wall painting breaking out under the force of the stream of water.

DOCUMENTATION OF INSTANCES OF DAMAGE, WEATHERING AND DETERIORATION

[illegible]

NORTHERN ROW OF <i>HUJRAS</i>										NORTH AXIAL PAVILION										SOUTHERN ROW OF <i>HUJRAS</i>										SOUTH AXIAL PAVILION										<i>MINARS</i>											
(Primary Elements)					Surface & Decorative Treatment					(Primary Elements)					Surface & Decorative Treatment					(Primary Elements)					Surface & Decorative Treatment					(Primary Elements)					Surface & Decorative Treatment																
Foundations	Walls	Spans	Floors	Roofs	<i>Kashikari</i>	Plaster render	<i>Tazakari</i>	Interior (frescoes)		Foundations	Walls	Spans	Floors	Roofs	<i>Kashikari</i>	Plaster render	<i>Tazakari</i>	Interior (frescoes)		Foundations	Walls	Spans	Floors	Roofs	<i>Kashikari</i>	Plaster render	<i>Tazakari</i>	Interior (frescoes)		Foundations	Walls	Spans	Floors	Roofs	<i>Kashikari</i>	Plaster render	<i>Tazakari</i> (NE minar only)	Interior (frescoes)													
																																												Mechanical damage	DAMAGE RESULTING FROM UNDESIRABLE USES & INTERVENTIONS						
																																												Vandalism							
																																												Loss of Structural elements e.g. brickwork	DAMAGETO STRUCTURAL ELEMENTS						
																																												Structural cracks							
																																												Deformation							
																																												Loss of cohesion	DAMAGETO SURFACE & DECORATIVE TREATMENTS						
																																												Detachment of plaster render							
																																												Loss of adhesion							
																																												Spalling							
																																												Pitting and Minor Cracks							
																																												Exfoliation							
																																												Salt Crystallisation & Efflorescence							
																																												Rising damp from floors & subfloors or ingress of rain water							
																																												Biological Colonisation or Higher Plants							
																																												Chromatic changes							



DISCOLOURATION

Three examples of discolouration, biological deposits and dust on various surfaces of the exterior.

Top Left: Discolouration and fading of exterior plaster render and tazakari work on the courtyard façade of the entrance dewrhi.

Above: Deposits of soil, dust and micro-algae on the northern façade of the southern axial pavilion.

Left: A similar process is occurring on the façade of the prayer chamber facing north.

MECHANICAL DAMAGE (opposite)

Instances of mechanical damage occasioned by insensitive uses and installations.

Top left: Damage caused to the historic fresco work by careless and insensitive moving about of electric fans.

Top right: Installation of leaking water tanks on the roofs of the southern hujras.

Bottom left: Insensitive installation of electric distribution cables on the historic monument.

Bottom right: Insertion of water/gas pipes into the historic walls.



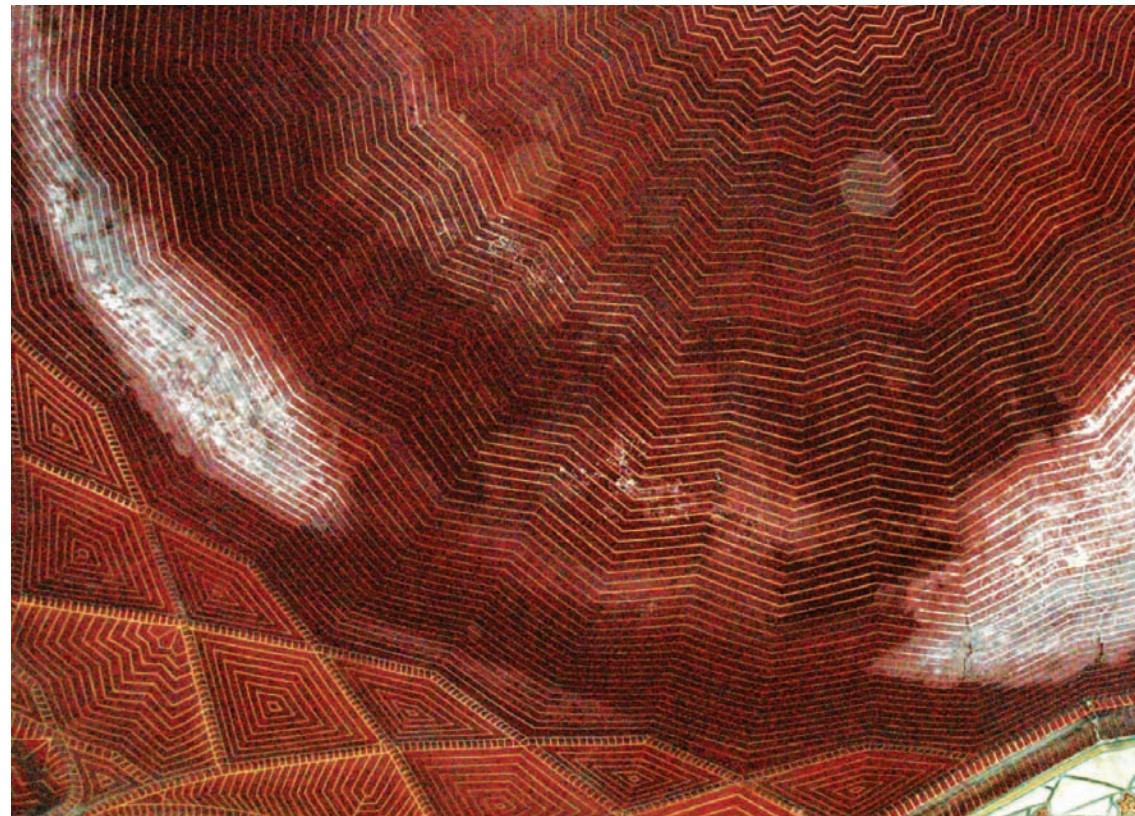
EFFLORESCENCE

Salt crystallisation / efflorescence occurs mainly at instances of water ingress from the exterior. But it is also caused by salts leaching from inappropriate materials used in repairs such as cement and white cement.

Salt crystallization results in the beginning of a process of disintegration of material at the finer grain.

Top: Efflorescence in the dome of the entrance dewrhi caused by rain water penetration through the structure.

Bottom: Efflorescence caused by the drying of render and the leeching of salts contained in inappropriate mortar.





BIOLOGICAL GROWTH

Top: At a microbial scale lichen and cyanobacteria begins a process of deterioration of lime based renders as well as porous left over of tile work after the glaze has exfoliated.

Left: Lack of vigilant maintenance can encourage higher order plants which cause mechanical degradation.



Puncturing of floor to accommodate fixtures such as metal hooks for tying shamiana ropes indicates the need for better and more appropriately located details.



Poor detailing of waste and storm water disposal grating.



Cutting up the patterned floor to accommodate a collector drain. A better and well distributed system of under floor drains is required.



Inappropriate use of materials to repair floor - in this case coloured cement / sand or coloured lime render.



Brick and fake brick markings on cement / sand or lime / sand renders create an unsatisfactory appearance. Note the subsidence crack on the right of the photograph.

EXAMPLES OF DIFFERENT TYPES OF DAMAGE TO THE COURTYARD FLOOR



Inappropriate use of cement/sand renders and over-grouting between bricks.



Erosion and disintegration of brick with surface wear.



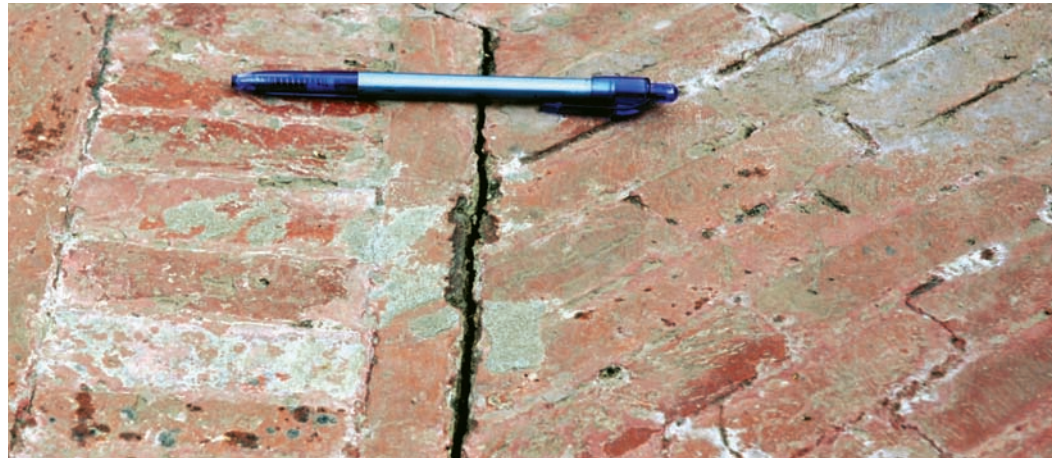
Faster rate of erosion of bricks with the inappropriate use of cement/sand renders used to achieve a water repellent surface.



Subsidence and inadequate repair at different levels.



Puncturing of floors for installment of drains, drain outlets and gratings indicate the need for better and more sophisticated detailing.



Major crack in the floor of the south-eastern part of the courtyard.



Major crack in the roof of the southern axial pavilion.



Major crack in the wall above the northern most archway of the prayer chamber.

EXAMPLES OF MAJOR STRUCTURAL CRACKS



Major crack in one of the domes of the chhatri above the entrance iwan.



Major crack in the vault of the northern most archway of the prayer chamber.



Erosion of mortar between the joints on the exposed surfaces of masonry.



Powdering of brick.



Sanding of mortar.

EXAMPLES OF LOSS OF COHESION



Peeling of upper coat of paint surface in the northern axial pavilion.



Partial loss of bond between tile and mortar.



Breakout of tile embedded in unglazed terracotta lattice.



Complete loss of bond between tile and mortar.



Peeling of the upper coat of surface render in the prayer chamber.

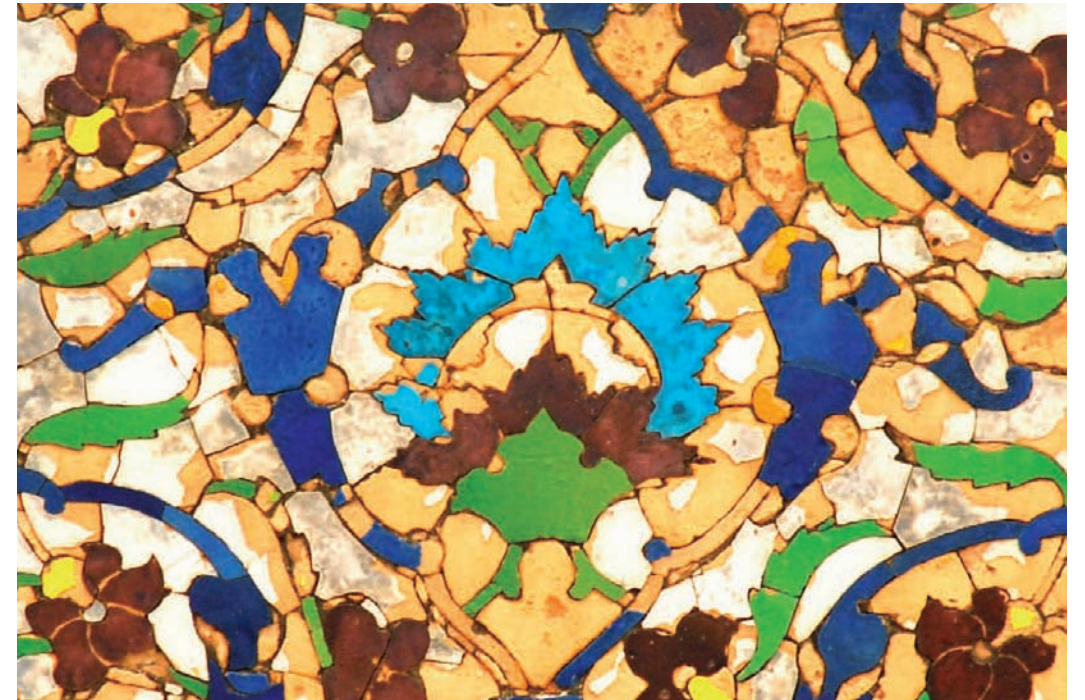


Advanced state of the deterioration of both mortar based external finishes such as faux brick and plain plaster render, as well as deterioration of crenellated tile work on the roof line of the north façade.

EXAMPLES OF LOSS OF ADHESION



Hairline cracks on the glazed surface of tiles. These cracks are sometimes indistinguishable from the fine joints of the cut-to-shape tiles, but could be the beginning of more advanced weathering processes.



Exfoliation of glaze from the terracotta body of the tile is the most common damage type on glazed tiles. In many instances concurrent existence of exfoliated glaze and tiles with glaze still intact presents a characteristic age-value of some interest and this situation could be one of the lower priority interventions to be addressed.

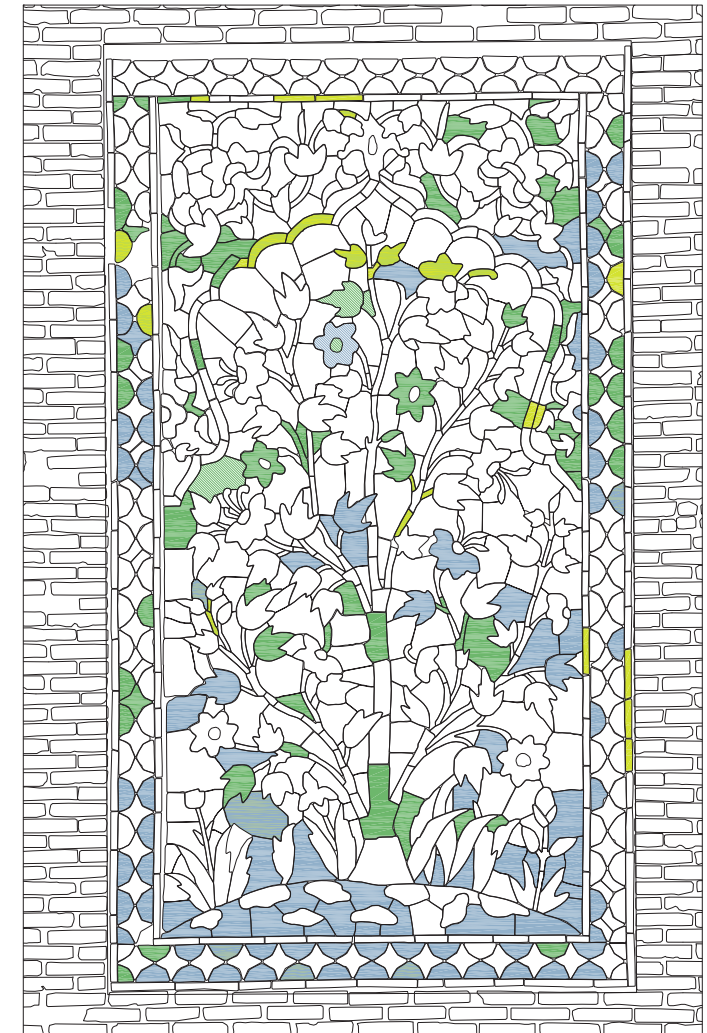
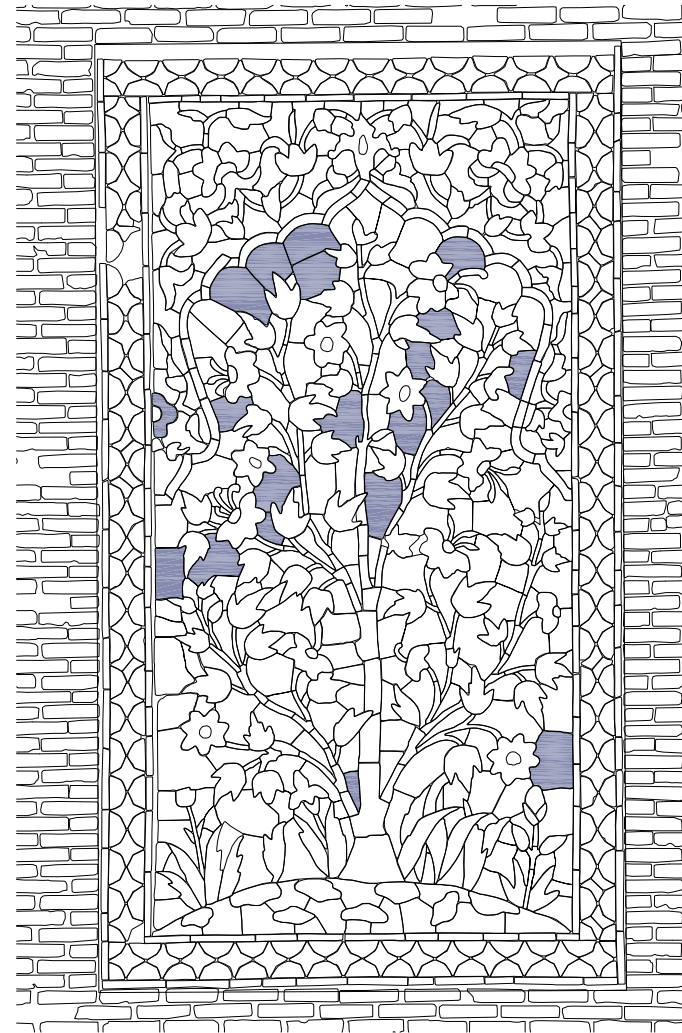


Pitting and spalling of thin layers of terracotta body of the tile. At this stage of deterioration, piece-meal replacement of sections of tile may be considered.



Advanced spalling of the core terracotta body of the tile.

EXAMPLES OF OTHER PROGRESSIVE FORMS OF WEATHERING AND DETERIORATION



0 20 40cm

SURFACE CHANGES

- Discoloration of glaze**
- Deposits of dust and biofilm**
- Heavy deposit and encrustation of biofilm (lichen, algae, microspores, cyanobacteria etc.)**

DISINTEGRATION OF MATERIAL

- Exfoliation and partial loss of glaze**
- Complete loss of glaze**
- Spalling/pitting of terracotta base**
- Breakout and complete loss of tile**
- Detachment of tile and base mortar from the wall**
- Complete loss of tile and base mortar**

DOCUMENTATION OF SURFACE CHANGES AND TILE DISINTEGRATION ON A SOUTH FACING KASHIKARI PANEL ON THE SOUTH-EASTERN MINAR

This arboreal and geometric south facing glazed tile panel on the south-eastern minar displays instances of discoloration of glaze, exfoliation of glaze from the terracotta body, complete loss of glaze from terracotta and spalling of tile body.



9.5 DAMAGE ANALYSIS OF INSTANCES OF EXTERIOR GLAZED TILE WORK

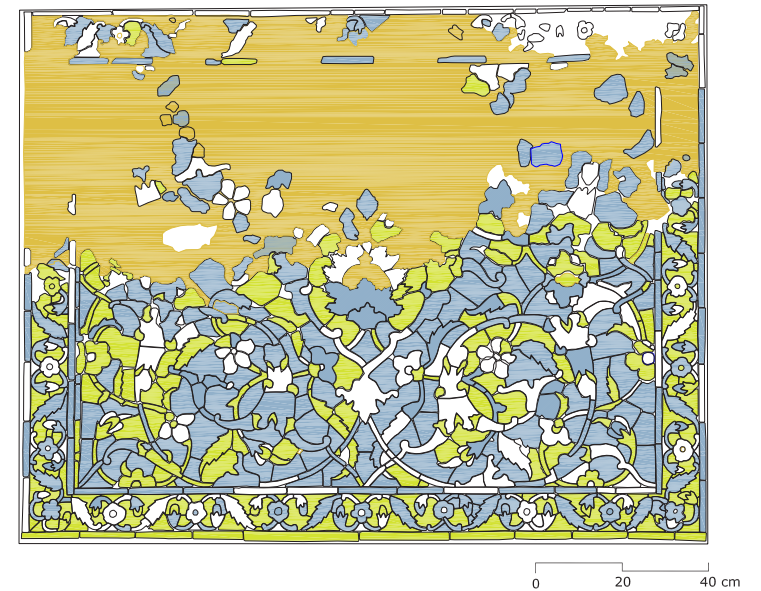
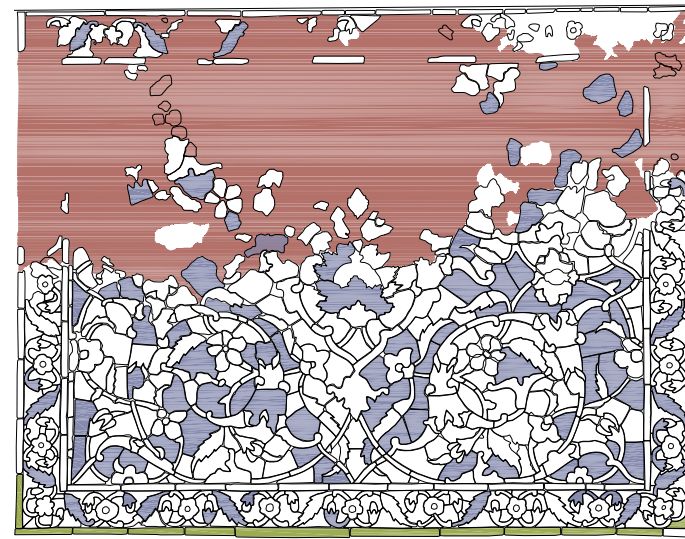
The illustrations on the page opposite and on the following two pages represent part of the process of analysis (described briefly in Section 9.3.1.i) of changes and damages sustained by the monument complex based on a categorization of various forms of weathering and other natural factors, as well as the effects of human use and handling of the monument. These changes, recorded at more general levels for various parts of the monument in the table on pages 130-31, are here recorded and analysed in detail for three specific panels of *kashikari*, two on the northern façade of the complex, and the third on the south-eastern *minar*.

The classification attempts to cover two main stages of changes that clearly appear: the first involving surface changes and the second pertaining to more substantive changes of progressive depth.

The surface changes observed ranged from slight discoloration and loss of chromatic quality, through deposits of dust and carbon particles (ranging from light to heavy), and long term infestation by algal colonies, which characteristically appear as dark brown to black stains covering large areas of the monument, chiefly on parts less exposed to the sun. These surface changes represent a combination of chemical factors deriving from biological and non-biological sources, the latter relating chiefly to the impact of air borne pollutants emanating from vehicle exhausts. The cracking of the glaze film manifested by hairline cracks appears to result naturally from the diurnal and seasonal temperature changes. In addition the non-biological or abiotic impacts of atmospheric pollutants can result in etching and pitting of the glazed tile surface, resulting in the penetration of water, the intrusion of algal colonization at the glaze and clay interface of the tile, accompanied by cyanobacterial colonization. The mechanics of biological decay of glazed tile has been demonstrated in certain scientific studies.⁴⁷ The biological sources in the Wazir Khan complex, on the other hand, are related to processes common on historic monuments in the subcontinent, and could comprise a host of algal taxa in combination with cyanobacterial species and strains, which behave differently in the hot dry and hot wet parts of the year in Pakistan and India.⁴⁸

The incipient changes described as surface changes give rise to more significant damage to the tile revetments, described under five categories that in fact represent gradual transformation of the glazed tile surface until the occurrence of the complete loss of the tile and its mortar under-bed. The earliest aspects of these changes, the exfoliation of the glaze, creates an age-value that could be the factor constraining us from aggressive “conservation” interventions. Pitting and spalling of the terracotta body under the glaze represents the first serious area of intervention, opening up the loci of significant scales of intervention. These could involve completion of the lost parts of a panel. Such reconstruction may or may not be carried out using tiles that attempt to recreate the complete panel, This could well involve tile glazed a specific tone of colour or even blank glazed tiles to distinguish the 17th century work from contemporary work, even if the evidence for a reconstruction exists. Tile panels that are detached from the base masonry could be re-anchored to the latter using appropriate grouts.

As stated previously the analysis of tile damage represented in these pages is a slow and laborious process the progression of which will produce the raw material for informing decisions such as those described in the previous paragraph.



SURFACE CHANGES

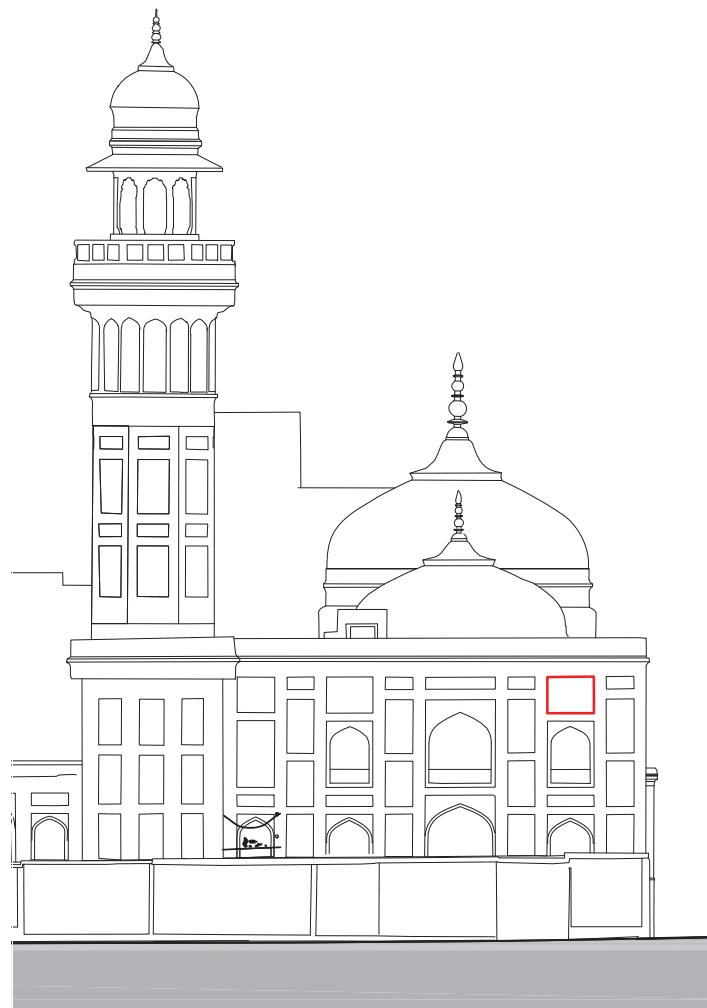
- Discoloration of glaze**
- Deposits of dust and biofilm**
- Heavy deposit and encrustation of biofilm (lichen, algae, microspores, cyanobacteria etc.)**

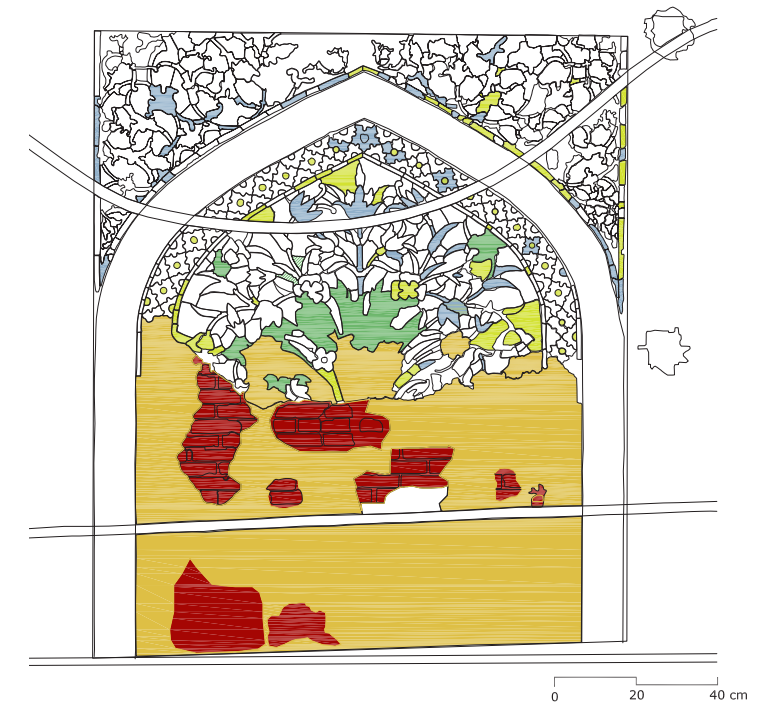
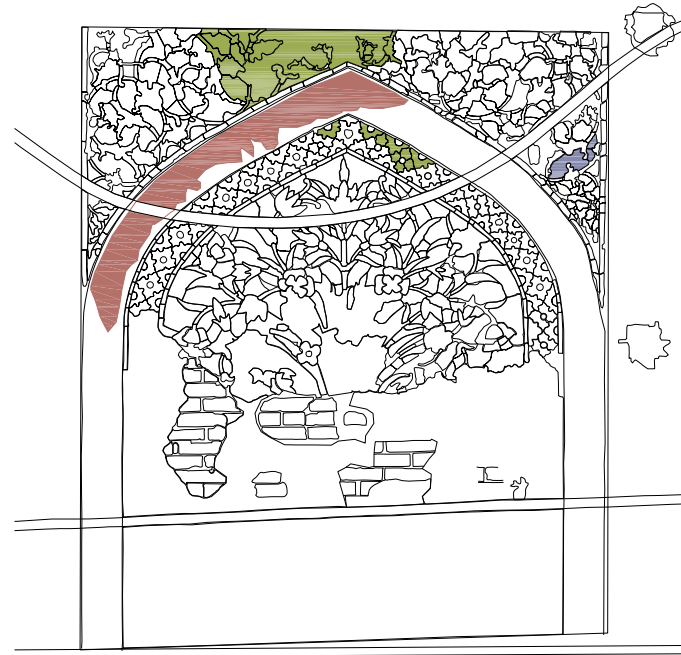
DISINTEGRATION OF MATERIAL

- Exfoliation and partial loss of glaze**
- Complete loss of glaze**
- Spalling/pitting of terracotta base**
- Breakout and complete loss of tile**
- Detachment of tile and base mortar from the wall**
- Complete loss of tile and base mortar**

DOCUMENTATION OF SURFACE CHANGES AND TILE DISINTEGRATION OF A PANEL ON THE NORTHERN FAÇADE OF THE PRAYER CHAMBER

This floral /geometric glazed tile panel on the north façade of the prayer chamber, is located above Kotwali Bazaar. It displays instances of discoloration of glaze, deposits, complete loss of tiles and base mortar, exfoliation of glaze from the terracotta body, complete loss of glaze from terracotta and spalling of tile body.



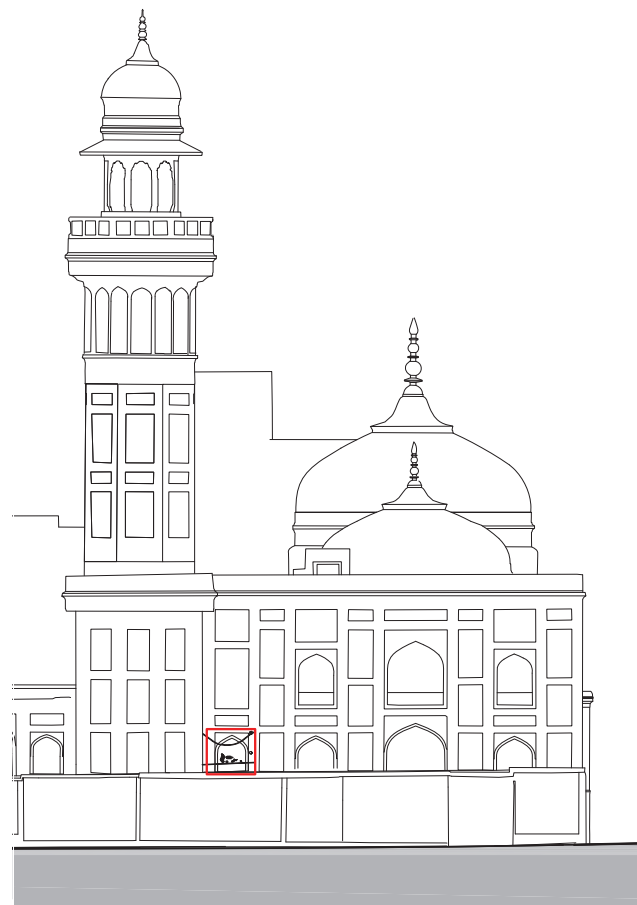


SURFACE CHANGES

- Discoloration of glaze**
- Deposits of dust and biofilm**
- Heavy deposit and encrustation of biofilm (lichen, algae, microspores, cyanobacteria etc.)**

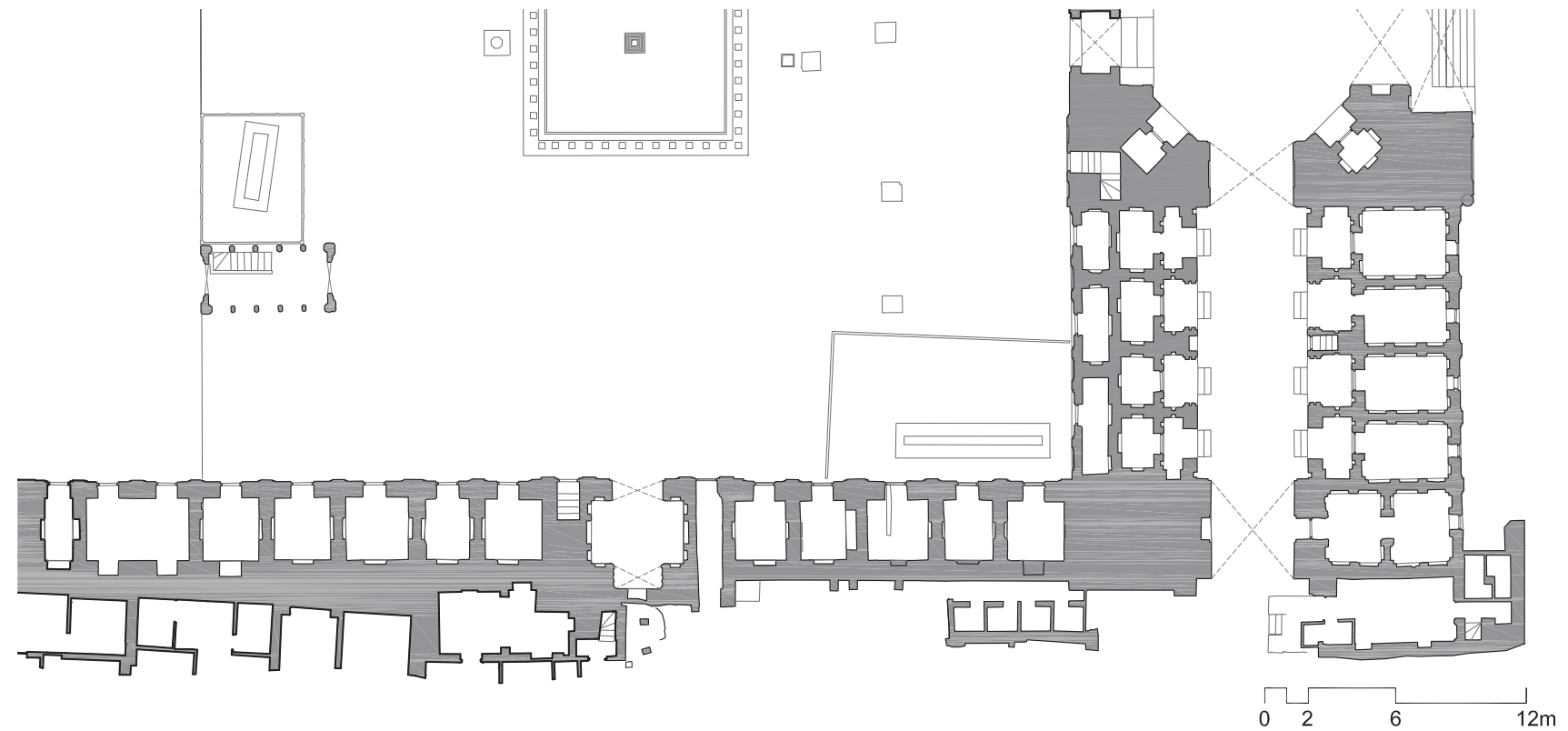
DISINTEGRATION OF MATERIAL

- Exfoliation and partial loss of glaze**
- Complete loss of glaze**
- Spalling/pitting of terracotta base**
- Breakout and complete loss of tile**
- Detachment of tile and base mortar from the wall**
- Complete loss of tile and base mortar**



DOCUMENTATION OF SURFACE CHANGES AND TILE DISINTEGRATION ON THE NORTHERN FAÇADE OF THE PRAYER CHAMBER

This arboreal glazed tile panel on the north façade of the prayer chamber, is located directly above the roofs of the shops on Level 0 and thus has suffered from the damages associated with Kotwali Bazaar. It displays instances of deposits, complete loss of tiles and base mortar, exfoliation of glaze from the terracotta body, complete loss of glaze from terracotta and spalling of tile body.



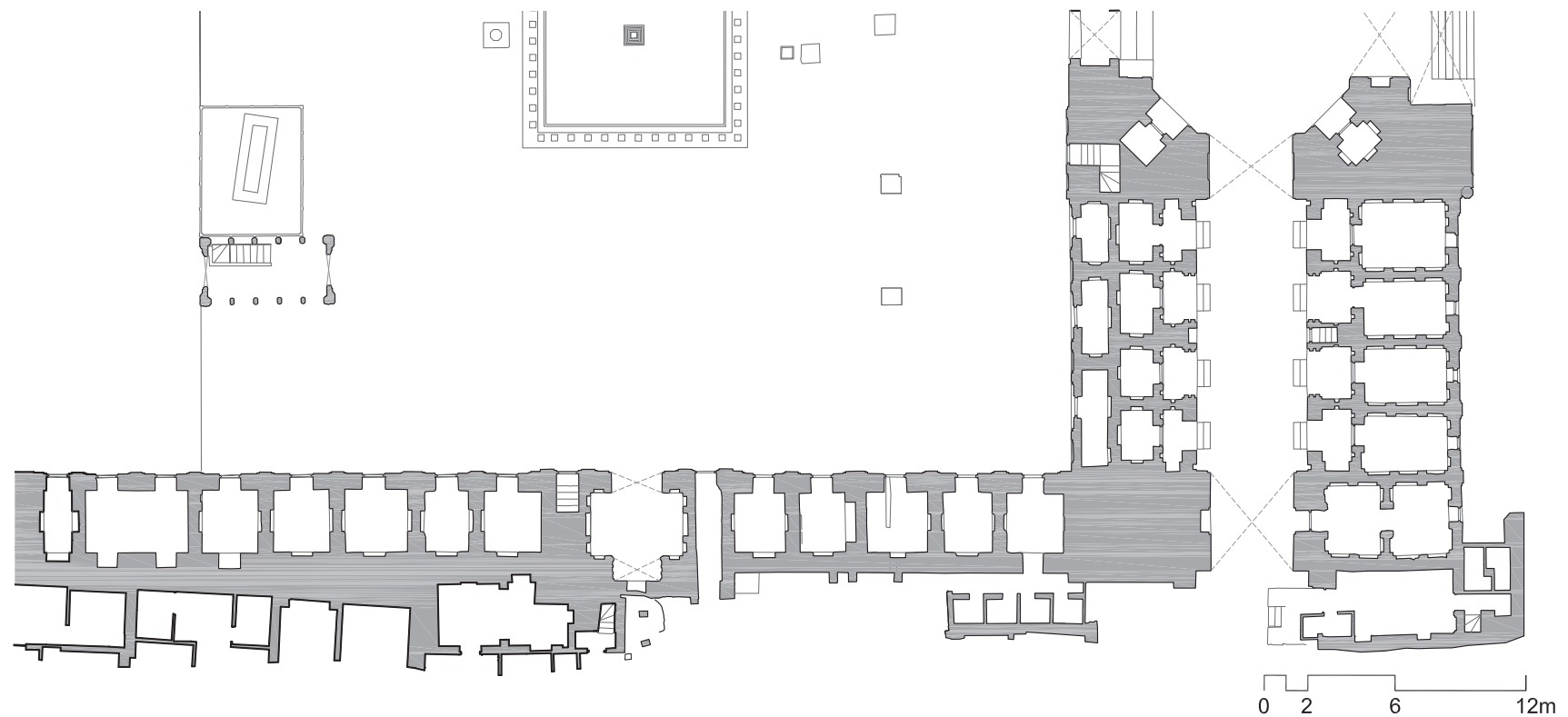
PLANS SHOWING CHANGES IN THE SOUTH-EASTERN CORNER OF THE MOSQUE COURTYARD

Top: Showing the ablution facility in the south-eastern corner, and the adjacent hujra (the first on the southern row) which at that time was still intact.

Below: The ablution facility after removal, and the passageway created through the hujra to the latrines located outside.

Opposite, top: The ablution facility before removal (seen from the north-west).

Opposite, below: The south-eastern corner of the courtyard, after the removal of the ablution facility, but before commencement of excavations.



10 CHANGES TO THE MOSQUE SINCE DOCUMENTATION

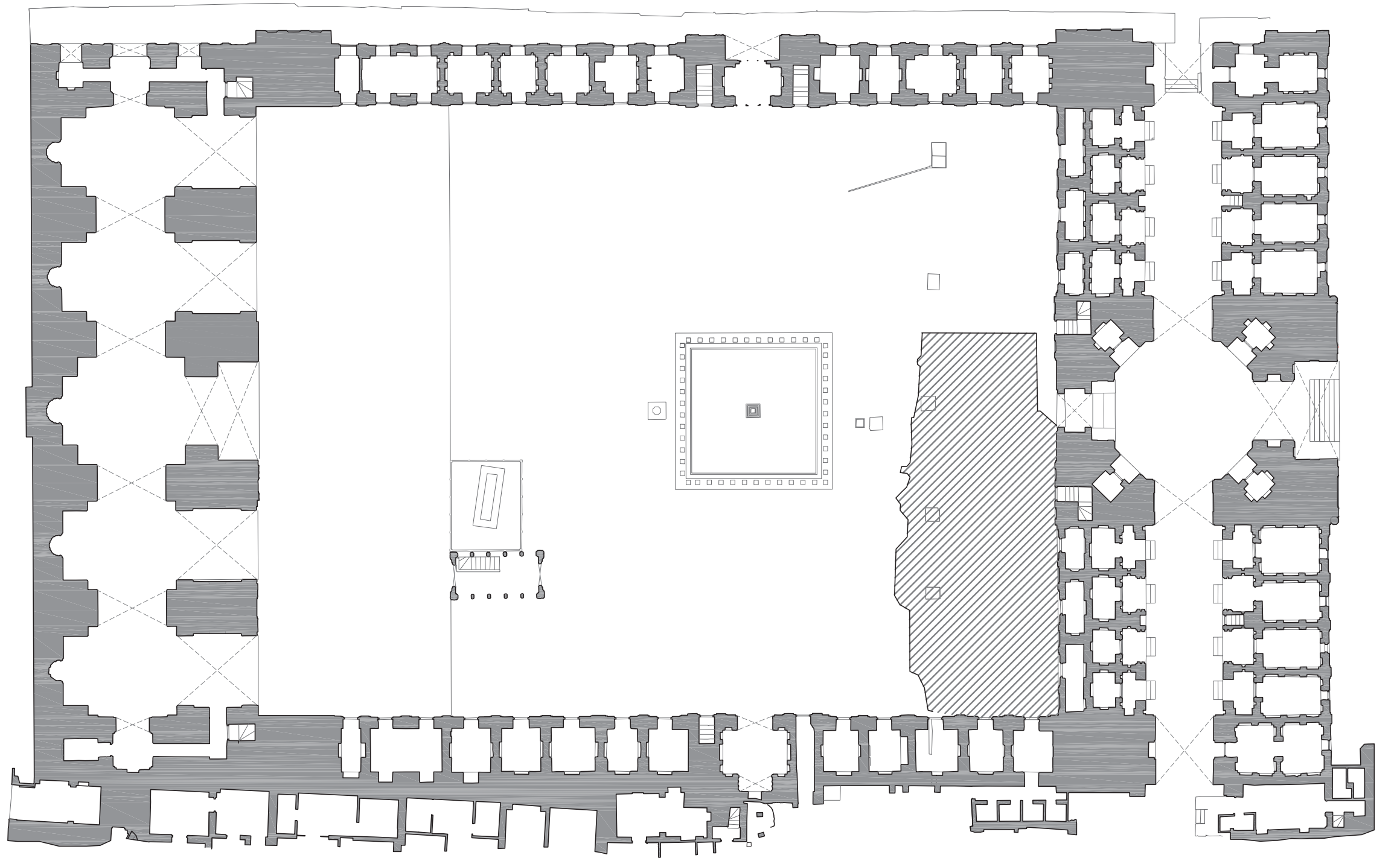
1. An important intervention made in the mosque some years ago was the reconstruction of the central ablution pond in the centre of the courtyard. At the same time a secondary ablution facility (now removed) was built in the south-eastern corner of the courtyard. On the other side of the row of the southern *hujras* exists the Auqaf established row of toilets. The sharp subsidence of the eastern half of the row of *hujras* on the south side is evidence of the abundant water seepage that has been the consequence of these two facilities on the southern and northern side of the *hujras*. In addition, in recent months, the courtyard floor on the south-eastern side has also shown a considerable subsidence. The outcry caused by this has resulted in a repair operation which is described below.
2. Another change brought about recently is the creation of a new access into the mosque courtyard from the southern side, i.e. from the proximity of the present toilet block. This was achieved by opening up an entrance portal in the external wall of the first *hujra* from the east in the southern flank of the courtyard.
3. In April 2011, the Punjab Archaeology Department commenced dismantling a portion of the courtyard of the mosque. This activity was aimed at addressing the subsidence of the courtyard floor, mentioned above.

In a meeting at the site held on 19th April, 2011 between the Director General, Punjab Archaeology Department, the Director General, PMU Sustainable Development of the Walled City of Lahore and representatives of AKTC-AKCSP, the removal of the historic lime sub-floor by the Archaeology Department was discussed. The Archaeology Department representative mentioned that the Department intended to repair the courtyard floor by replacing the sub-floor by cement concrete. In the discussion which followed, it was agreed that the Department will substitute the cement concrete base with lime and kankar lime mix to be as authentically close to the original base concrete as possible.

It was also decided to use the opportunity to explore the depth of the foundations of the *hujra* wing on the southern side of the courtyard.

The expanse of the courtyard floor removed by the Punjab Archaeology Department was documented as were the depth of the excavations. This is shown overleaf.

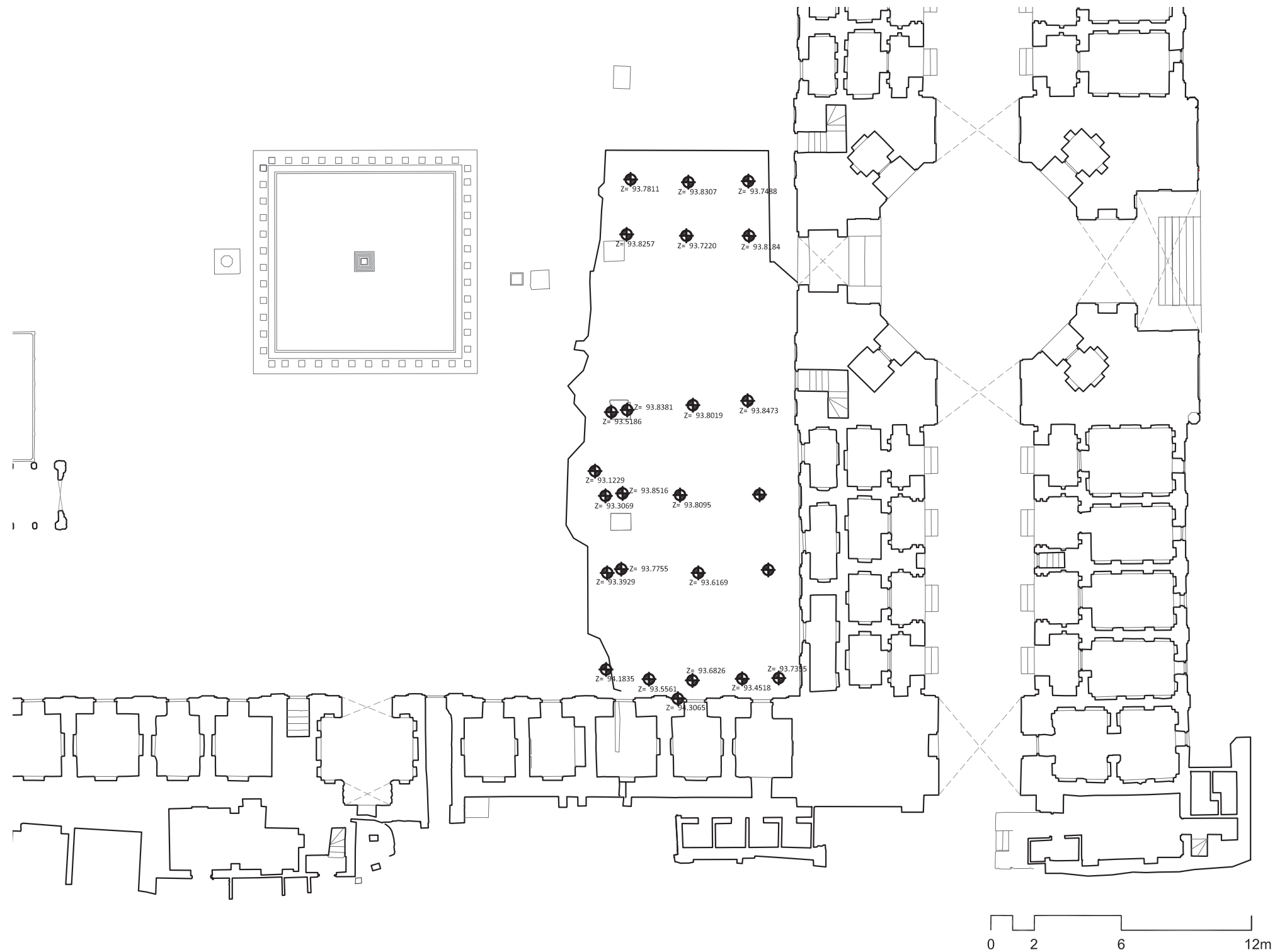




PLAN SHOWING AREA OF EXCAVATION IN THE SOUTH-EASTERN CORNER
OF THE MOSQUE COURTYARD



View from the north-west minar of the excavation work in the south-east corner of the courtyard.



PLAN SHOWING EXCAVATIONS AND THEIR DEPTHS
AT VARIOUS LOCATIONS



Close-up view of the excavation work.

ENDNOTES

1. This would hold true for the country as a whole. The pioneering documentation effort carried out by the Conservation and Rehabilitation Centre for the city and the monuments of Uch, District Bahawalpur, and the conservation process that followed it is perhaps the only glaring exception.
2. Chaghatai, Abdullah, (1975) *The Wazir Khan Mosque, Lahore*. Lahore: Kitab Khana-i-Nauras.
3. See in particular, Chaghatai, op. cit.
4. International Council of Monuments and Sites (ICOMOS) is an international non-governmental organization of professionals, dedicated to the conservation of the world's historic monuments and sites. The relevant documents are: (i) the International Charter for the Conservation and Rehabilitation of Monuments and Sites, 1964 (the Venice Charter), (ii) the Charter for the Conservation of Historic Towns and Urban Areas, 1987 and (iii) ICOMOS Charter - Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage, 2003.
5. The United Nations Educational, Scientific and Cultural Organization (UNESCO).
6. $\pm 3\text{mm}$.
7. Reflectorless Electromagnetic Distance Measurement.
8. The software used was TheoLT by Latimer CAD of UK.
9. The software used was Manual TREXtify by Bjorn Van Genechten, Catholic University Leuven, Belgium.
10. Chaghatai, Abdullah, (1975) *The Wazir Khan Mosque, Lahore*. Lahore: Kitab Khana-i-Nauras.
11. Kamil Khan Mumtaz has published on his website an article titled "Reading Masjid Wazir Khan". In this erudite interpretation of the calligraphy of the Wazir Khan Mosque, he links the use of the Surat-al Fath on the main façade of the prayer chamber to the graphic illustration of an event in the life of Prophet Muhammad (PBUH) in the fresco on the entrados of the first secondary arch on the northern half of this façade, as one instance of the use of calligraphy in Islamic architecture to illustrate esoteric meaning and imbue to architecture the role of a vehicle of transcendence from the material to the spiritual. (www.kamilkhanmumtaz.com)
12. Qureshi, Muhammad Abdullah, (1962) "*Masaajid: Ahd-e-Ghazvanvi se zamana - e - haal tak*". The author states that in 1850 the British administration cleared out encroached houses and buildings built during the Sikh rule from Chowk Wazir Khan. Illegal occupation by shops were removed at least twice over the course of the last 150 years: the first during the early British period, and the second in 1953 soon after religious disturbances and the declaration of Martial Law in that year.
13. The Antiquities Act (1975).
14. Kanhaiyya Lal Hindi, (1884) *Tarikh-e-Lahore*. Lahore: Victoria Press. Latif also mentions the epigraphic tablets on the two monuments, the dates and the circumstances surrounding the constructions; however, Qureshi, has claimed that the dome was built earlier and had already undergone several transformations before the most recent one in 1990.
15. Aijazuddin, F.S. Lahore, (reprint:1991) *Lahore: Illustrated Views of the 19th Century*.
16. Latif, Syed Muhammad, (1892) in *Lahore, its History, Architectural Remains and Antiquities* offers the complete transcript of the plaque that existed on the structure demolished in 1990.
17. Photographed in the 1970's.
18. This well is evidenced by etchings and water colours produced in the 19th century, and by a photograph taken in the 1880's.
19. As recorded in 1988. See *Pakistan Environmental Planning and Architectural Consultants/Lahore Development Authority, Walled City of Lahore*, Lahore, 1992, reprinted and republished by Sustainable Development of the Walled City of Lahore, 2010.
20. The functioning open drain was part of a system of similar drains that ran along the sides of the streets all the way through Delhi Gate Bazaar to Delhi Gate, and which have likewise been closed, their function taken over by the main sewer in the bazaar.
21. Published in Latif, Syed Muhammad, (1892) *Lahore, its History, Architectural Remains and Antiquities*. Lahore: New Imperial Press.
22. Kanhaiyya Lal Hindi, (1884) *Tarikh-e-Lahore*. Lahore: Victoria Press.
23. Chaghatai, Abdullah, (1975) *The Wazir Khan Mosque, Lahore*. Lahore: Kitab Khana-i-Nauras.

24. Chaghatai, (1975) op. cit.
25. Numbers such as SE-05-X1 and SE-05-X2 are accorded by AKTC-AKCSP in their city wide inventory to properties that lack the normal number codes established during British times.
26. Chaghatai mentions that in the early seventies the well still existed and that water was being drawn from it using an electric motor. (1975, p.38)
27. From a comparison of the present situation with the 1907 cadastral map obtained from the Punjab Revenue Department.
28. Chaghatai, Abdullah, (1975) *The Wazir Khan Mosque, Lahore*. Lahore: Kitab Khana-i-Nauras.
29. The geotechnical investigations carried out by AKCSP were in the main restricted to the four *minars* and those parts of the foundations that could be accessed from within the courtyard.
30. Oral communication by Mr. Talib Hussain.
31. The 1907 cadastral map obtained from the Punjab Revenue Department clearly shows the drain in the south side of the mosque.
32. Authored in all probability by the late Wali Ullah Khan; the authority on which this statement is based is not known.
33. Evidence for this is found in numerous instances: Asif Khan's tomb, the upper structure of the Hazuri Bagh pavilion, the precious stones in the Naulakha pavilion and Shish Mahal of the Lahore Fort, etc.
34. Chaghatai, (1975) op. cit. Chaghatai recounts that once Maharaja Ranjit Singh became seriously ill after spending a morning of amusement on one of the *minars* of the mosque, but thereafter left the mosque alone after having been told that his illness was the consequence of his disgracing the mosque and the tomb of Syed Ishaq Gazruni.
35. Kanhaiyya, Lal Hindi. (1884) op. cit.
36. Chaghatai, (1975) op. cit.
37. Qureshi, (1962) op cit., mentions that the Auqaf Department was established in 1961.
38. These monuments were Badshahi Masjid, Lahore, Wazir Khan Masjid, Lahore, the tomb of Shah Rukn-e-Alam, Multan, the tomb of Bahau Uddin Zikarya, Multan and Shahi Masjid, Chiniot.
39. Established under Sir Sikandar Hayat Khan, Punjab Chief Minister in the early 1940s.
40. The progression of steel fabrication from simple knife making on the eastern side of the Chowk to large scale fabrication of steel architectural elements is a measure of the growing failure of municipal regulatory functions.
41. Lime mortar has the tendency to become stronger with the passage of time due to progressive carbonation of the lime. Lime mortar in historic buildings also has relatively low compressive strength and higher flexibility than other forms of mortar, absorbs seismic and thermal movement and protects the bricks from the effects of such movement. The fact that the basic construction module is the small *waziri* brick embedded in relatively thick mortar beds in the body of the walls also appears to have lent resilience to the building fabric. The size of the brick used in the masonry is 1.25 x 4 x 8 inches.
42. In the 1907 revenue map, the location of a manually excavated pit was occupied by a house.
43. Geotechnical investigations were carried out in August - September 2009 by Berkeley Associates of Lahore.
44. Please refer to Appendix B.
45. Chaghatai mentions the earthquake of 1902 in discussing the damage sustained by the mosque. This is supported by Dr. Wenzel (ibid.)
46. Mumtaz, op. cit.
47. Watanabe, K., Ohfuji, H., Ando, J., and Kitagawa, R., (2006) "*Elemental behaviour during the process of corrosion of sekishu glazed roof-tiles affected by crustose lichen*", Clay Minerals 41, p.p.819–826.
48. Samad, L.K., and Adhikary, S.B., (2008) "*Diversity of Micro-algae and Cyanobacteria on Building Facades and Monuments in India*", Algae Volume 23(2): p.p.91-114.