

Research Article

# Defensible citadel: History and architectural character of the Lahore Railway Station

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character

**Abstract** This study aims to investigate the defensible character of the Lahore railway station built in response to “the war of independence in 1857,” which greatly impacted the location and design of the building. This study demonstrates the integral role played by the railway station in the development of the new colonial city, which the British wants to be defensive in every aspect. Railways were introduced in Pakistan (India) soon after their inauguration in Britain. Beginning from the mode of transportation, the multifaceted contribution of railways toward the urban growth, new architectural style, mode of construction, and technology cannot be recanted. The research is based on the documentation and analysis of the history of Lahore railway station design. First, this study uses primary and secondary data to offer a history of the Lahore railway station from its inception to final execution. Second, it explores the criteria adopted by the British for its site selection to make the station a defensible post. The research finding includes the visual features that enhanced the architectural character of the building. Qualitative methods are used including several other approaches, namely, literature review, archival data collection, analysis of photographs, and study of architectural drawings and old maps, to achieve the objectives.

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## 1. Introduction

The industrial revolution, with all its technological advancements, introduced rail roads as a new mode of

transportation. In the first quarter of the 19th century, the emergence of steam engine gained extraordinary importance due to its revolutionary transformation in transport structure and introduction of new technologies. The first

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railway was opened in Stockton & Darlington Railway, UK in 1825 (Acharya, 2000).

"The British never really conquered India. But the railways did" (Christian, 2017). Imagining Pakistan (India at that time) without the contribution of railway networks is difficult. The arrival of the British was the most fascinating change. Rail roads largely impacted the urban growth patterns, technology, building techniques, architectural design, and the economic development of the country. Railways were introduced in India through the steam boat by Rowland MacDonal Stephens, who was a young employee of the first Steam Navigation Company; he was later acknowledged as the "Father of the Indian Railways" (Berridge, 1969).

In 1845, he persuaded the directors of the East India Company to establish railways in India/Pakistan. In 1849, Lord Dalhousie contributed his best to accelerate the establishment of this new era of rail networks. Tracks of more than 23,000 miles were laid, and railways became the most costly project undertaken by the British. In Pakistan, the first railway track of 105 miles between Karachi City and Kotri City was opened for public traffic on May 13, 1861. A double line of 21 miles was later built between Karachi City and the Karachi cantonment. The railway network gradually spread in the country and connected the whole country similar to a web. The network soon became the symbol of power and identity of the British.

The selection of the Lahore railway station for studying history and design development has many reasons. Lahore was an important historical city long before the Mughals. Mughal emperors attracted the commerce and residents by making the city a provincial capital from the 16th to 18th century. They gave the city a grandeur in the form of beautiful architecture. Sikh followed their footsteps, and the city remained the central attention of Punjab as political and commercial capital of Ranjeet Singh Kingdom (1801–1849). The British ruled Lahore as the last foreign invaders from 1849 to 1947. They built many buildings incorporating their ideologies and styles of construction. They soon realized the historical and geographical importance of Lahore and established the rail network in the city. The Lahore railway station was one of the earliest built railway stations in Pakistan. It was the junction (worked by the Sindh, Punjab, and Delhi Railway Company) and the headquarter of North Western railways. This system enhanced the importance of the city and the railway station. Given that the system was built shortly after the war of independence in 1857, it incorporates the features of a train station and a defensible post. The railway system was established in Punjab as Punjab Railway Company in 1862, and the Lahore railway station housed all the administrative setup.

An extensive study has been conducted since the beginning of railways (in 1853) to explore different aspects of British Indian railways, its history, engineering, associated infrastructure, railroad construction, and administrative setup. One of the key descriptions of the development and expansion of railways in Pakistan was that by Malik (Malik, 1962). It includes data about the history, track lengths, development, and income and expenditure with reference to years. Some other books also have significant contribution toward the British Raj and the development of

colonial India. Kerr in his book (Kerr, 2007) explained the initiation, pioneering decades, and expansion of railways in India (India, Pakistan, Bangladesh) and how it marked the social improvement and advancement. Christian Wolman is a popular railway historian and described the creation, influence, and legacy of Indian railways in his latest volume. The book covers present Indian cities; thus, the architectural history of the Lahore railway station remained a neglected part (Christian, 2017). An excellent effort was also done by Berridge (1969), who served North Western railways for 20 years. He explained the opening and construction of various lines in Punjab and discussed steel bridges and long-span structures. Railways of the Raj have also been discussed in the historical development of railways in India (Satow and Desmond, 1980). Railways were the single most costly project by the British in India. The current study mainly aims to understand the historical importance and visual character of one of the most important railway stations of the colonial period in India. No comprehensive study is available at present to introduce the tangible and intangible qualities to communicate the architectural significance of the Lahore railway station among practitioners and researchers. Architects and historians should not only preserve but also document the heritage buildings that have stored a rich architectural history of their existence.

This research is based on the documentation and analysis of the history of Lahore railway station design. The main objective here is to describe the importance of station design at that period and the factors to consider to ensure functional and secure buildings. To achieve the objectives, qualitative methods are used including several other approaches, namely, literature review, archival data collection, analysis of photographs, and study of architectural drawings and old maps. First, this study uses primary and secondary data to describe the history of the Lahore railway station from its inception to final execution. Second, it explores the criteria adopted by the British for its site selection to make the station a defensible post. The research finding includes the visual features that enhanced the architectural character of the building. The Lahore railway station is also compared with other railway stations of Punjab to have a clear picture of that region where Lahore is considered the most important city that must be defensible.

## 2. Significance of architectural character

Buildings are unique due to their identity and distinguished architectural character. Many aspects make historical buildings significant. Character, including shape, materials, decoration, craftsmanship, site, and environment (Nelson, 1988), defines the physical and visual appearance of buildings. Identifying the architectural characteristics of buildings and learning the lessons are important. Skills, expertise, and knowledge of traditional builders can keep the local identity alive and contribute to the growth of highly sustainable environment (Asquith and Vellinga, 2006). Buildings tell many stories and can embody the past in the form of memory and feelings associated with events and people. Buildings are never alone and achieve

their meaning through context. Site selection is important for defining the character of buildings, particularly historical ones. Given that building location is important for the Lahore railway station, we highlight the history, site selection, and character that define the aspects of the station building.

### 3. Construction of the Lahore railway station

The walled city of Lahore was irregular trapezium in shape with its longest side toward the north. The north-west side of the city was at a right angle to the Ravi River flowing nearby, as shown in Fig. 1. During the Mughal period, the city gained considerable attention and many tombs, mosques, and other buildings were constructed in the suburbs of the walled city. The Sikh nobility following their footsteps built gardens mostly on the eastern side; however, they misused the Mughal buildings and took away the precious gems and stones. The decayed and ruinous suburbs were described by the travelers during the Ranjeet Singh reign (Glover, 2008; Qadeer, 1983).

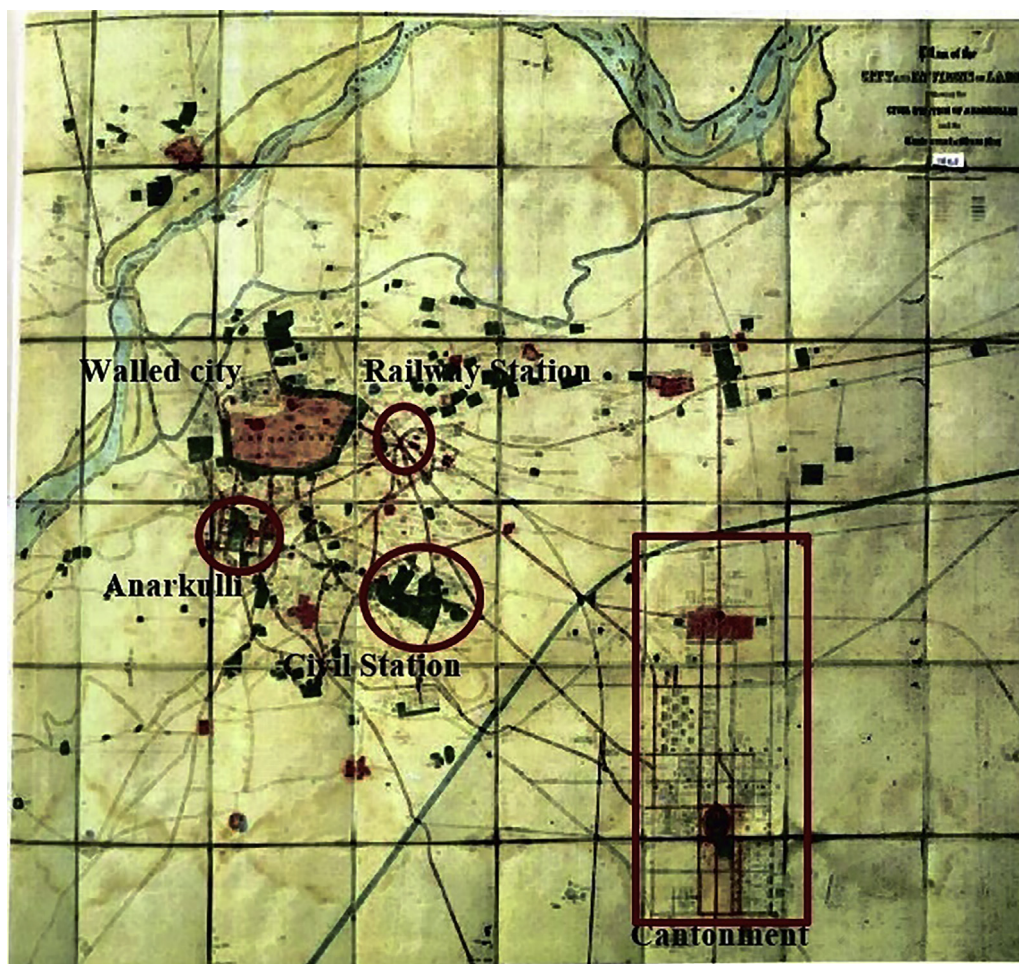
The British took control of the city and made it the capital of the province because of its historical importance. The houses and offices of the first British residents were confined to the neighborhood of the old cantonments, which occupied a strip of alluvial soil to the south of the city and running parallel with an old bed of the Ravi. However, as the European population increased in numbers, their station gradually spread eastward. The map of Lahore in Fig. 2 clearly shows no village or garden on the north or west side of the Ravi River because this area may be subject to flooding. The civil station and the Anarkulli cantonment were already established on the south side.

Anarkulli was abandoned as a cantonment in the period of 1851–1852 due to the terrible morality among the troops stationed there. The cantonments of Meean Meer was established on the east of the civil station at about 3 miles distance due to the unhealthiness of the former cantonments at Anarkulli (Gazetteer, 1883–1884). As a result, the east side was finalized for the development and expansion of the railway. An additional advantage of the present site is its location near the Ravi River, which can be used as an alternate transportation route. Initially, the purpose of the railway station was to accommodate the staff, store goods, and facilitate passengers moving to and from the city. Although the site has a drawback due to the presence of ruins of the old city, laying the foundations on firm soil is difficult. However, the above-mentioned convincing advantages make the local administration and railway company bear all the difficulties and high cost of construction.

The first evidence about the introduction of railways in Lahore was found in Lahore Chronicle published in June 1852. The article encouraged the idea of rail transport between two cities as it will support the commercial activities, which will be beneficial for the government. However, the first step for the development of railway lines from Lahore to Amritsar was taken when a letter was written from the civil engineer's office on February 3, 1853. According to the letter, "To lay a single line of Rails on one side of the Grand Trunk Road from Lahore to Amritsar leaving the remaining width of the road for the ordinary traffic ... which after deduction of cost of maintenance will secure a surplus income of 267,9325 rupees ..., length of the line would be 36miles" (Punjab Government Civil Secretariat, 1853). It took few years for the finalization of the project and on July 15, 1857. Chief Engineer William Brunton presented the architectural drawings of the Lahore



Fig. 1 Lahore (1839), red color showing walled city with river Ravi flowing on the western side and suburbs with ruins of Mughal gardens (rendered by the author).



**Fig. 2** Plan of the city and environs of Lahore (1867), showing Civil Station, Anarkulli, Cantonment and Railway Station. Source: Mapping Lahore tracing geography of city through maps. Rendering and illustration by the author.

railway station to the Scinde Railway Company (Khan, 2013). He also wrote a report on the selection of the site. The report indicated that generating revenue through the railway transport was the motivation of the British. According to the report, "I have consulted the wants of the Meean Meer cantonment and have allotted a station at each end of their lines. The stations at Lahore, Umritsir, and Mooltan, I have placed more especially with a view to native passenger traffic, which will be the main source of revenue from passengers: they are also in suitable positions for the delivery and reception of goods" (Andrew, 1857).

In the period of 1857–1858, Indian troops rebelled against the British for using animal grease in guns that was religiously forbidden for Muslims and Hindus. That rebellion was known by several names as Indian Mutiny, revolt of 1857, and the war of independence by the natives. They not only occupied British quarters and institutions but also killed many Europeans. The blood shed during the war send shock waves to the Colonial Britain, and the British did not consider it a safe place to live. Given that the project of the Lahore railway station was already delayed, this fear of natives greatly influenced the design of the railway station; they designed it more similar to a fortress. Now, the

foremost concern of the government was securing the British troops and civilian against any native uprising. Thus, along with the availability of land, the location, and damage from flood, the safety from any future revolt was the top priority. The station meant to be grand and imposing.

In 1854, the station was located within the cantonment, but Brunton forwarded the case and argued that it should be defensible in every aspect. Thus, the final location of railway stations that was previously based on population density and nature of land had a new factor added; after the mutiny in 1857, strategic location and defensible design were considered (Satow and Desmond, 1980).

In 1859, the foundation stone was laid by Sir (afterwards Lord) John Lawrence, who was the Late Lieutenant Governor of the Punjab, with the trowel inscribed with Latin motto "tam bello, quam pace," which means both war to peace (Talbot, 1988). It described the façade of the station. The Lahore railway station was constructed by the late Mohamed Sultan, who was the contractor to the Public Works Department. In 1860, the first train from Lahore to Amritsar ran for public traffic. The whole building was castellated and one of the finest and the most substantial specimens of modern brick work in the country that costed

**Table 1** Events in the construction of the Lahore railway station in chronological order.

Year	1852	1857	1857–1858	1859	1860
Events	Proposal of the project	Presentation of the architectural drawing	Project delayed due to the mutiny in 1857	Foundation stone laid	First train ran from the Lahore railway station

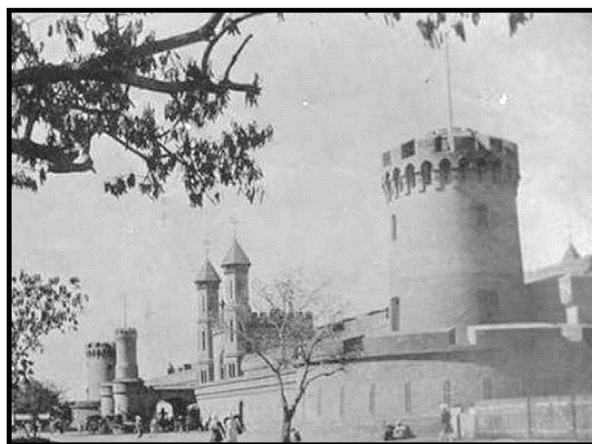
half a million rupees. By the end of 1861, 109 3/4 miles of the line were constructed. The chronological order for construction dates of the Lahore railway station is shown in Table 1.

#### 4. Historical character of the station

Along with the style of construction and material, other tangible elements embody the significance of buildings. These elements are those events and memories of the people associated with the building to give it a historical importance. Many official reports and comments proved that the Lahore railway station was a debated topic during its time of construction. Many officials and travelers visited it later and mentioned the building in their reports and writings. In 1863, the Principal Thomson College narrated the location and fort-like appearance of the building. "The Lahore Railway Terminus is about 400 yards distant from the Delhi Gate of the city, on the site of the old Sikh Cantonment of Nulukha, among the ruins of the ancient city. In designing the Passenger Station, it was thought advisable to give it a defensive character, as far as possible, and to arrange the defenses to require but a small garrison hence the Fort-like appearance of the present structure" (Medley, 1865). The British wants to have a building that would be frightening for the natives by its appearance. Burton was successful in achieving that goal and remarked about the appearance of the station, "The face these stations presented to the outside world was grim: high walls, rounded corners that would deflect shot, battlemented towers and firing slits" (Burton, 1996). Fig. 3 portrays the



**Fig. 3** The picture of Lahore Railway Station taken in 1880's depicting the fort like appearance. Source: city History.



**Fig. 4** Lahore Railway Station with crenellated towers and loop holes that were used for gun shooting.

appearance of the station that was also explained by I.J. Kerr as, "The 'fortified main station at Lahore' looked more like a medieval castle than a welcoming entrance to a key transport network. It was not just stations: The Rebellion led to the concern, at times an obsession, that was to last for decades among the authorities, namely ensuring the military security of the railway lines, bridges, tunnels and stations" (Kerr, 1995). The manager of the North Western railway system, Lieutenant Colonel Boughey, R.E, also described the building as, "It has connection with all the railways and all the principal places of India. It is therefore a busy center and the building itself (a castellated structure) is a fine piece of modern brick-work" (Walker, 2006). William J glover explained the building as, "The Lahore station, built during a time when securing British civilians and troops against a future 'native' uprising was foremost in the government's mind, looked like a fortified medieval castle, complete with turrets and crenellated towers, battered flanking walls, and loopholes for directing rifle and canon fire along the main avenues of approach from the city" (Glover, 2008), as shown in Fig. 4.

In 1875, the Prince of Wales (later known as King Edward VII) came to Lahore. He was welcomed with banners and triumphal arch fixed near the railway station, as shown in Fig. 5. It was a great reception by many rulers of the Punjab. The event highlighted the importance of the station as an entrance to the city. It was the first purpose-built building by the British at 400 yards distance from the Delhi gate. It served as a gate to the city designed by the British according to their ideas of a modern city and changed the urban life of Lahore (Ali and Qi, 2019).



Fig. 5 The archway built near railway station to welcome prince of whales in 1875. Source: Royal collection trust.

The Lahore railway station had always played its part since its construction. One of the important shares was contributed during the Anglo–Afghan war in 1878. The station facilitated 75 trains of troops and soldiers in every 24 h. It also supported the transportation of goods in the 1980s, which resulted in the form of Karachi as a major port. Another significant role was during the partition in 1947, when each train carried around 4000 passengers. However, the train reached the station with only handful of survivors. The building also acted as a refuge for those who want to leave the country. People hide in the railway station while they waited for the train to take them across the border. This historical character of the building is still alive in the minds and memories of the people due to the mega partition and the loss of many lives.

### 5. architectural character: identifying visual features of the lahore railway station

Rail stations can be best described as the “face of public transport” due to their role in the overall experience of the journey (Hale, 2013). Initially, only the train sheds were

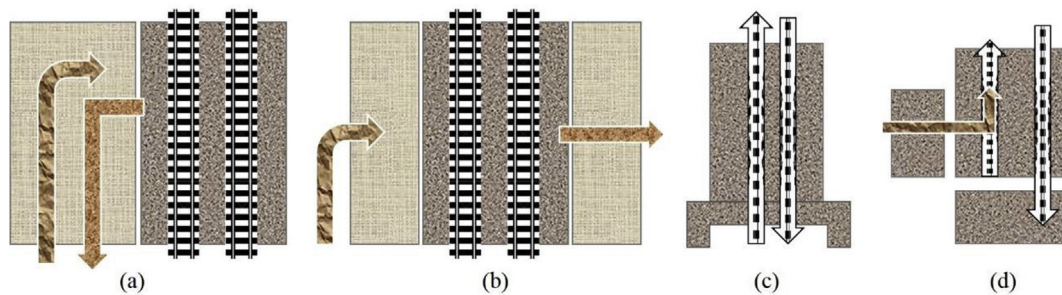


Fig. 6 Four types of stations based on circulation (a) the one sided, (b) the two-sided, (c) the head type, (d) the Type. Drawn by the author according to the classification published by Daly in 1846.

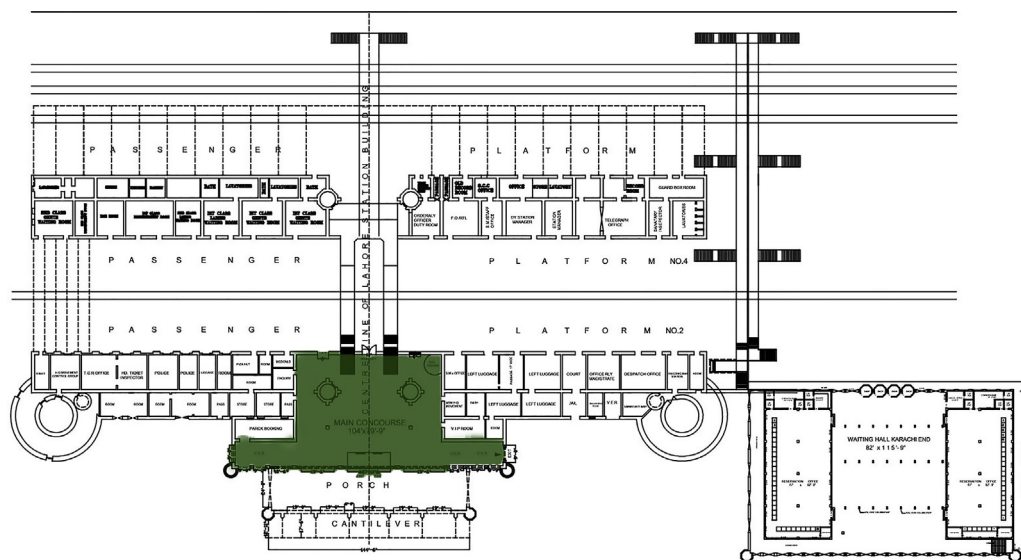


Fig. 7 Plan of the Lahore Railway Station drawn by the author. Green color shows the concourse.



Fig.8 The picture shows platform with two railway tracks in 1886.

provided and covered the railway tracks and platforms. Train sheds alone cannot fulfil all the functions. Provision of other facilities, such as waiting area, protections from weather, and access to the rail through other modes of transportation (such as horse and cart), was also essential (Edwards, 2013; Griffin, 2004; Meeks, 1995). Thus, railway stations were developed. More than 150 years ago, the first railway station was built, and no guidance on either function or design of the railway station was provided. "Every solution had to be invented" (Carroll, 1956).

The architectural character of the Lahore railway station is analyzed here according to four main features: station plan, elevation, masonry, and roof design. Designing for a large number of people that can cater the entrance and exit of passengers at the same time is difficult for architects. Previous churches and theatres used to cater to a large number of people at one time, but their design was not helpful for architects. In those buildings, same



Fig. 9 The auto CAD elevation of the station (by Author).

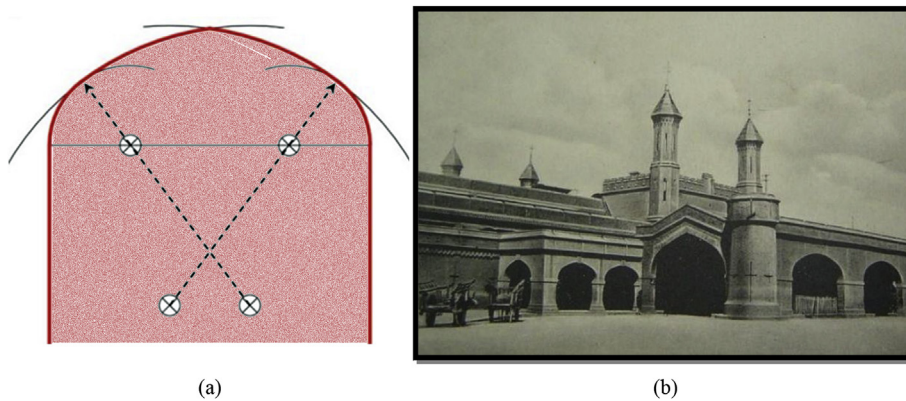


Fig. 10 (a) The construction drawing of Tudor arch, (b) the Portico with Tudor arch at both ends.

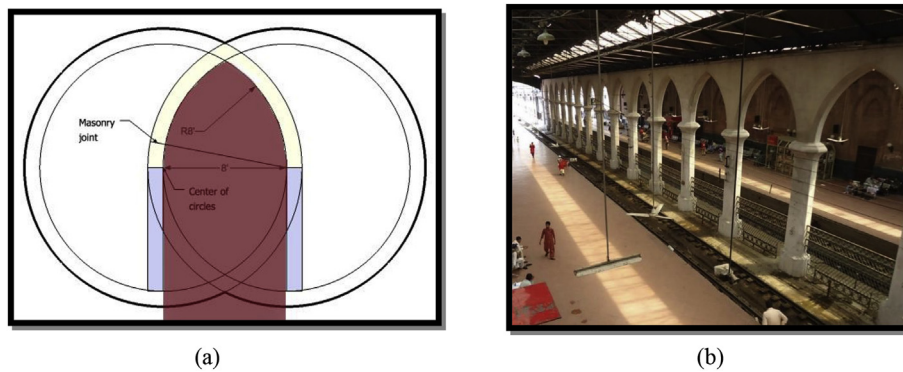


Fig. 11 (a) Gothic Arch constructed with straightedge and compass, (b) Row of gothic arches supporting the long span of roof without creating visual barrier.



Fig. 12 Gothic Arches in red bricks and white plaster on both sides of Railway Station.

entrance and exit can be used because worshipers and audience have fixed time to enter or move out. Here, the plan of the Lahore railway station building is categorized according to the very first and basic classification published by the editor of the *Rel'lte Generate de l'Architectllre* in 1846 (Ching, 2014). He established an important criterion for the identification of station and categorized four types, namely, one-sided, two-sided, head type, and L type, as shown in Fig. 6. The basis for this division is the circulation routes of the arriving and departing passengers and the linkage between the form and function of buildings and the tracks.

In the early years of railway development, the stations were simple and mostly one-sided. With the advancement of railways, the number of tracks increased, and the stations had to cater to more passengers at a time. Later, two-sided stations were constructed to facilitate the departure and arrival of passengers through separate buildings. The first Euston Station in London in 1839 is an example of a two-sided station. The Lahore railway station was designed



Fig. 13 Clock towers placed at the center of roof top. It was a distinct feature of British Designs.

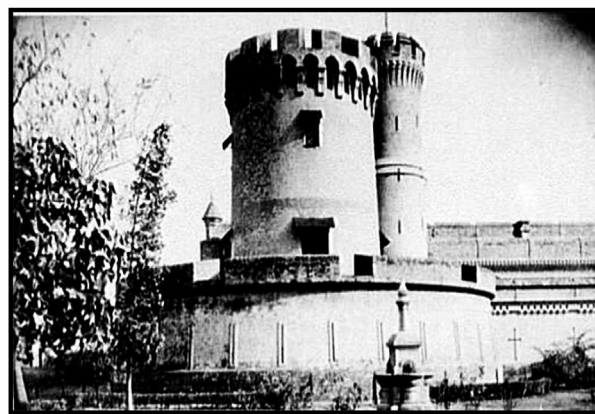


Fig. 14 Turrets designed at both ends of front façade  
Source: A view of Lahore Railway Station c. 1895.

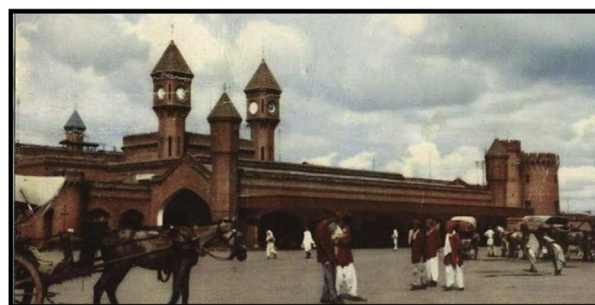


Fig. 15 Lahore Railway Station built entirely in brick masonry

according to head house concept, where the passenger walkways and concourses were designed in the center and other facilities were on the sides. The head house and concourse proved to be the most significant feature of railway architecture because it provided a pragmatic solution to the volumes of train and passenger traffic (Sheppard, 1996). Functionally, they allowed arriving and departing passengers to gather at a same area. After entering through the portico, a concourse was situated, as shown in Fig. 7. The concourse also acted as a main circulation area between the entrance and destination zones, "where passengers stop to consider their next action" (Ross, 2000).

The building was oriented in the North–South direction. It was rectangular with two symmetrical blocks parallel to each other. Initially, there were four railway tracks and two platforms that were 519' long, as shown in Fig. 8. Later, with the change in size of track gauge, two tracks were replaced with one track. The interior was spacious with arrival and departure platforms. The station was well planned to handle any emergency. Huge gates were situated at the entrance and exit, and heavy sliding door was imbedded across the track to seal the station (Davidson, 1868). In the beginning, the British did not expect much popularity of railways among the natives; thus, only two platforms were built. The Lahore station was also the junction. Thus, with the development of railways, the





(a)



(b)

**Fig. 16** (a) The ceiling of portico (the main entrance of station), (b) the roof and steel bridge connecting the other platforms.

number of platforms also increased. At present, there are 11 platforms in the Lahore railway station, and all are connected through steel bridges. The passengers must cross the track by foot using steel bridges to reach the other platform. The plan in Fig. 8 shows three main platforms and the parallel activities, namely, the ticket office, station master room, waiting areas, and refreshment rooms. The fort-like appearance of the station is also shown in Fig. 9 through the AutoCAD drawing by the author.

Since the time of ancient Greek, arches have always been the dominant feature of buildings. However, with the passage of time, the size, form, and function of the arches changed. The Mughals left a rich architectural inspiration for Britain; among them, arches were an important feature. The Lahore railway station was one of the earliest purpose-built buildings. Thus, Britain tried to incorporate its style rather than only following the Mughals. In the station

building, two types of arches, namely, Tudor and gothic arches, were mainly used. Tudor Arch was constructed by the Mughals and was found in many of its buildings. Gothic arch was the addition by the British to this new style of architecture in India. This style was later termed as Indo-Saracenic architecture.

The entrance to the station building is through the portico with Tudor arches at both ends. The porticos were added to provide protection from severe environmental conditions; they also drew attention and made the entrance significant (Arthur and Passini, 1992). Tudor arch was most popular in England during Tudor Dynasty (1485–1603). It also remained an architectural feature during the late 19th and early 20th century as Tudor revival architecture. It was a four-centered arch, and two key features defined it. It had a pointed apex as one of its distinguishing features and finished at a distinctive point.

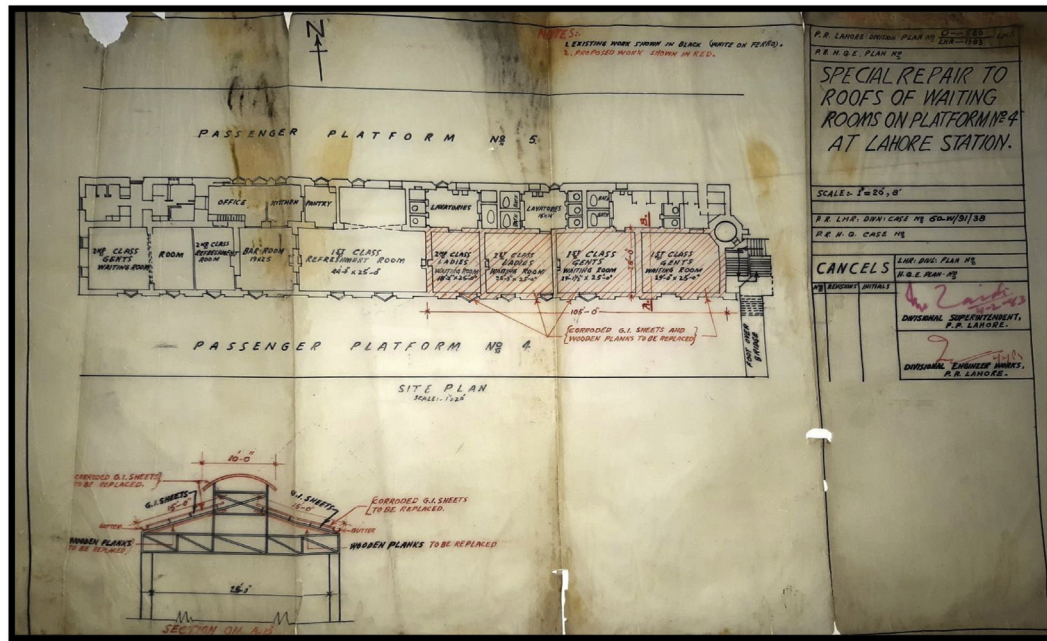


Fig. 17 The plan of Passenger platform 4 and 5 shows the repairs that have been made on the roofs of the room in 1983. the changes were marked with red color. Source: Railway headquarter design department.

Meanwhile, traditional arch used by the Mughals had round or curved top. The second key feature was the relationship between the rise and span. It was much wider than its height, as shown in Fig. 10(a). The portico was wide and low heighted. Thus, it was primarily used at the entrance and the windows. It gave more welcoming appearance and did not disturb the character of the building due to the low height. On the side of the portico facing the front, traditional arches were used, as shown in Fig. 10(b).

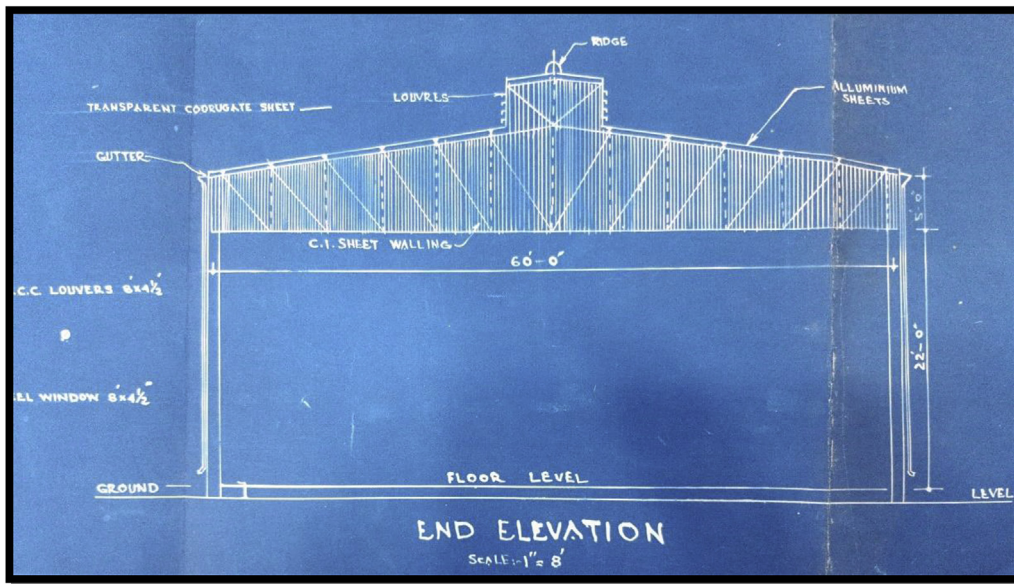
Inside the building, the major type of arches used was Gothic arch. It was a sharp-pointed arch and composed of two arc segments (parts of a circle). The lower part of the arch was parallel sided and up to the level of the springing points. That was evolved from the round-topped Roman arch, which was taller than a circular arch of the same width. This design also placed much less horizontal stress on the piers holding it up. The introduction of the Gothic arch allowed the building to be much taller and more open, thereby allowing larger windows and less raw material for support, as shown in Fig. 11(a) and (b). Gothic arch was used in the station for decorative purposes and to support the long-span structure. It reached higher than the normal arch for a given width and was less visible. A major consideration when building a masonry arch was the amount of horizontal thrust that it produced on its foundations. The advantage of using Gothic arch was that it puts only half the side-thrust compared with the Roman arch. This style was a well-designed successor to the Roman arch style.

To support the large span of roof structures, the British used the arches fascinatingly. They were used in two different ways, as shown in Fig. 12. On the one hand, open style was used to give more spacious appearance and keep the other side of the platform visible. On the other hand,

parallel rows of gothic arches were filled with masonry. This contrasting color and mode of construction gave the platform a magnificent and elegant appearance.

The developing phase of railway stations was much standardized between 1844 and 1890. It included the acceptance of certain design elements that were made symbol of railway stations. The tower, the bell, the clock, and the concourses were not only symbolic representation but also proved to be the source of wayfinding (Quinn, 2008). With the arrival of the British Raj, the clock towers obtained significant status in the major cities of Pakistan. Clock towers were also introduced in the station building in around the 1940s as a source of audible cues, as shown in Fig. 13. Before that, no system of timekeeping was available nationwide. Bells and clocks were the main elements of clock towers, and nearly all the major railway stations designed by the British had the clock towers in them. Eight clocks were imbedded in the twin tower on all the four sides. Keeping the track of train timing was important because the arrival and departure of train follows the timetable. Thus, they were the best source to signal the passengers about train timings. Soon, "station clocks became symbols, governing the comings and goings of trains and people" (Sheppard, 1996).

The Lahore railway station was designed to serve for defense and as the train station. Turrets were one such design elements that provide a projected defensive position to cover fire, and the holes were used for firing if any incident or revolt happened. Turrets were designed on both ends of the front elevation. They were small towers with crenellated circular tops and were projected vertically from the wall of a building, as shown in Fig. 14. They were curved structures that allowed a 360° view of the outside world. They were primarily used in the military forts and



(a)



(b)

Fig. 18 (a) The sectional elevation showing construction details, (b) the picture of west side of platform.

castles for defensive purposes. It was considered excellent defensive position in the times of war. William Brunton, who was the architect of railway station, also explained that the whole station had a “defensive character.” Thus, a small garrison could secure it against enemy attack. Turrets also served the decorative purposes in the building. This character was entirely different from that used in the design of forts before the arrival of the British.

The building was constructed entirely with brick masonry, as shown in Fig. 15. At present, some part of the building has exposed brick walls, and others are plastered and painted. The old bricks used during the Mughal period were slightly different from the modern bricks. The texture of the modern brick used in the station building appeared

closer and smoother, and the edges were straighter and sharper than those of the old material. In addition, the color and size of the modern brick were much reddish and thicker in a standard size than those of the old brick. The size of the brick used was as follows: length of 9”, width of 4.5”, and thickness of 3” (standard size of brick used by the British in many building). These dimensions led to a variety of bonds in construction. Nearly all the buildings during the colonial period and even in the post-colonial period used these bricks because they were practical. In the Lahore railway station, the native and modern bricks by the British were used due to two reasons. First, the old bricks were readily available because the station was built near the ruins of the old city. Second, Mian Muhammad Sultan, who

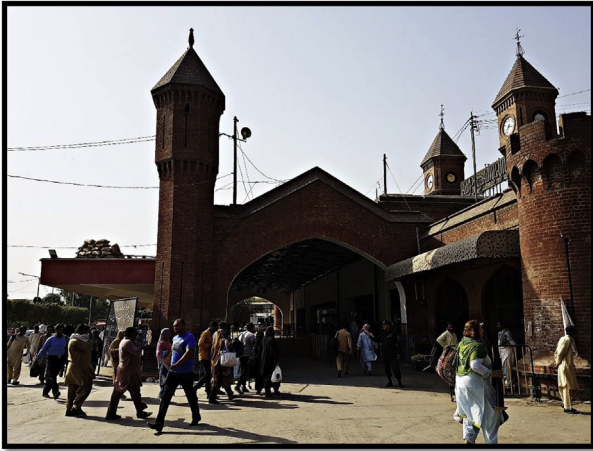


Fig. 19 Present status of Lahore Railway Station (2018) (by author).

was the contractor of the Lahore railway station, was famous for selling old native bricks. He also used these bricks in railway stations, railway bungalows, and other buildings. Bricks were bonded and stacked together by a mortar joint, which was a mixture of sand, water, and cement; and lime prepared from chalk or limestone burnt in a kiln and then hydrated or slaked with water. The use of lime in a mortar gave the mixture a soft texture, which enables the buildings to breathe freely. The outer surface had a closely joint brick surface and was perfect and pleasing to the eyes. As a result, Architect William Brunton called it "the best in the world." He felt confident that it could survive even full-scale howitzer fires. Bricks were used throughout, the outer surface had carefully closed joints, and the masonry could not be better even today.

During the pre-colonial period, the traditional builders were expert in the construction of brick masonry arches.

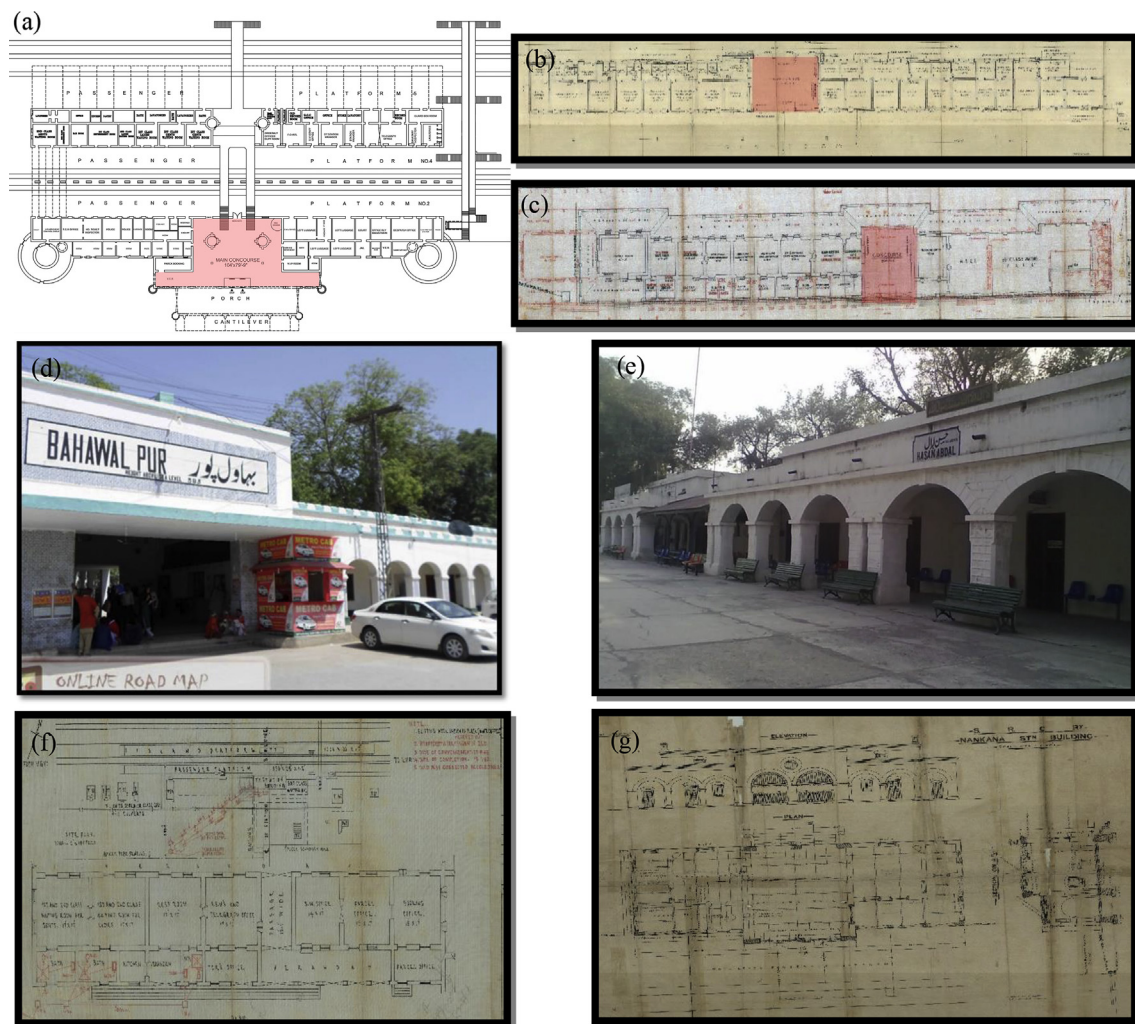


Fig. 20 Original drawings and pictures<sup>1</sup> of different railway stations for comparison with the Lahore railway station. (a) Lahore railway station with a concourse in red. (b) Sahiwal railway station with a concourse in red. (c) Gujranwala railway station with a concourse in red. (d) Bahawalpur railway Station as the longest station building in length. (e) Hasan Abdal railway station. (f) Okara railway station. (g) Nankana Sahb railway station.

<sup>1</sup> The original drawings are unavailable for the Bahawalpur and Hasanabdal railway stations. Thus, recent pictures are used.

**Table 2** Comparison of architectural features of railway stations.

Stations	Lahore	Sahiwal	Gujranwala	Bahawalpur	Hasan Abdal	Okara	Nankana Sahn
Construction year	1860	1865	1866	1892	1893	1925	1948
Single story	single story with high ceiling and access to turrets and clock towers	✓	✓	✓	✓	✓	✓
Brick masonry with lime mortar	✓	✓	✓	✓	Stone masonry	✓	✓
Load bearing masonry wall thickness	13.5"–18"	13.5"–21"	18"	13.5"–18"	21"–24"		
Stone masonry	13.5"–18"	13.5"–18"					
Jack arches in brick masonry with steel I beams	✓	✓	✓	✓	Sloping steel shed comprised of corrugated sheets, purlins, steel beams, and columns	✓	✓
Rooms and hall heights (ft)	18'	22'	18'	15'	18'	17'	17'
Veranda height (ft)	16'	16'		12'	12'	12'–6"	12'–6"

Meanwhile, European experts have technical knowledge based on the scientific calculations of structural members and strength of roof materials. The combination of both resulted in a sustainable and economical solution of roofing system, that is, jack arches. In the Lahore railway station, jack arches were used as roofing system.

The development of railways was one of the main driving forces behind the introduction of steel in various forms. Strong links were situated between the railway and steel construction industries not only in the demand for steel for rails and locomotives but also in infrastructure development, particularly bridges, stations, and warehouses. Train sheds have been called the single-most important design innovation of the 19th century (Brown, 2005). In the station building, the use of steel and iron was mainly for truss design, sheds, and connecting bridges between different platforms. The trusses supporting the roof, as shown in Fig. 16(a), were the first to be noticed upon entering the station building. It was the distinctive feature of the railway station. Before that, people were used to see decorative and floral painted ceilings as in most of the Mughal buildings. This feature continued in the platform and train shed. From the beautiful complimenting arches on the sides of the platform, the character of steel trusses on the roof made the station highly engineered and technical project of that time, as depicted in Fig. 16(b). The truss used was modified queen post. Wooden planks and galvanized iron (G.I) sheets were used as roof to cover the trusses. In 1983, the corroded G. I sheet and wooden planks of four rooms at platform number 4 were replaced. Fig. 17 shows the amendments made at that time. The roof design of the platforms was different from the rest of the station building. A lot of steel was used for the trusses because the railway had a lot of residual steel that cannot

be further used for the tracks. Accordingly, the engineers used them for long-span roofs of station platforms, and it was visible in the Lahore railway station as well. The steel trusses on the platform were covered with G. I sheet walling that was 5 feet in height. Transparent corrugated sheets were used on the top to have sufficient light. Louvers with a ridge were installed on the center for light and ventilation. On both ends, a gutter was also provided for the drainage of rainwater. The span of the roof was 60 feet with 22' height. The section of the platform is shown in Fig. 18(a), and the side elevation is shown in Fig. 18(b). Every part of the station building was well planned and well thought off.

## 6. Present status of the lahore railway station

After the British felt secured and with increasing demands of rail transport, few changes were made in the design and elevation of station buildings. However, the elevation of buildings did not change after the partition in 1947, as shown in Fig. 19. Only the repair work was done to strengthen the structure. At present, the Lahore railway station is protected under Punjab Special Premises Preservation Ordinance (1985). No further changes can be made to damage or alter the character of the building.

## 7. comparison of the Lahore railway station with other stations of Punjab

The railway continued to expand, and different other stations were built in Punjab Province. Some major stations and the Lahore railway station built from 1860 to 1948 are compared. The original architectural plans and picture (original drawings

were unavailable) of the stations are shown in Fig. 20(a–g). The comparison is conducted in the form of a table to study the architectural style and other structural features of these stations. It includes number of story, masonry type, wall thickness, supporting structure, and room heights, as shown in Table 2. This way would help analyze the technology the British used to build these stations.

## 8. Result and discussion

The comparison of the Lahore railway station with other stations shows that the British constructed single-story railway stations. The offices and other facilities in the Lahore railway station were provided on the ground floor. However, access was provided to reach the clock towers and turrets. Brick masonry was mostly used except for the Hasan Abdal railway station due to the location of the city. The thickness of the walls was also remained the same and varied from 13.5" to 18". The roofing of these stations was done with jack arches that rest on steel I beams. This system was already in use in Europe for industrial buildings to fulfill the requirement of large-span structures. Thus, the British used this system initially in every railway station and in every railway building by the 20th century. Only few stations had concourses because they were built in major cities catering to a large population. Although the Sahiwal and Gujranwala railway stations were built few years after the Lahore railway station, the defensive character was not visible in any other stations. The reason was that Lahore was the capital of the province and the junction station connecting the Karachi–Peshawar line and the Lahore–Amritsar line. This strategic location of the city demanded the station to be defensive in every aspect. Furthermore, forts were constructed for defensive purposes in the pre-colonial period. The British constructed the railway station in India with defensive character for the first time, and this feature remained linked with only the Lahore station. The British kept a basic symmetry in their design of railway stations, as shown in Table 2. All the main stations had longitudinal plan that runs parallel to the railway line. The facilities and offices were planned side by side facing the platform, as shown in Fig. 20. These plans also showed symmetry in sizes of the rooms and elevation. However, after partition, the construction and modification of the railway stations varied either according to the historical value of the city or the requirements of the area using modern techniques. Only the stations that are protected under the government law remained the same at least in their visual character. The Lahore railway station is one such example. Currently, the Lahore railway station is no longer used as a defensive building. It now only fulfills the transportation needs of passengers. The elevation has been maintained to its original condition and standing as an emblem of the golden era of the British Raj.

## 9. Conclusion

The Indian railway network was the largest technological project of the 19th century by the British. The magnitude of the project, the massive difficulties, and the short duration of achievements made this structure the most daring

experiment of the colonial period in terms of economic and engineering. The presence of the fort and the wall around the old city depicts that the defense has always been important for previous rulers as well. However, the construction of the Lahore railway station was an advancement in terms of its design, material, and the dual purpose of the building. It proved how the British used transportation as a symbol of power. It is the only station in Pakistan that was constructed not only for the defense of the city but also to provide safe exit for the British in case of any future revolt. This study highlights the importance of the design aspects of buildings and provides a guideline of the purpose of each design element in addition to beautification. The selection of design elements has strong architectural character. From its setting in urban fabric to its overall shape, each part of the building enhanced the visual character of the Lahore railway station. This study also proves that stations can be multipurpose if they are designed strategically. The tangible and intangible factors should be considered for the study of historical buildings. If the war of independence did not happen, then the design of the station would be entirely different and may be similar to other Mughal buildings or a completely colonial structure. Even the location of the station would be different. Given that stations played a role in the city development, the whole expansion of Lahore City would also not be like how it is today.

## Conflict of interest

There is no conflict of interest.

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