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فُتوگِرامتری
معماری

Architectural Photogrammetry

Shiraz University of Arts Architectural Photogrammetry Studio

Ali Asadpour, PhD, Associate Professor
Documenting Iranian Architecture Heritage &
Smartphone-based Photogrammetry Program, 2021
Interior Architectura Department

DOCUMENTING IRANIAN ARCHITECTURE HERITAGE

& Smartphone-based Photogrammetry Program

فُتوگرامتری
معماری



فتوگرامتری معماری

هسته «مطالعات تاریخی معماری» دانشگاه هنر شیراز
مستندات پروژه‌های مستندنگاری میراث معماری ایران
و برنامه فتوگرامتری با موبایل
گروه معماری داخلی

مدیر پروژه

دکتر علی اسدپور

گرافیکست و صفحه آرا

دکتر علی اسدپور

دانشجویان

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تمامی حقوق مادی و معنوی این مجموعه برای
دانشگاه هنر شیراز و علی اسدپور محفوظ است.

Architectural Photogrammetry

Shiraz University of Arts Architectural Photogrammetry Studio
Project of Documenting Iranian Architecture Heritage & Smart-
phone Based Architectural Photogrammetry Program
Interior Architectura Department

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Our Vision

تنوع و پراکندگی آثار معماری در ایران به حد قابل توجهی چشم گیر است و با وجود تلاش هایی که در دهه های اخیر برای مستندسازی و ثبت این آثار انجام شده، کماکان بخش مهمی از آنها فاقد اسناد قابل استناد هستند. افزون بر این رشد شتابان شهرنشینی در دهه های اخیر، توسعه شهرها را با چنان سرعتی روبرو نموده که به سختی برای حفظ «میراث معماری شهری» زمان کافی در دسترس بوده است؛ بافت های تاریخی و میانی شهرها که گنجینه آثار معماری بودند با تخریب مواجه شدند و یا با مداخلات کالبدی ساکنین یا مالکین تازه خود، چهره راستین خود را از دست دادند یا دستکم چهره های مخدوش یافتند. به این فرآیند باید نگرش های نخبه گرایی که مفهوم «اصالت» و «ارزش تاریخی» را به دوره های تاریخی خاص و عناصر هنری و بصری ویژه محدود می کردند را نیز افزود. بر اساس چنین دیدگاهی بخش مهمی از آثار معماری که فخر کمتری نسبت به نمونه های شاخص داشتند از گردونه مطالعات مستندنگاری حذف شدند یا در اولویت قرار نگرفتند و یا دوره های متأخر در تاریخ معماری ایران، کم ارزش یا بی اهمیت تلقی شدند. به همین سبب حساسیت های عمومی نیز برای حفظ و نگهداری از آنها تضعیف گردید. هدف از این مجموعه کوششی برای استفاده از فتوگرامتری معماری در مستندنگاری آثاری از این دست است.

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Our Vision

“ The diversity and dispersion of architectural works in Iran is considerable and despite the efforts made in recent decades to document and record these works, a significant part of them still lack credible documents. In addition, the rapid growth of urbanization in recent decades has accelerated the development of cities to such an extent that sufficient time has been available to preserve the “heritage of urban architecture”; The historical and early modern parts of the cities that were the treasures of the architectural works were destroyed, or with the physical interventions of their new residents or owners they lost their true face or at least their properties were distorted. To this process must be added the elitist attitudes that limited the concepts of “originality” and “historical value” to particular historical periods and particular artistic and visual elements. According to this view, an important part of the architectural works that were less proud than the outstanding examples were removed from the scope of documentary studies or were not given priority or the later periods in the history of Iranian architecture were considered insignificant. As a result, public sensitivities to maintain them were weakened. The purpose of this collection is an attempt to use architectural photogrammetry in documenting such works. ”

Director Preface



Dr. Ali Asadpour

*Head of Interior Architecture Department
Member of CIPA (Comité International de
la Photogrammétrie Architecturale)*

Associate Prof. Dr. Ali ASADPOUR has received M.A. in architecture from Shiraz University (2007) and PhD from Iran University of Science and Technology (2014). He was editor-in-chief of the Journal of Urban Landscape Research (JULR) from 2014 to 2017. His research interests focus on interdisciplinary issues in social and historical aspects of architecture and landscape.

He is currently researching in architectural photogrammetry based on smartphones for small heritage documentation.

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E-learning of Architectural Photogrammetry in Iran

Although the Covid-19 pandemic had many negative effects on various economic, social, cultural, political, and most importantly, health issues in the world, it also brought up the unique opportunity in Iran to hold the university Architectural Photogrammetry Program as a course for interior architecture students completely virtually. The Shiraz University of Arts, as a public university located in Shiraz, Iran, managed and supported this course in the second semester of its academic year in the winter and spring of 2021. This 16-week course was held from January 30 to June 2 as an e-learning program. As the tutor of this course, I prepared a four-stage program, including a) theoretical basics, b) instructing students to capture photos and how to work with Metashape software, c) case selection, and finally d) students weekly report of workflow.

Basics of architectural photogrammetry and how to capture stereo photos properly were instructed a quarter of this semester. Students were then shown a virtual example of hands-on work from start to finish and were finally asked to practice and increase their photography skills and work with photogrammetry software at home. The rest of the program was choosing a case for photogrammetric work and providing weekly reports to troubleshoot in virtual class.

A total of 19 four-year interior architecture students participated in this course, most of whom (more than 80%) were female. They were located in 7 different provinces of the country: Fars, Isfahan, Khorasan, Khuzestan, Kohgiluyeh



Photogrammetry of a) a garden stone wall in a village and b) details of the brickwork of the vaults and domes seen from below

& Büyer-Ahmad, Kerman, and Tehran. Students were asked to document architectural heritage, especially that of endangered or cases that may be less considered by the government or rarely documented before. Cases varied considerably; from historical tiles to the houses entrances, doorways, plasterworks, and buildings being demolished in rural areas. What mattered was their scale and importance of documentation. The fact that students were solely responsible for searching and finding these cases in their hometown was part of this pre-designed curriculum. In the end, students were required to prepare a 3D model, extract orthophotos and draw the necessary drawings in AutoCAD, thus producing scaled documents. Since they could not access the Total Station, checkpoints were used instead of targeting.

The results of a questionnaire conducted online at the end of the course

showed that 81.3% of the participants believed that a course for architectural photogrammetry should be included in their curriculum. 87.5% also stated that they have learned the necessary practical skills in this course virtually. 93.8% of the students were satisfied by participating in this course and all of them emphasized to different degrees that they will continue to do photogrammetry in the future. This e-learning experience provided an opportunity to teach photogrammetry to the interior architecture students online for the first time in The Shiraz University of Arts. This curriculum is an introduction to setting up an archive or documentary center of architectural monuments in the Department of Interior Architecture. The Shiraz University of Arts, which was established more than about a decade ago, needs such a center to record and document architectural heritage, and photogrammetry can be an efficient, rapid, and relatively cost-effective solution.

*Mobile Photogrammetry for Architectural Documentation:
Tips from a Case Study*

Ali Asadpour, Assistant professor, Interior Architecture Department, Shiraz
University of Arts, Shiraz, Iran

Introduction

Photogrammetry is the science and technology of making measurements using photographs (Collier, 2009) or is any measuring technique allowing the modelling of a 3D space using 2D images (Egels & Kasser, 2001). Therefore, architectural mobile (smart-phone) photogrammetry could be defined as a process to produce a 3D geometric model of a building or parts of it from several images taken by conventional mobile cameras. This study is a concise report of practical work that has aimed to provide some suggestions for accurate and precise use of mobile cameras in architectural photogrammetry. For this purpose, in a case study, this paper tried out to find an effective capturing method that could lead to the correct orthoimage production for further indirect measurement and CAD drawings.

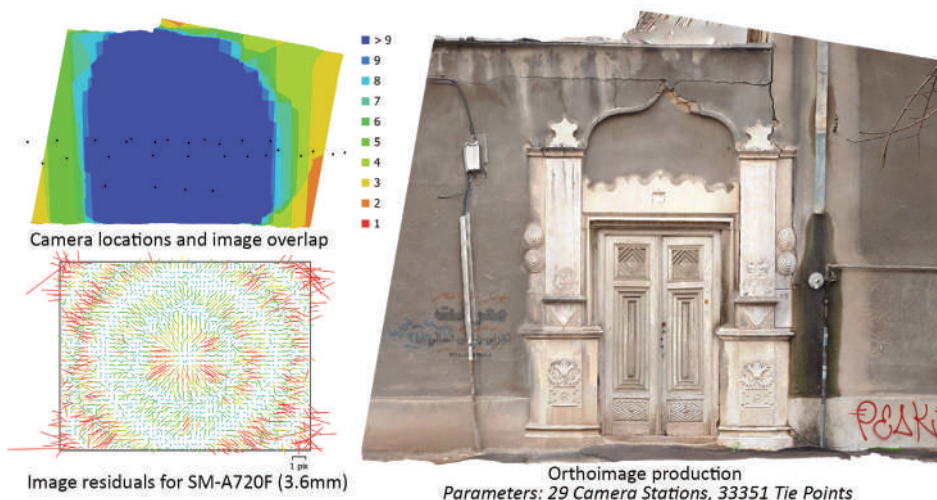
Backgrounds

Gruen and akca (2007) reported that mobile phone cameras in comparison to digital still video cameras have great potential for consumer-grade photogrammetric processing. They stated that despite image-to-image varying systematic error patterns in some of them, they still give us an interesting option in terms of accuracy, costs, and flexibility. Sarhan Satchet (2011) showed that whenever mobile phone camera resolution increases the Root Mean Square Error (RMSE) computed by the comparison between the calculated value and the measured value

Mobile Photogrammetry for Architectural Documentation: Tips from a Case Study

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Documenting historic tileworks using smartphone-based photogrammetry

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Keywords

Smartphone
Documentation
Photogrammetry
Tile paintings
Háfèz tomb

ABSTRACT

Photogrammetry is a metric technique for indirect measurement through images. This technique could be applied in recording architectural features and documenting buildings. Therefore, smartphone-based photogrammetry can be considered a creative method for architects and conservators to document monuments quickly and promptly. The main objective of this paper is to study the smartphone-based photogrammetry capabilities in two case studies in terms of accuracy and precision. Historic tileworks in Háfèz tomb, Shiraz, Iran, has been considered as examples of traditional decorations in Iranian architecture. For this purpose, close-range photogrammetry with stereo photography was used. A smartphone camera has captured the photos. Photogrammetric steps were performed in Agisoft Metashape Professional. The result was 3D models and an orthoimage of the tiles. The accuracy of the results was acceptable for ordinary documentation and differed on average 0.45% to as-built measures. Orthoimage is believed to be an important document for analyzing and studying the patterns and colors used in these works of art. The results of this study emphasized that close-range photogrammetry with a smartphone can in the future be a public and reliable technique for documenting architectural heritages, especially in medium and small-scale projects.

1. INTRODUCTION

Documentation is defined as a systematic collecting and archiving activity to prepare historic building records (Stylianidis, 2020). However, it is a costly and time-consuming procedure, particularly in documenting architectural ornaments and interior decorations. Much of these architectural heritages have been disappeared at a higher rate than that which could be well documented in the last decades by the rapid reconstruction or renovation policies. Hence, developing a cheap and easy technique for documentation is necessary. Recording all of these works is difficult and perhaps impossible. Since digital cameras are one of the practical and relatively inexpensive devices for documentation, photogrammetry would be an affordable, instantaneous, and accessible technique to record architectural evidence and documenting as-is features and building properties.

The idea of Single Images in Conservation recommended by International Committee for Architectural Photogrammetry, CIPA, also presupposes the importance of images in the conservation of architectural heritages (see Schuhr & Kanngieser,

1999, 2003). CIPA's general mission also emphasizes the development of principles and practices for recording, documenting, and managing information by specialized tools and techniques (Quintero et al., 2017). It seems that photogrammetry could be a cost-effective method in the future. That means it could be more pervasive than it is today.

Since photogrammetry is a 3D measuring technique through a central projection model, it should be considered as a multidimensional discipline that integrates art, science, and technology. The primary purpose of a photogrammetric measurement is the three-dimensional reconstruction of an object, which can be re-accessed at any time. Another purpose is producing an orthoimage that can be used for real distance measuring, which is being done on maps with the consideration of scale factor since it is adjusted properly for elevation, lens distortion, and camera tilt (Luhmann, Robson, Kyle, & Harley, 2011; Stylianidis, 2020). These features make photogrammetry attractive for experts in the fields of architecture, conservation, archeology, and documenting cultural heritage. In this context, architectural photogrammetry can pave the way for accurate documentation and could be rapidly widespread by the growth of mobile

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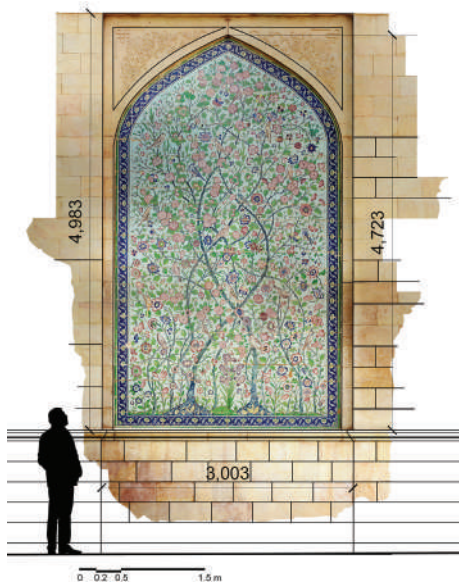
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Documenting Historic Tileworks Using Smartphone-based Photogrammetry

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“ Photogrammetry is a metric technique for indirect measurement through images. This technique could be applied in recording architectural features and documenting buildings. Therefore, smartphone-based photogrammetry can be considered a creative method for architects and conservators to document monuments quickly and promptly. The main objective of this paper is to study the smartphone-based photogrammetry capabilities in two case studies in terms of accuracy and precision. Historic tileworks in Hafez tomb, Shiraz, Iran, has been considered as examples of traditional decorations in Iranian architecture. For this purpose, close-range photogrammetry with stereo photography was used. A smartphone camera has captured the photos. Photogrammetric steps were performed in Agisoft Metashape Professional. The result was 3D models and an orthoimage of the tiles. The accuracy of the results was acceptable for ordinary documentation and differed on average 0.45% to as-built measures. Orthoimage is believed to be an important document for analyzing and studying the patterns and colors used in these works of art. The results of this study emphasized that close-range photogrammetry with a smartphone can in the future be a public and reliable technique for documenting architectural heritages, especially in medium and small-scale projects. ”





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Tabriz Islamic Art University / 20 May, 2021



کاربرد «موبایل فتوگرامتری» در مستندنگاری معماری (نمونه مورد مطالعه: کاشی کاری های دروازه قرآن شیراز)

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چکیده

بخش مهمی از میراث معماری و به ویژه ترتیبات وابسته به معماری به دلیل رشد شتابان ساختوساز، توسعه شهرها، مداخلات کالبدی در بناها و در نهایت به دلیل تنوع و پراکندگی آثار در سطح کشور با چالش تخریب بیش از مستندسازی یا نادیده انگاشتن در مطالعات مواجه هستند. از این روی یافتن راهی سریع و ارزان برای مستندنگاری ضروری است. «فتوگرامتری معماری» به عنوان دانش استخراج ابعاد و اندازه از روی عکس، روشی دقیق و شناخته شده در مستندسازی معماری در سطح جهان به شمار می رود. با این حال کاربردهای آن در ایران چندان فراگیر نیست. امروزه «موبایل فتوگرامتری» همزمان با پیشرفت فناوری های رقومی در تلفن های همراه می تواند جایگزینی برای دوربین های حرفه ای و گران قیمت در فتوگرامتری مرسوم باشد. در این پژوهش ضمن معرفی این روش و مراحل اجرای آن، مجموعه کاشی کاری های دروازه قرآن شیراز به عنوان اثری برجای مانده از دهه بیست قرن چهاردهم خورشیدی مستندسازی شده است. این کاشی کاری ها که به دست محمدباقر جهانگیری - کاشی نگار شاخص اواخر عصر قاجار و پهلوی - طراحی و اجرا شده اند، نمونه ای فاخر از ترتیبات وابسته به معماری هستند که به دلیل ابعاد و مکان قرارگیری، امکان تهیه عکس های تخت و نقشه های مستند از آن به آسانی ممکن نیست. در این پژوهش مدلی سه بعدی بر پایه مکانی با موبایل از این اثر در نرم افزار Agisoft Metashape Professional نسخه ۲۰۱۹ تهیه گردیده و با استخراج «پونکتو (عکس تخت)»، فرایند مقیاس دهی به آن ها نیز انجام شده است. خروجی های مقیاس دار، مبنایی برای ترسیم ها و تهیه نقشه های دقیق از اثر هستند. یافته های این مطالعه میدانی نشان می دهند که «موبایل فتوگرامتری» می تواند روشی مقرون به صرفه، سریع و دقیق برای ثبت میراث معماری و به ویژه ترتیبات وابسته به بنا بوده و داده های ارزشمندی برای مقاصد پژوهشی و مرمتی تولید نماید.

واژه های کلیدی: مستندسازی، فتوگرامتری برد کوتاه، کاشی کاری، دروازه قرآن، محمدباقر جهانگیری

۱- مقدمه

مستندنگاری و مستندسازی میراث معماری در ایران همچون بسیاری از دیگر نقاط مشابه در جهان دستکم با دو چالش جدی روبرو بوده و هست. چالش نخست به شرایط اجتماعی و شتاب دگرگونی های شهری بازمی گردد؛ تنوع و پراکندگی آثار معماری در ایران به حد قابل توجهی چشم گیر است و با وجود تلاش هایی که در دهه های اخیر برای مستندسازی و ثبت این آثار انجام شده، کمالات بخش مهمی از آن ها فاقد اسناد قابل استناد هستند. افزون بر این رشد شتابان شهرنشینی در دهه های اخیر، توسعه شهرها را با چنان سرعتی روبرو نموده که به سختی برای حفظ «میراث معماری شهری» زمان کافی در دسترس بوده است؛ یافته های تاریخی و مبنای شهرها که گنجینه آثار معماری بودند با تخریب مواجه شدند و یا با مداخلات کالبدی ساختن یا مالکین تازه خود، چهره راستین خود را از دست دادند یا دستکم چهره ای مخدوش یافتند. به این فرایند باید نگرش های نخیه گرانه ای که مفهوم «اصالت» و «ارزش تاریخی» را به دوره های تاریخی خاص و عناصر هنری و بصری ویژه

Using Mobile Photogrammetry for Architectural Documentation (Case Study: Tiles of Quran Gate in Shiraz)

Citation: Asadpour, A. (2021). Using Mobile Photogrammetry for Architectural Documentation (Case Study: Tiles of Quran Gate in Shiraz), National Conference on Architecture, Civil Engineering, Urban Development and Horizons of Islamic ArtAt: Tabriz Islamic Art University, Iran. DOI: 10.13140/RG.2.2.19700.68483

“ An important part of architectural heritage and especially architectural ornaments are faced with the challenge of destruction or neglect in studies due to the rapid construction, urban development, physical interventions in buildings, and finally due to the diversity and dispersion of works across the country. Therefore, it is necessary to find a fast and cheap way to document. “Architectural photogrammetry” as the knowledge of extracting dimensions and size from photographs, is an accurate and well-known method in documenting architecture worldwide. However, its applications are not very widespread in Iran. Today, “Mobile (smartphone) Photogrammetry” can be a substitute replacement for professional and expensive cameras in photogrammetry, along with the development of digital technologies in mobile phones. In this research, while introducing this method and its implementation stages, the collection of tiles of Shiraz Quran Gate has been documented as a surviving work from the twentieth century. Designed and executed by Mohammad Baqer Jahanmiri, a prominent late Qajar and Pahlavi painter, these tiles are a glorious example of an architectural decoration that, due to its size and location, makes it impossible to obtain ortho photographs and documentary drawings. In this research, a three-dimensional model based on mobile (smartphone) photography of this work has been prepared in Agisoft Metashape Professional software version 2019 and by extracting “orthophoto”, the process of scaling them has also been done. Scaled outputs are the basis for drawing and preparing accurate drawings of the work. The findings of this case study show that “Mobile (smartphone) Photogrammetry” can be a cost-effective, fast and accurate way to record architectural heritage, especially building-related decorations, and generate valuable data for research and restoration purposes. ”




Projects Locations



1



Ali Asadpour

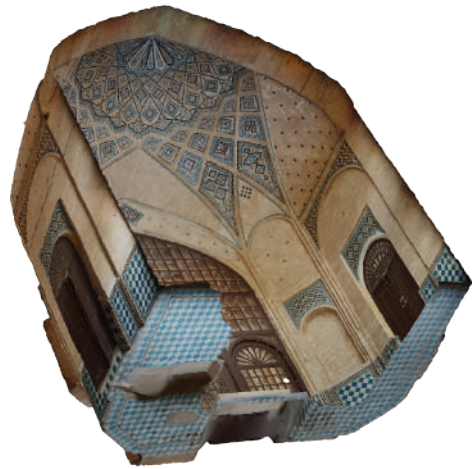
 Samsung A720F

The Qavam Family Mansion in Hafez Tomb in Shiraz, Fars

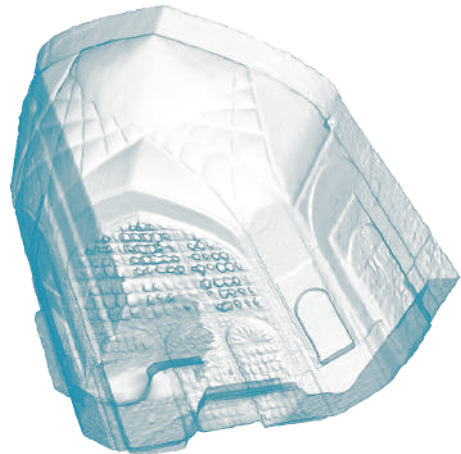
The Tomb of Hafez is a memorial structures erected in the northern edge of Shiraz, Iran, in memory of the celebrated Persian poet Hafez. The open pavilion structures are situated in the Musalla Gardens on the north bank of a seasonal river and house the marble tomb of Hafez. The present buildings, built in 1935 and designed by the French architect and archaeologist Andre Godard, are at the site of previous structures, the best-known of which was built in 1773. The tomb, its gardens, and the surrounding memorials to other great figures are a focus of tourism in Shiraz.

The tomb of Ghavam family is one of the historical monuments in Hafez complex. The building consists of a central dome and three Ivans, the south Ivan of which is covered with a window. There are several tombstones of Ghavam family and their relatives in this complex. The building is made of brick and has a few tiles as decoration.

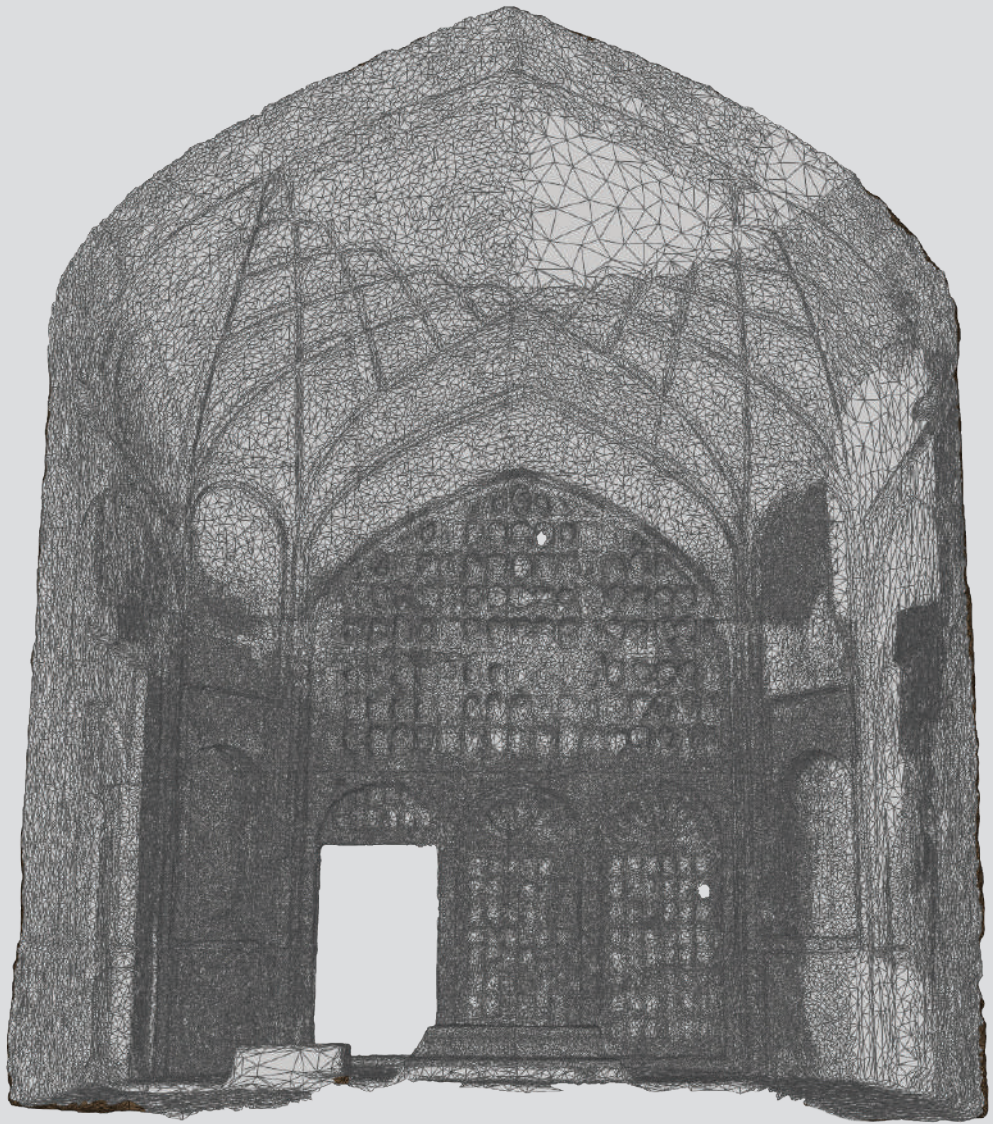
This project shows a three-dimensional facing of the south Ivan, the window of which has been removed to better display the interior.



Orthoimage of The Ceiling Decoration



3D Reconstruction of the Qavam South Ivan in Hafez Tomb



Wireframe 3D Reconstruction of the Qavam South Iwan in Hafez Tomb, Shiraz

2



Zahra Shaeri Kholari

 Samsung M317F

The Qavam Familyy Mansion in Hafez Tomb in Shiraz, Fars

The first member of family to reach political influence was Hajj Ebrahim Kalantar Shirazi. He was a Vizier and Kalantar of Fars in Zand government and his decision to betray Lotf Ali Khan Zand was instrumental in ending Zand dynasty and bringing Qajars to the throne. However Fath Ali Shah Qajar did not trust Hajj Ebrahim and had him executed in 1801. His fourth son, Ali Akbar Khan, was very young and ill and was spared from Shah's revenge. He later returned to Shiraz and gained influence. He became the Kalantar of Fars by Fath Ali Shah in 1812. He was later awarded the title Qavam ol Mulk (Pillar of kingdom) in 1830 which became family's last name. In 1864 he became the administrator of Imam Reza shrine at Mashhad. Hajj Ali Akbar Khan was survived by his fourth son Ali Mohammad Khan who also inherited the title Ghavam ol Mulk. In total five members of the family held that title until it was abolished by Reza Shah in the 1930s. Ebrahim Khan, Ghavam ol Mulk was exiled by Reza Shah to Tehran. Fath Ali Khan, Saheb Divan, another son of first Ghavam ol Mulk went to Tehran in 1830 and married a daughter of Fath Ali Shah and became influential in government. He became governor of many provinces. Nasir ol Mulk another son Ali Akbar Khan remained in Fars and served as governor of Bushehr, Lar and Bandar Abbas.

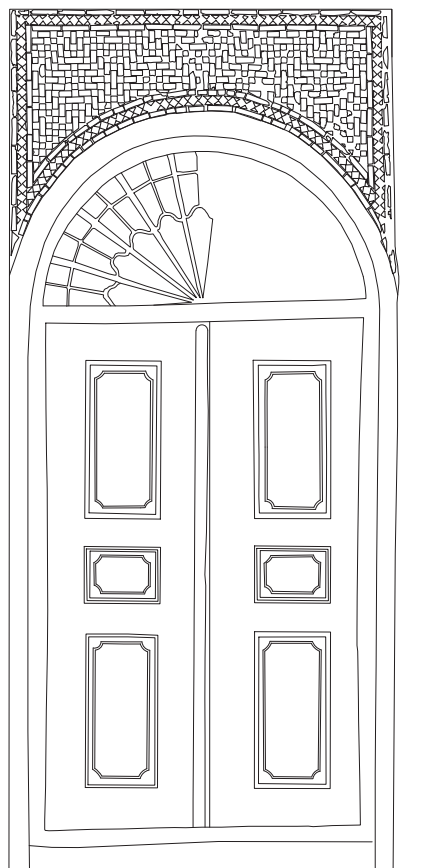
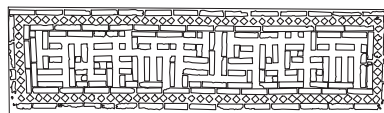


3D Reconstruction of the Qavam East Iwan in Hafiz Tomb, Shiraz



Bannai Script of the East Iwan Decoration

The tile decorations of this building are mainly Bannai script. The designs are simply repetitive and symmetrical. However, the decorations of the eastern Iwan are the most important. In other words, this Iwan should be considered the main entrance of the complex. The doors and windows of this building are made of wood and glass, which have a semicircle on top of them, and all of them are designed in a larger geometric design. Despite the great attention that has always been paid to the tomb of Hafez (a famous 14th century Iranian poet). This complex has received less attention and little documentation has been prepared about it so far.




Orthoimage of the Qavam East Iwan

CAD Drawing a Doorway Details

3



Soroor Taheri

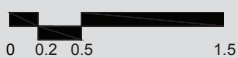
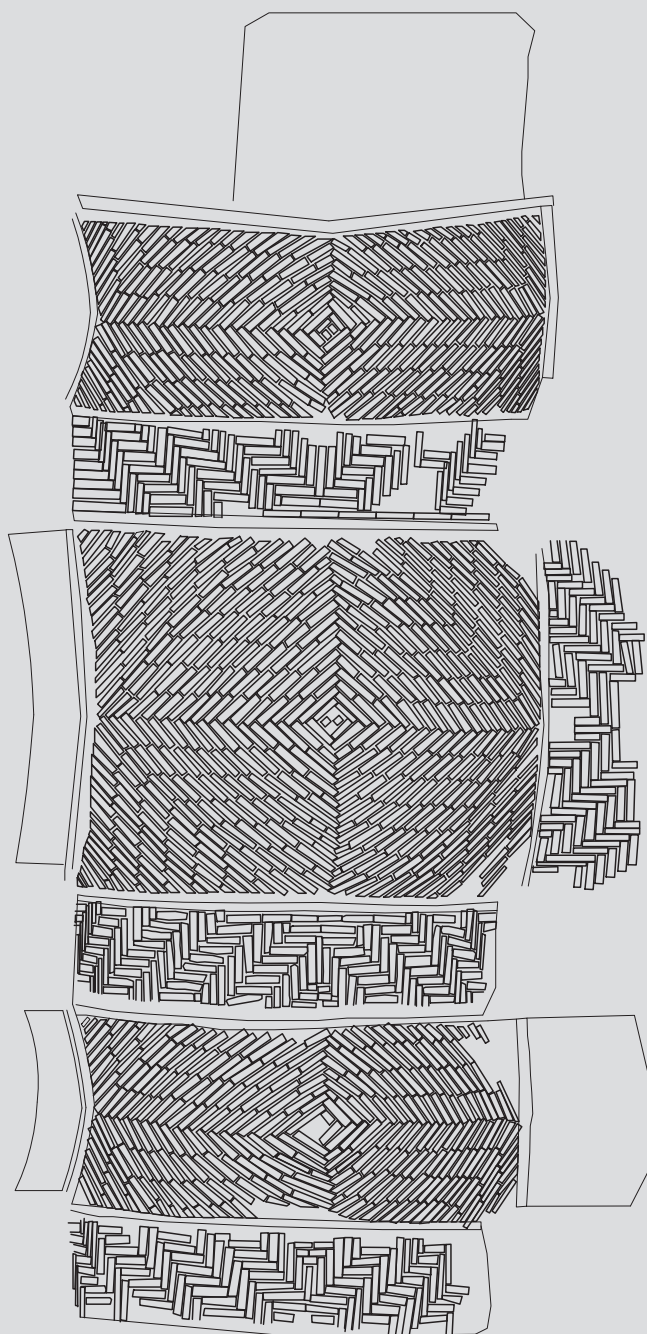
 Samsung A720F

A Sabat in Sang-e Siyah Historical District in Shiraz, Fars

Sang-e Siah neighborhood is the name of one of the old Shiraz. Since the time of Karim Khan Zand, when the neighborhoods became smaller and smaller and the city wall narrowed, the Darb-e-Kazerun neighborhood, which was a separate neighborhood, was merged with this district and both of them were called Sang-e Siah (Black Stone). This sabbat is located in Sang-e Siah. Sibouyeh Street, the main route to the bazaar, passes through this Sabat. Important neighbors of this Sabat include Qajar houses, the shrine of the Imams and traditional residences. The entrance of a house related to the first Pahlavi period is located in this Sabat, which is currently uninhabited.



Orthoimage of the Brickwork of the Vaults and Domes Seen from Below



CAD Drawing of the Brickwork of the Vaults and Domes

4

Xiaomi M2007J3SY

Takht-e Zarabi West Stone Facade in Shiraz, Fars

Shayasteh Eskandari

Takht Zarabi is located above seven people and at the foot of Chehel Magham Mountain. It is an old building with several rooms, an Iwan, a water storage, which was built in 669 AH (1270 AD) by the then Judge of Fars Province «Yahya Ibn Ismail Paul Nik Rooz» for the rest of the people during the Qajar period. Aghaa Moeir has repaired it and it is known as «Takht Zarabi». It is known by this name because it was erected by a person who was the head of the old mintage office in Shiraz. On the western wall of this building, an inscription in the third line from the seventh century AH is left, which

indicates the date of its construction. It is also gilded on the quadruple stone at the top of the reservoir. Next to this building, a slide like Tang Saadi has been built, which used to be a place of entertainment for the people in the past. This building has four stone facades. The current project has documented its western view. It is located on a relatively steep slope overlooking the city and is still inhabited by locals.



Orthoimage of the West Facade Stonework



CAD Drawings and Patterns of the West Facade Stonework



5



AmieHosien Mirvakili

 Cannon Eos 1200D

East Entrance of the Jame'a Mosque of Yazd

The Jame'a Mosque of Yazd is the grand, congregational mosque within the Yazd Province of Iran. The 14th-century mosque is still in use today. It was first built under Ala'oddoleh Garshasb of the Al-e Bouyeh dynasty. The mosque was largely rebuilt between 1324 and 1365, and is one of the outstanding 14th century buildings of Iran.

According to the historians, the mosque was constructed in the site of the Sassanid fire temple and Ala'oddoleh Garshasb commenced building the mosque. The previous mosque was constructed by order of Ala'oddoleh Kalanjar in 6th century A.H., however the main construction of the present building was done by order of "Seyyed Rokn al-Din Mohammad Qazi. he mosque is a fine specimen of Persian architecture. it is a great example of the Azari style of Persian architecture.

The entrance to the mosque is crowned by a pair of minarets, the highest in Iran, dating back to the Safavid era and measuring 52 meters in height and 6 meters in diameter. The entrance is decorated from top to bottom in tile work. Within is a long arcaded courtyard where, behind a deep-set south-east iwan, is the sanctuary chamber. This chamber, under a squat tiled dome, is exquisitely decorated with tile mosaic: its tall tiled Mihrab, dated 1365, is one of the finest of its kind in existence. On two star-shaped sgraffito tiles are the name of the craftsman and the date of construction of the Mihrab.

However, not all the features of this mosque are limited to its main entrance. In general, mosques used to have several entrances. The

eastern entrance of this mosque is also of great importance, which has been less paid attention to. This entrance was repaired by Seyyed Ali Mohammad Vaziri Arizi in 1947, which is written in the text of an inscription above the entrance door.



Orthoimage of the East Entrance of Jame Mosque of Yazd



Orthoimage of the East Entrance of Tileworks



Orthoimage of the East Entrance Details

6



Atousa Setoudeh

 Nikon D7200

Ghou Hotel Entrance in Ahvaz, Khuzestan

The Ghou (Swan) Hotel is a national monument, but is now on the verge of demolition. This building is located in Khosravi Street, the east coastal road of Ahvaz. It was built in the late Qajar period and the beginning of the Pahlavi period. Swan Hotel has been registered as one of the national monuments of Iran on March 16, 2000 with the registration number 3354. This building was first used as a hotel and then it was handed over to the Ahvaz Health Department and later changed its use as a residential house. 20 years after the registration of this building, the cultural heritage of Khuzestan has not yet taken action to renovate the "Ghou Hotel".

Ahvaz Ghou Hotel is built in the form of a two-storey main building and a number of ancillary buildings such as a caretaker and a kitchen. And parts of it have fallen due to wear and tear and are being destroyed. Due to its location, the Ghou Hotel is one of the most scenic and prominent places in the old part of Ahvaz. But in spite of its antiquity, beauty and special location, it is being destroyed.

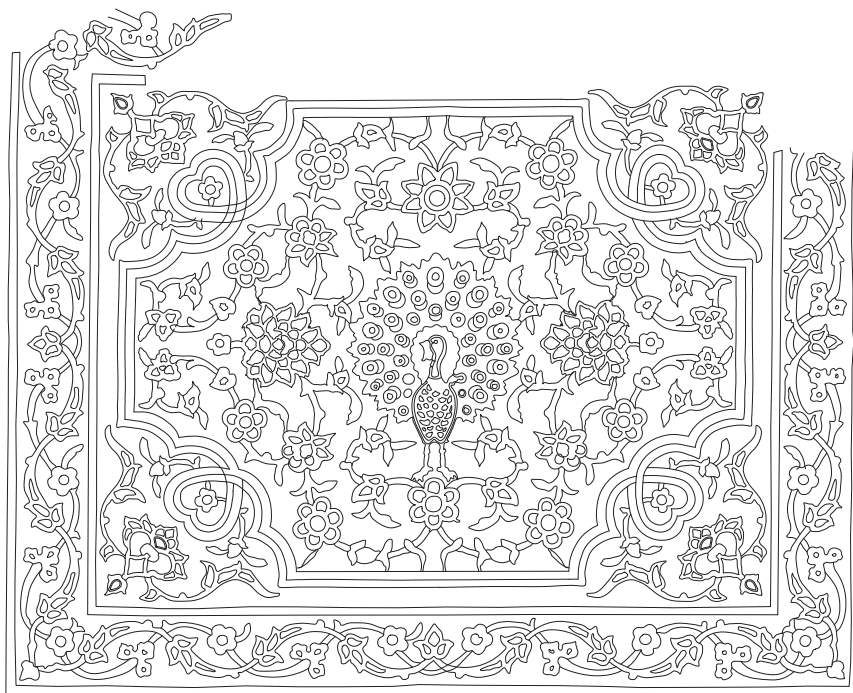
The current project is dedicated to documenting the entrance of this building. The tiles of this section are the only feature visible from outside the building. The tiles are symmetrical and parts of them have been destroyed over time. The middle tile has a peacock with its open feathers, which is a very brilliant example of the art of tiling.



The Entrance Tileworks



Orthoimage of the Entrance Peacock Tilework



CAD Drawing of the Entrance Peacock Tilework

7

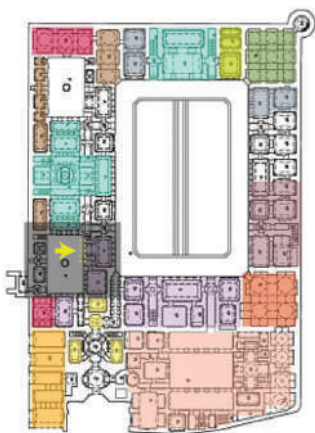
 Samsung A217F

Ornaments of Haj Agha Ali House in Ghasemabad, Rafsanjan, Kerman

Hosien Poyanmehr

Haj Agha Ali House with an area of 7,000 square meters and beautiful and Iranian architecture is one of the largest brick and traditional houses in the world, which was built by Haj Agha Ali known as Zaeemullah Rafsanjani (the greatest Iranian businessman of that period) in 1757 AD. This building is located six kilometers away from Rafsanjan city (near Qasemabad). Haj Agha Ali's house used to be known as Waqf House. The house has eighty-six rooms (seven doors, five doors, three doors

and a closet) which are built in four main parts of the pool house, royal residence, autumn and winter. A large kitchen and a large storage room are responsible for meeting the needs of this complex. Four courtyards, indoor and outdoor corridors and three porches also provide the connection of different parts of this house. All the parts of the house are made perfectly symmetrically. As mentioned, this house has 86 rooms.



Main Plan

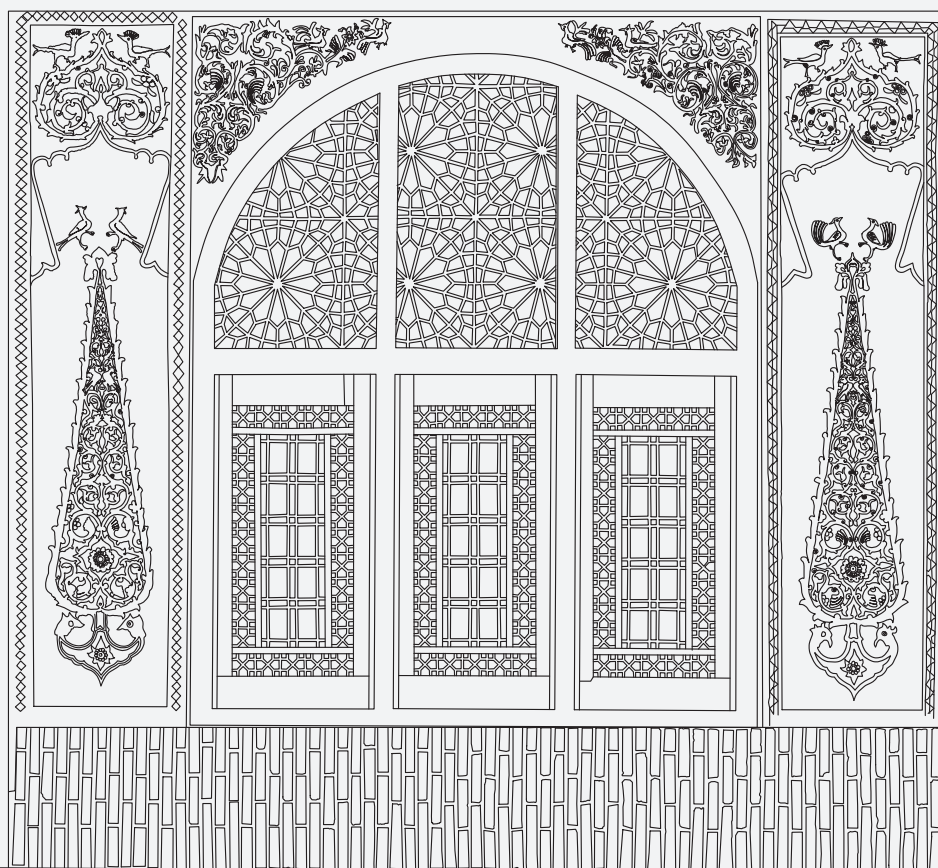


Orthoimage of the Facade Ornaments

One of the attractions of this building is the prominent plasterwork with Islamic designs. This house has been neglected compared to other buildings of its age, and less action has been taken to maintain, repair and renovate it. The art of plastering or stucco is one of the arts related to architecture that has had its own form and style in each region and each time period. As the name implies, the main materials used in this art are plaster. In Iran, stucco has been associated with differences in different historical periods. Stucco is widely used in decorative arts due to its ductility, adhesion,

desirable color, easy application, abundance and cheapness.

This project has documented one of the stucco decorations of this house. Drawing these decorations on a real scale and correct design has been the goal of this project.



Details of the Facade Ornamentations, Haj Agha Ali House, Ghasem Abbad, Kerman

8



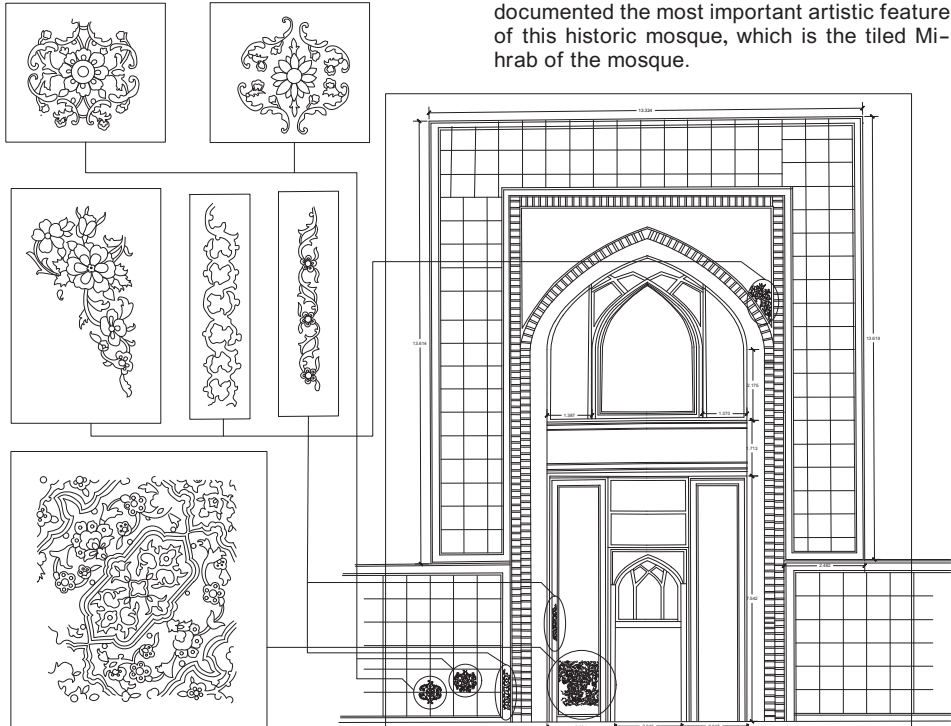
Seyedeh Fatemeh
Taheri

 Cannon Eos 750D

Mihrab of Jame'a Mosque of Kashmar, Razavi Khorasan

The Kashmar Grand Mosque was built in 1791 AD during the reign of Fath Ali Shah Qajar and during the reign of Abdul Ali Khan Mishaan in the city of Torshiz. This mosque was registered in the list of national monuments of Iran on March 16, 2001, number 5152 by the Cultural Heritage Organization of Iran. The architecture of this mosque is relatively simple and; It has a courtyard with 12 rooms and an Iwan 10 meters

wide and 15 meters high. The altar or Mihrab of the mosque is located in the center of the Iwan, where the art of Isfahani and Mogharnas tiling and some Quranic inscriptions have been used by two unknown artists named "Mohammad Isfahani" and "Ismail Azani", and the year of their construction is 1799 AD. This mosque does not have a pool or fountain; But there is an underground basin below it. The current project has documented the most important artistic feature of this historic mosque, which is the tiled Mihrab of the mosque.



CAD Drawings of the Mihrab of Kashmar Jame'a Mosque



Orthoimage of the Mihrab of Kashmar Jame'a Mosque Tileworks

9



Atefeh javid

Xiaomi M2007J20CG

Tileworks of a Mosque Entrance in Yasuj, Kohgiluyeh & Boyer-Ahmad

Yasuj is a city and capital of Kohgiluyeh and Boyer-Ahmad Province, Iran. Yasuj is an industrial city in the Zagros Mountains of southwestern Iran. The area of Yasuj has been settled since as early as the Bronze Age. Findings include the Martyrs Hills (dating from 3rd millennium BC), the Khosravi Hill from the Achaemenian period, the ancient site of Gerd, the Pataveh bridge, and the Pay-e Chol cemetery. Yasuj is the place where Alexander III of Macedon and his Macedonian forces stormed the Persian Gates (Darvazeh-ye Fars), and found a way into the Persian heartland (331 BC). Yasuj has the typical continental-influenced Mediterranean climate (Köppen Csa) of western Iran, though because of its location in the direct line of rain-bearing winds from the Persian Gulf it is the wettest Iranian city south of the Elburz Mountains with an annual rainfall nine times that of Isfahan and twice that of Kermanshah. The heavy precipitation allows the existence of small glaciers on the highest Zagros peaks – in contrast the Kuhrud Mountains to the east have no glaciers despite being of the same height due to aridity.

The current project documents the decoration of the entrance of a mosque named after Imam Hassan Ibn Ali Askari in the Ibn Sina neighborhood located on Ummat Street. Parts of the tiles of this mosque have been destroyed. The purpose of this study is to record artistic features in parallel with documenting these destructions. Azure and blue colors are the general background of tiles. The decorative motifs of flowers in Islamic ivy are also used in symmetry.



Details of a Tilework



Orthoimage of the Mosque Entrance

Details of the Tileworks Demolitions and the Entrance General Layout

10

 Nikon D7200

The Entrance of Naranjestan-e Qavam Ornaments in Shiraz, Fars

Emad Banijamali

Qavam House (also widely called Narenjestan-e Ghavam) is a traditional and historical house in Shiraz, Iran. It was built between 1879 and 1886 by Mirza Ibrahim Khan. The Qavam family were merchants originally from Qazvin, but they soon became active in the government during the Zand dynasty, followed by the Qajar, and Pahlavi dynasty as well. The Qavam "Naranjestan" preserves the elegance and refinement enjoyed by the upper-class families during the 19th century. The paintings on the low ceilings of the house are inspired by Victorian era Europe. The mirrored Iwan was a focal point of the house, overlooking a small garden that was designed with fountains, date palms, and flowering plants.

During the second Pahlavi era, the House became the headquarters of Pahlavi University's Asia Institute, directed by Arthur Upham Pope and Richard Nelson Frye. Frye and his family also lived in the house for a while.

The Asia Institute was founded in 1928 in New York City as the American Institute for Persian Art and Archaeology. Later, it continued its activity in Shiraz, Iran between 1966 and 1979. Its affiliations, functions, and publications have varied over the years, although it no longer exists as an organization. Two remnants of the Asia Institute are the Bulletin of the Asia Institute, published in the United States, and the Narenjestan Museum at Shiraz University, Iran. Due to close contacts with the royal family of Iran, Pope and his wife moved to Shiraz in 1966, where the Asia Institute was re-established as a part of Pahlavi University (now Shiraz University) and housed in the late-nineteenth-century Qajari mansion called the Narenjestan.

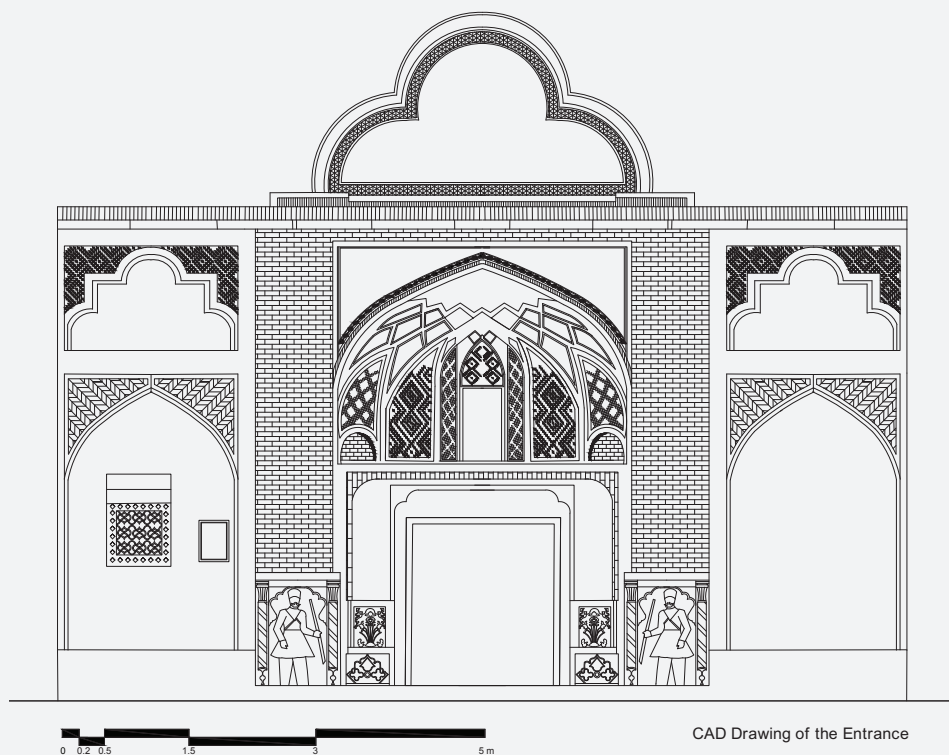
The institute organized the Fifth International Congress of Iranian Art and Archaeology, which took place in Tehran in 1968.

The institute in Shiraz was closed after the Islamic revolution in 1979, but the Narenjestan re-opened as a museum.

The current project is dedicated to documenting the entrance of this building. Most of the attention has always been focused on the decorations inside the building and the artistic features of the entrance of the building are not well documented.



Orthoimage of the Tileworks Representing the Logos of the Pahlavi University and the Asi Institute



11



Fatemeh Hasiri

IPhon 12 ProMax

Eram Garden South-East Entrance in Shiraz, Fars

Eram Garden is a historic Persian garden in Shiraz, Iran. It belonged to the leaders of Qashqai tribe before being confiscated by the central government. The garden, and the building within it, are located at the northern shore of the Khoshk River in the Fars province. Over its 150 years the structure has been modified, restored or stylistically changed by various participants. It was one of the properties of noble Shiraz Qavami Family. The building faces south along the long axis. It was designed by a local architect, Haji Mohammad Hasan.[2] The structure housed 32 rooms on two stories,

decorated by tiles with poems from the poet Hafez written on them. The structure underwent renovation during the Zand and Qajar dynasties. In 1965, Sir Denis Wright, a British ambassador in Iran, was invited by the Chancellor of Shiraz University, Asadollah Alam, to a party in Eram Garden for Princess Alexandra.[1] The compound came under the protection of Pahlavi University during the Pahlavi era, and was used as the College of Law. The building also housed the Asia Institute. Today, Eram Garden and building are within Shiraz Botanical Garden (established 1983) of Shi-



Orthoimage of the Entrance Decoration

raz University. They are open to the public as a historic landscape garden. They are World Heritage Site, and protected by Iran's Cultural Heritage Organization. The southeastern entrance of this garden contains a part of the garden's history that has not received much attention compared to the main building of the garden. This is the side entrance

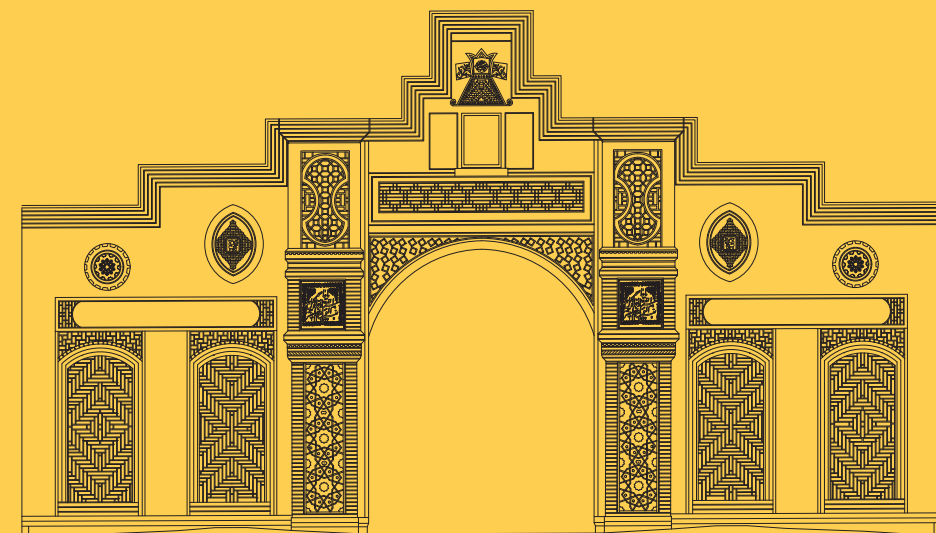
of the garden and it is not used except to serve the gardeners. An inscription on the tile shows the date of its construction as 1925. The aim of the current project is to document this entrance, which has received less attention from experts and its artistic effects have been neglected.



CAD Drawing of the Left Tilework



Orthoimage of the Right Tilework



CAD Drawing of the Entrance Decoration

12



Freshteh
Zarea Kar Moghaddam

 Cannon Eos 750D

Bagh-e Melli Entrance Ornamentaion, Tehran

The National Garden (Bāgh-e Melli) or Ministry of Foreign Affairs Gate is a historical and governmental compound in Tehran, Iran. Formerly referred to as the Parade Square. It used to be a military shooting range during the Qajar period. It was then turned into a public park for a short period, and eventually important governmental offices and museums were built around it.

The field was first constructed as a shooting practice range, during the reign of the Qajar Dynasty. It was used for the military garrison, and the Cossacks practiced military parade in it. The range was then developed during the reign of Nasser ed Din Shah, with a new building named Cossack House, which was somewhat transformed during the reign of Mozaffar ed Din Shah.

Under the rule of Reza Shah of the Pahlavi Dynasty, the range was turned into a modern public park for a short period, and the famous gate of the compound was built by Mirza Mehdi Khan Shaghaghi (Momtahn od Dowle) before the arrival of World War II. Eventually, important governmental buildings were built around the compound; such as the "Police House" (or the "Shahrbani House") which was built for Shahrbani, an organization responsible for maintaining security in the city.

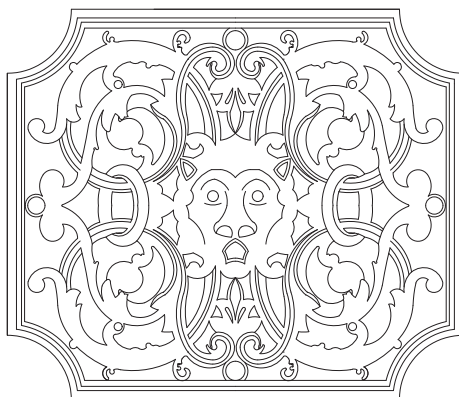
Building number 9 of the Ministry of Foreign Affairs (formerly the "Police House"), the University of Art (formerly the "Cossack House"), Malek National Museum, Post and Communication Museum, and the National Museum are situated in the compound.

The entrance has a large passage through

and two sidewalks on either side. The exterior features poems by Nadim al-Mulk, tiled motifs with two lions encircling the crown, leopards, lions and suns, arrows and cannonballs.

The interior has the following motifs: the scene of the conquest of Tehran in the coup d'etat of 1920 near the gates and towers and fortifications of Tehran (probably the Qazvin Gate), full-length images of Cossack Legion soldiers, machine guns and motifs of the angel of victory, more or less adapted from Bostan arch carvings.

All three doors have cast iron gates that were built in Tehran's Qorkhaneh by Mohammad Ali Kermani which are the most characteristic decorations of the work. Each of these 6 lugs is made of metal, each of which weighs several



CAD Drawing of a Lion Motive Cast in Iron



Orthoimage of the Entrance Tilework above the Doorway

tons, and all of them are made by the method of casting in the kiln. Abstract doors (like a dragon) or the role of the imaginary bird "Homa" have been used to decorate the doors. The important point about the doors is that they have a unique geometry and are very advanced and creative compared to the time of construction, and it even has the merit of having to change to a decorative element regardless of the outer shell. Regarding the metal role of Reza Khan in the upper part of the doors, Hossein Maki quoted Seyyed Hassan Modarres as saying: "Thus, Sardar Sepah had built the entrance to Mashkh Square (National Garden). Two small statues were built on top of the crescent. They were glued together.

One day, one of the sides of Sardar Sepah asked the teacher what the building at the entrance of Maidan Mahaq was like. Modarres had replied: "The statue above the entrance is

like Reza Khan Douro".

By building adjacent buildings, the side of the building and the inscription were covered. During the time of the Islamic Republic, the sun lion emblem was removed from the Iranian flag, the two sides above the entrance (interior and exterior) as well as inside the crescents. Also, the metal half of Reza Shah was removed from the top of the cast iron door.

The designer of this entrance is Jafar Khan, an architect from Kashan. Other architects have helped him. Ismaili also played a role in the construction of this building. The columns were made by Karim Manijeh and its tiles were made by Khaknegar Moghaddam.

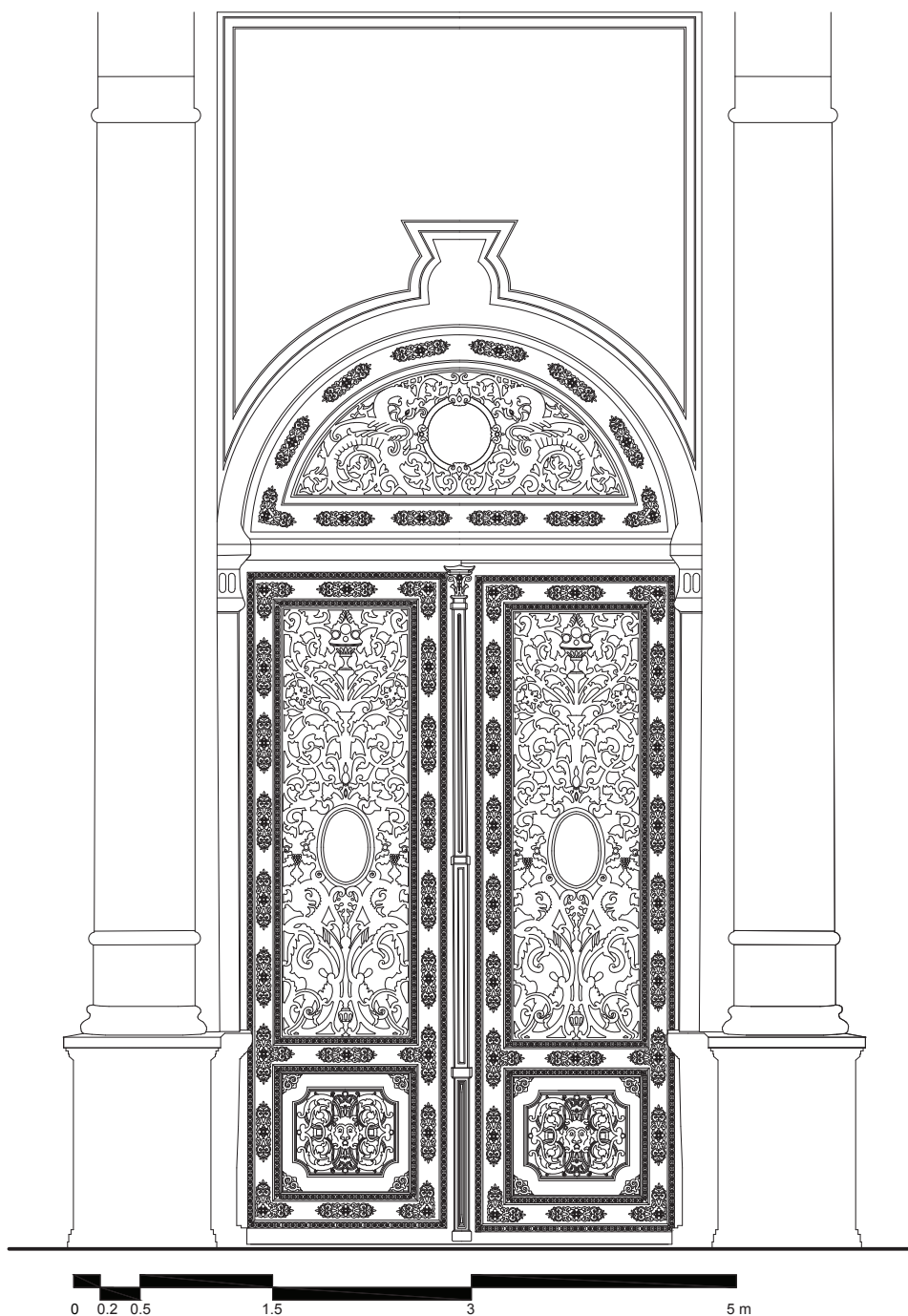
This building is designed with a mixture of Iranian-European architectural style, especially in tiles and pergolas. The foundation of this building and the base and shawl of its eight columns and the legs of the columns are made of brick. In the tiles of the upper parts of Islamic designs and images, machine gun, battlefield, sixty bullets, Reza Shah with sixty arrow (Maxim; Reza Khan's favorite weapon), two angels of victory, tricolor flag of Iran, cannonball, leopard, Quranic poems and verses And the letters of the Imams are written in the form of an inscription under the pergola. In the upper part of this building, a watchtower, trumpet

blast and military passage have been designed. In the tiles of this building, there are elements to commemorate the third coup of Esfand and the conquest of Tehran by Reza Khan, among which we can name the destruction of the fortress with cannonballs, Reza Shah shooting, two angels of victory.

The current project has documented the decorations of the eastern part of this entrance and its side entrance.



Orthoimage of the Northeastern Doorway and its Tileworks



CAD Drawing of the Northeastern Doorway Details

13



Farnaz Dastranj

The Tileworks of the Saadi Tomb in Shiraz, Fars

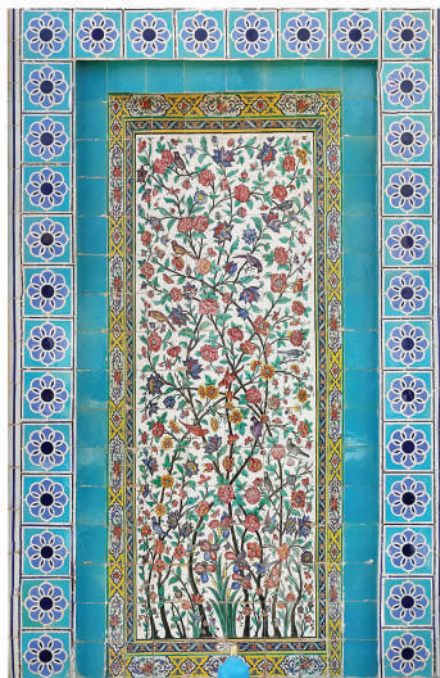
 Samsung G610F



Flower-shaped Repeating Square Motifs that Cover the Entire Entrance Surface.

Saadi (1210–1291 or 1292 AD) was a major Persian poet and prose writer of the medieval period. He is recognized for the quality of his writings and for the depth of his social and moral thoughts. The Tomb of Saadi, commonly known as Saadieh, is a tomb and mausoleum dedicated to the Persian poet Saadi in the city of Shiraz. Saadi was buried at the end of his life at a Khanqah at the current location. In the 13th century a tomb built for Saadi by Shams al-Din Juvayni, the vizir of Abaqa Khan. In the 17th century, this tomb was destroyed. During the reign of Karim Khan was built a mausoleum of two floors of brick and plaster, flanked by two rooms. The current building was built between 1950 and 1952 to a design by the architect Mohsen Foroughi and is inspired by the Chehel Sotoun with a fusion of old and new architectural elements. Around the tomb on the walls are seven verses of Saadi's poems.

The tiles of this building are the joint work of Haj Baqer Jahanmiri and Karim Faghfour. These tiles are always of interest to tourists, but they have not been documented yet. The current project is done for this purpose.



Orthoimage of the West Tileworks beside the Main Entrance

14



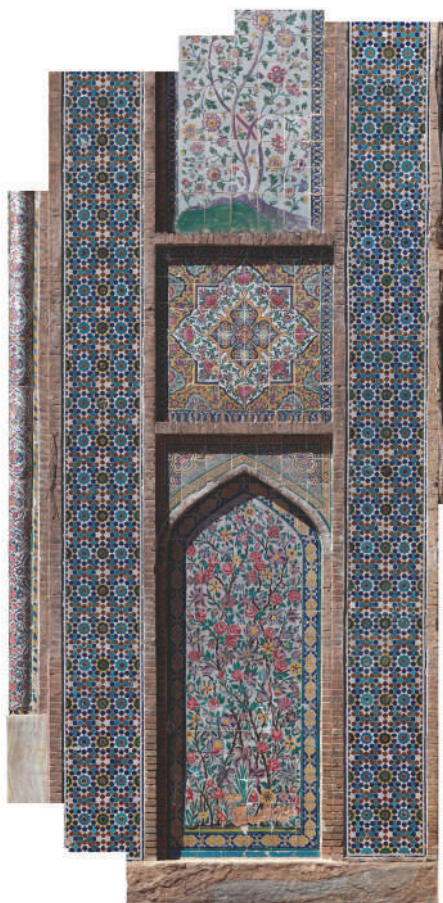
MohammadReza
Mehdizadeh

 Cannon Eos 80D

The Facade Tileworks of the Vakil Mosque in Shiraz, Fars

The Vakil Mosque is a mosque in Shiraz, southern Iran, situated to the west of the Vakil Bazaar next to its entrance. This mosque was built between 1751 and 1773 AD, during the Zand period; however, it was restored in the 19th century during the Qajar period. Vakil means regent, which was the title used by Karim Khan, the founder of Zand Dynasty. Shiraz was the seat of Karim Khan's government and he endowed many buildings, including this mosque. Vakil Mosque covers an area of 8,660 square meters. It has only two iwans instead of the usual four, on the northern and southern sides of a large open court. The iwans and court are decorated with typical Shirazi haft rangi tiles, a characteristic feature of the art and industry of Shiraz during the latter half of the 18th century.

The tiles of this building have been destroyed and rebuilt many times due to successive earthquakes. The current tiles in this project were restored based on the original model during the Pahlavi era. An important part of these tiles is the work of Karim Faghfour with the paintings of Mahmoud Naghashzadeh. This project has documented part of this work of art.



Orthoimage of the West Tileworks beside the Main Entrance

15



Melika Talebian

 Nikon D5300

An Entrance of a Traditional House in Jolfa, Isfahan

Isfahan Jolfa neighborhood is somewhere between Jolfa Hotel, Jolfa Square and Isfahan Vank Church. Where Muslims, Christians, Zoroastrians, and everyone has been together; But it is better known by the name and reputation of the Armenians. The Armenian merchants who once came here by force and started to rebuild, not only regained and created the lost life, but also added things to Isfahan and Iran. As:

Like the first printing house and the first printed

book in Iran, the first photography studios, the first modern schools, the first bicycles, the first lemonade factory, classical music and best of all, their beautiful customs. There is no trace of "Old Julfa" anymore. The one that was next to the Aras River in the Caucasus region and was burned by the order of Shah Abbas Safavid. Instead, the expelled Armenians on the outskirts of Isfahan during the Safavid period, with the order and help of Shah Abbas and in special royal lands, built a town called "New Julfa"



Orthoimage of the Entrance

to mark a new history in a new land. The new Julfa was established by the Armenians themselves and with the support of the Shah of Iran in the south of Zayandehrood. The Armenians migrated to Isfahan in 1605 AD and a year later created New Julfa. They built a east-west street parallel to Zandaroud River and named it after one of the rich people of the Julfa region, named Khajeh "Naazar". This street is today's "Nazar" street, which is divided into three parts: east, west and middle. After that, they made another ten crossings along the river to

the south (the slopes of Mount Sofeh). The passages that also intersected Nazar Street formed the Jolfa neighborhoods, which led from the south to the Southern Plain and the Armenian Cemetery and Mount Sofeh, and from the north to the Zayandehrood River. The wealthy built their houses near the river and the northern part of New Julfa so that they could take full advantage of the cool breeze of the river and the amazing and spectacular view. This project has documented the entrance of one of these houses.



Stucco Details above the Doorway



16

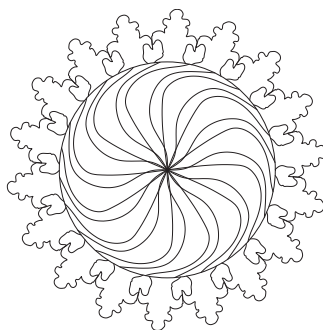


Yasaman Izadi

 Samsung G955F

The Ornaments of the Tymche Sarafyan Entrance, Abadeh, Fars

Abadeh is a city and capital of Abadeh County, in Fars Province, Iran. According to archeological excavations, settlement in the current area of Abadeh dates back to the first millennium BC, but its development and progress began almost from the time when Karim Khan Zand made Shiraz the capital of Iran. Abadeh historical monuments include Emirate Kolah Farangi, Tymcheh Sarafyan and Khaje tomb, located in the Khoja mountains. The main owner of the building was Haj Mohammad Sadeh Lotfali Khan, who later sold the building to a Shirazi named Haj Baqir and inherited it from his two sons, Haj Ahmad and Haj Mahmoud Sarafian. In this Tymcheh, they engaged in trade and commerce, and goods such as tea, raisins, carpets, almonds, and tragacanth were exported, and most of their imports were nuts. Tymcheh (small caravanserai) of Abadeh money changers, a relic from the Qajar period, has been a place for trade in 2 floors and 36 rooms. This building was built about 120 years ago by the talented master Reza Yazdi in the old part of the city (old bazaar). The area of this building is about 1080 square meters, two-story aristocracy is about 1050 square meters. Tymcheh entrance door is made of wood, the edge and frame of which are beautifully inlaid, and there are two percussions on it, the left percussion is for men and the right percussion is for women. The head at the entrance of Tymcheh building is plastered in a semicircle with the shapes of lion, flowers and plants.



CAD Drawing a Rounded Iron Motive on the Wooden Door



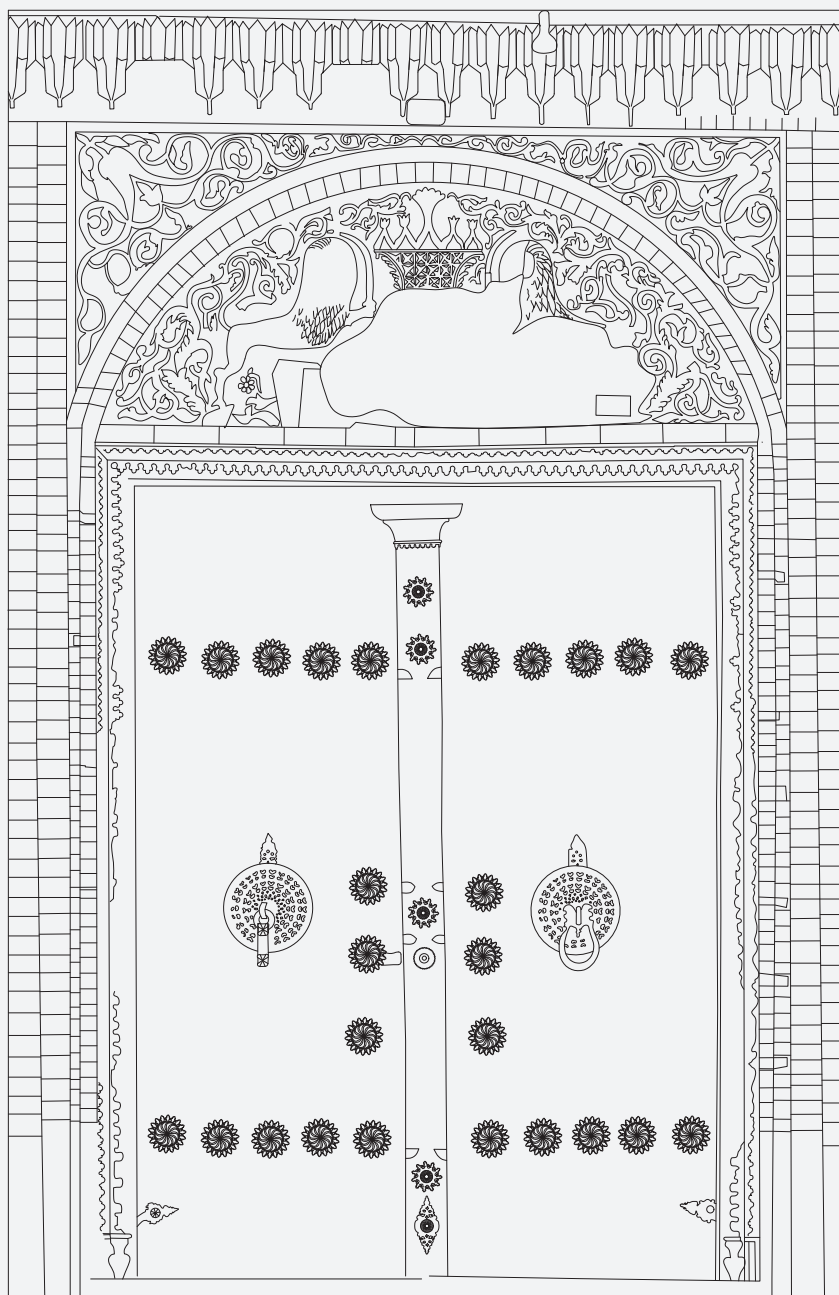
Orthoimage of the Entrance of Tymcheh Sarafyan

The main owner of the building was Haj Mohammad Sadegh Lotfali Khan, who later sold the building to a Shirazi named Haj Baqir and inherited it from his two sons, Haj Ahmad and Haj Mahmoud Sarafyan. In this Tymcheh, they engaged in trade and commerce, and goods such as tea, raisins, carpets, almonds, and tragacanth were exported, and most of their imports were nuts. Regarding the naming of

this Tymcheh as money changers, it is said that because these two brothers were wealthy and famous merchants and also were skilled in identifying foreign currencies, they were called money changers and the money changers became their family last name and this Tymcheh also remained with the same name. The current project has documented the decoration of the entrance of this historical monument.



CAD Drawing of the Entrance of Tymcheh Sarafyan



CAD Drawing of the Entrance Doorway and Stucco Above it Representing Two Lions in front of Each Other and a Crown on top Partly Destroyed



Orthoimage and the CAD Drawing of the Entrance Stucco

17

 Samsung A515F



Seyyedeh Yasaman
Dehbozorgi

The Ornaments of Dr. Farzaneh Entrance in Shiraz, Fars

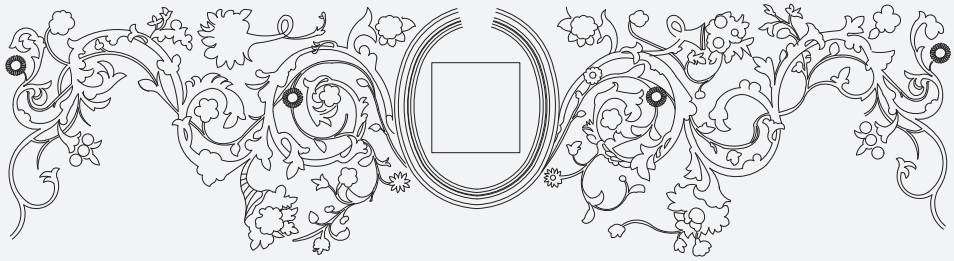
Shiraz is the capital of Fars Province, which is also known as Pars and Persia and known for its literary history and many gardens. Though, there is no definitive record of its existence prior to the late 7th century CE, few archaeological finds dating from 1933 and beyond indicate that the site or vicinity of Shiraz was likely settled in the pre-Islamic era as early as the

6th century BCE. The present city of Shiraz was founded or restored in 693 by Muhammad ibn Yusuf al-Thaqafi, the brother of the Umayyad viceroy of the eastern half of the caliphate, al-Hajjaj ibn Yusuf, or the latter's kinsman Muhammad ibn Qasim.

This project documents a house built outside the city's historic fence in the early 20th centu-



Orthoimage of the Entrance



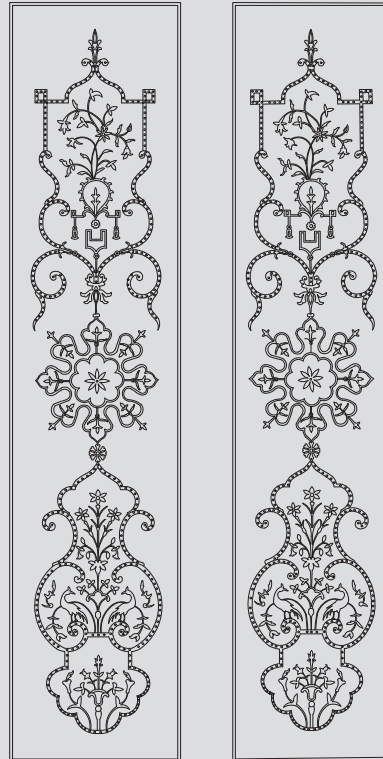
CAD Drawing of the Doorway Stucco



0 0.2 0.5 1 m

CAD Drawing of the Entrance Doorway and Stucco Above it

ry. This house is located in an area that marked the beginning of the development of the city at the beginning of the twentieth century. This development took place on the western outskirts of the old city and was limited to Qarani, Dariush and Saadi streets in the east and Moshir Fatemi and Nader streets in the west. The north of this area was limited to Ferdowsi Street and the south to Moshir Street. Contrary to the old fabric of the city, this area had regular and wide streets and alleys with new and large houses that were considered the residence of the wealthy and wealthy people of the city. That is, those who gradually emerged from the old city and leaned north and west of the city. They first moved west and southwest because the presence of the northern mountains of Shiraz and military installations limited the possibility of construction. The average date of construction of buildings in this section is 1947. Dr. Farzaneh's house is a brick building and only its entrance can be seen from the outside. The entrance of the building consists of a wooden door decorated with bricks that have been worked around in a pearl shape. A beautiful stucco is also executed on top of the door, which is unique in its kind.



CAD Drawing of the Doorway Wood Carving




Orthoimage of the Main Wooden Doorway

18



Yasamin Noorsobhi

 Samsung G950F

The Ivan's Tiles of the Jame'a Mosque of Isfahan

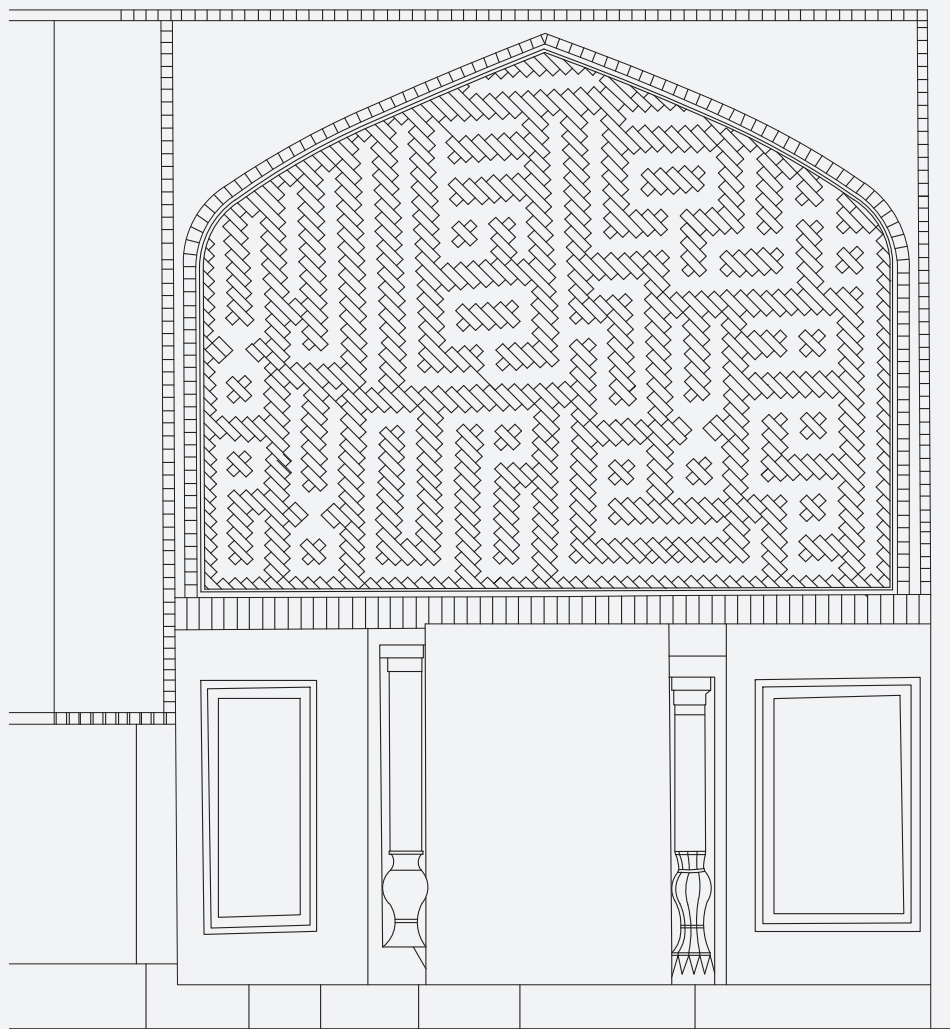
The Jāme' Mosque of Isfahan also known as the Atiq Mosque was the grand, congregational mosque of Isfahan city, within Isfahan Province, Iran. The mosque was the result of continual construction, reconstruction, additions and renovations on the site from around 771 to the end of the 20th century. The Grand Bazaar of Isfahan can be found towards the southwest wing of the mosque. It has been a UNESCO World Heritage Site since 2012. Built during the Umayyad dynasty, it is rumored in Isfahan that one of the pillars of this Mosque were personally built by the Caliph in Damascus. Prior to it becoming a Mosque, it is said to have been a house of worship for Zoroastrians.

This is one of the oldest mosques still standing in Iran, and it was built in the four-ivan architectural style, placing four gates face to face. An iwan is a vaulted open room. The qibla iwan on the southern side of the mosque was vaulted with muqarnas during the 13th century. Muqarnas are niche-like cells.

The current project is documenting the Bannai script on the west iwan of this mosque. The west iwan is 12 meters long and wide with arches and large muqarnas.

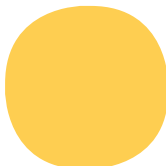


Orthoimage of the Bannai script on the west iwan



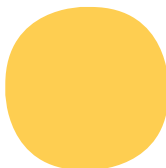
CAD Drawing of the Bannai script on the west iwan

Documenting Iranian Architecture Heritage

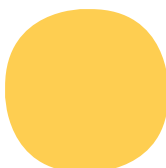
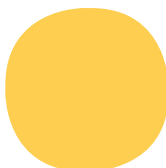


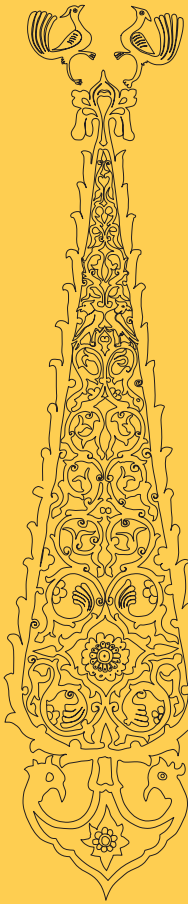
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