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Heritage In The Shadow Of Progress: Assessing The Impact Of The Orange Line Metro On Lahore's Historic Architecture

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Abstract: *This study critically investigates the conflict between infrastructural advancement and heritage conservation through the case of Lahore's Orange Line Metro Train (OLMT). While the project promises modern urban mobility, it threatens the structural integrity and visual sanctity of several UNESCO-listed and protected heritage sites most notably, the 17th-century Shalimar Gardens. Violations of both local heritage protection laws and international conventions have resulted in widespread alarm among architects, conservationists, and civil society, culminating in a legal petition submitted to the Supreme Court of Pakistan. The 11 heritage sites include Shalimar Gardens, Gulabi Bagh Gateway, Buddhu ka Awa, Chauburji, Zebunnisa's Tomb, Lakshmi Building, General Post Office, Aiwan-i-Auqaf, the Supreme Court's Lahore registry, the St Andrews Presbyterian Church on Nabha Road and Baba Mauj Darya Bukhari's shrine. Even mosques and churches, some as old as St Andrew's Church built in 1860 (located next to the Supreme Court registry), are either pulled down or seriously threatened. The construction of the track has led to a partial or complete demolition of 42 schools and colleges as well. The research assesses environmental degradation, loss of architectural authenticity, and socio-cultural disruptions caused by OLMT construction. Drawing upon heritage conservation principles, policy analysis, and environmental impact data, the paper exposes systemic gaps in planning and mitigation. The findings underscore an urgent need for urban development models that integrate preservation protocols and participatory governance to prevent irreversible cultural loss. This paper contributes to the global discourse on sustainable heritage management amid rapid urbanization in historic cities.*

Keywords: Orange Line Metro, Shalimar Gardens, heritage conservation, Lahore, urban planning, UNESCO, architectural impact, sustainability

I. INTRODUCTION

Lahore, the second largest city of Pakistan, has a population of around 10 million inhabitants. At an average, the transportation demands of the city rounds off to 6.8 million daily person trips for work and other recreational activities. This doesn't include walking trips. Lahore is often described as the "city of gardens". Although deserving of this title, few of its historic gardens survive to the present day and even fewer are preserved in something close to their original state. Shalamar is a grand exception to this

trend. Comprising nearly forty acres on three broad terraces, its majesty brings to life the Mughal genius for landscape architecture like no other monument in Lahore. Prior to Shalamar, the Mughal emperors had been no strangers to garden building. Babur, the founder of the dynasty, had constructed a number of gardens during and after his invasion of the Indian subcontinent. Judging by his memoirs, he held a consummate interest in cataloging and describing the flora and fauna of the Indian landscape, and his gardens often incorporated varieties of native plants.

Environmental impacts can be defined as the positive or negative effects that developmental, industrial or infrastructural activity causes on the environment or environmental quality (Park, 2007). In general, the environmental impacts generated from infrastructure construction projects include extensive consumption of large amounts of renewable and non-renewable resources, emission of dust and smoke during the production and transportation of construction materials, generation of waste, pollution, contamination of soil and water, etc. (Muhwezi, 2012)

“UNESCO stated that the Punjab government did not take it on the board prior to launching this development project, particularly at the stretch passing along the Shalamar Gardens that is on the list of world heritage list.”ⁱ

II. THE CONCEPT OF SHALIMAR GARDEN

The Paradise Garden theme was also portrayed in the design of carpets. In the seventeenth century, a carpet based on this theme was made for Shah Abbas of Persia.

Figure 1: Shalamar Garden



Source: Collected by Author

The layout plan of Shalamar remarkably resembles the design of the carpet. The division and subdivision on the carpet design, the location of the central and cross canal, and the symbolic representation of cypress trees along the central canal is very close to the tree plantings and garden layout at Shalamar.

The tradition of constructing gardens in a series of ascending terraces existed before Shalamar was built. Gardens around Dal Lake in Kashmir are well-known examples, but never before in the plains was such a bold Site selected where the difference between the highest and the lowest terrace was more than six meters. As Shalamar Garden in Lahore was constructed on the model of Shalamar, Kashmir, they both have three terraces.

Figure 2: Shalamar Garden Elevation



Source: Google Images

The plan of Shalamar Garden revolves around a central tank placed between two chahar baghs, or fourfold plans of the upper and lower terraces. The original entrance of Shalamar was through a lofty door on the western side of the lower terrace. Like all Mughal gardens, Shalamar was approached from the lowest terrace. As one moved up, there was a feeling of discovery, whereas the present entrance is through the southern wall of the highest terrace and the total experience is reversed. During Mughal times the highest terrace was reserved for royal ladies whereas the middle terrace was the king's private garden. The lowest terrace was for the people of relatively lower ranks.

III. HISTORICAL DEVELOPMENT

In 1651 once Aurangzeb visited Shalamar Garden. In one of his letters addressed to Shah Jahan. He expressed his views of the newly garden. In a fairly short period after its construction the garden seemed to have blossomed fairly as well observed by the prince. He mentioned flowers such as tulips, yellow Jasmine, lilies and iries.

He was particularly moved to see a judas tree and was believed that in Kabul where judas trees were generally available in abundance at that time. There was not a tree to match the elegance of this Judas tree. Sujan Rai another contemporary of Aurangzeb, who visited Shalamar towards the latter half of the 17th century, shares more or less same views.

The garden was well looked after till the early part of the eighteenth century but with the weakening of Mughal Empire the garden went into decay. The disturbed state of Punjab in the eighteenth century was at the mercy of Afghans and Sikhs. Nadir Shah encamped in the garden in 1738. Ten years later Ahmed Shah Durrani's camp was fixed in the vicinity.

Figure 3: Metro Line Train



Source: Rendering by Author

The gardens of Lahore suffered quite heavily during this period when a war was fought in the vicinity of Shalamar between the local ruler Muin-ul-Mulk and Ahmed Shah Durrani. It is said that until this tune, the gardens of Lahore in general were intact but they were then cut down for the purpose of entrenchment. Green gardens were merged with dry and dusty lands and studded with trenches; all was over in no times.

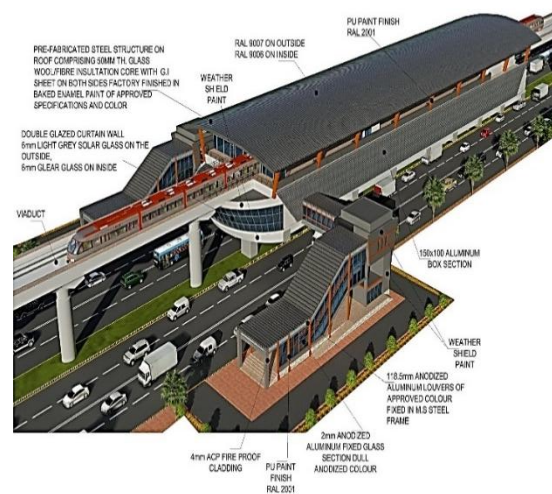
Sikhs the rulers Of Punjab towards the mid-18th century and the garden continued to suffer quite heavily. A costly pavilion was removed by Lehna Singh, one of the local rulers who old It to stone polishers in the city.

Whereas the original landscape of Shalamar Gardens must have till the put or 18th century. By the early 19th century statements of traveler's report that were fruit trees in the garden and some of the fruit trees were of high quality, particularly mango tree, but there were generally planted in the garden without any special consideration of theme. Britishers conquered Punjab in 1849. H.H Cole first curator of Ancient monument by the British gave following description in his reporting 1883-1884.

IV. ORANGE LINE METRO TRAIN

The Orange Line will be Pakistan's first modern rail-based mass [rapid transit](#) system and it is fully automated and driverless.

Figure 4: Metro Line Train



Source: Rendering by Author

At the cost of \$ 1.6 billion, the Orange Line aims to cater to the transport needs of a growing city by ferrying up to 30,000 passengers per hour. The Orange Line MRT feasibility study was done by the Consultant MVA Asia Ltd. in year 2007 for 27 km route. The study was updated by NESPAK in 2014 through Addendum to the Feasibility Study. The Orange Line starts from Ali Town on Raiwind Road and terminates at Dera Gujran. The alignment follows the Multan Road corridor from Thokar Niaz Baig up to Chauburji, then via Lake Road, Mcleod Road, Nicholson Road to the main Railway Crossing to reach G.T. Road and follows G.T. Road till interchange of Lahore Ring Road. The project cost is USD 1478.18 million (exclusive of contingencies).

The features of the Lahore Orange Line Metro Train project are as follows:

Total Length: 27.1 km (Cut & Cover Section: 1.72 km; Elevated: 25.4)

Total Stations: 26 (Elevated Stations: 24 & Cut & Cover Stations: 02)

Rolling Stock Requirement - 27 Train Sets at the Start of Operations

Ridership: 245,000 Passengers / Day

<https://pma.punjab.gov.pk/orange-line-metro-train-system>.

Cost Of Project

16,621,000,000 PKR

Commencement Year

Jan, 2016

V. THE EFFECT OF OLMT

The current PML-N government is spending billions on infrastructural projects with a primary focus on the transportation system in the country. Starting from Lahore Metro project, the government also invested billions in the construction of Rawalpindi and Multan Metro Bus Projects. It decided to launch OLMT in Lahore to address the growing needs of transportation of the residents of the capital of Punjab. However, the latest transportation project is facing severe resistance from civil society and international bodies due to the threat it poses to the world heritage site.

Figure 5: Metro Line Train



Source: Rendering by Author

Other sectors need immediate attention of the government, primary among which are agriculture, education, and health. The hospitals in the province of Punjab have been afflicted with abysmal standards. The agriculture production is at its lowest for several decades which is alarming. The government also needs to introduce a uniform and standard system of education in the country. As the elections come near, pressure would mount on the incumbent government to deliver public services which merit immediate attention.

The decision also provided the following recommendations to compel the government to comply with the international standards on protection of heritage sites. In the absence of any mitigation measures proposed by the state, it is recommended that the committee immediately inscribes the property on the List of World Heritage in Danger. It also requests the state to invite a Reactive Monitoring Mission to define comprehensive mitigation measures and reverse threats to the property. The WHC should request the state party to immediately stop construction work on the section of OLMT where it approaches Shalamar Gardens and if it doesn't do so, the sites mentioned be removed permanently from World Heritage Register. Energy consumption is also one of the main issues that will be generated as a consequence of OMLT. It will run on the existing energy grid system of Lahore. Two high voltage stations have been designed, one located near by the UET station and the other at Shahnour station. Each of these stations is connected to 132kV power supply from the upstream local substation. Dedicated power supply of around 80MW capacity has to be derived from the existing grid system of LESCO.

Figure 6: Metro Line Train



Source: Rendering by Author

Another major issue is that of security and privacy. 25.4 km of the track will be elevated at the height of 2.5 to 6 story building. Not only this but at many points the tract is very close to the nearby building which is the cause of serious concerns. 250,000 passengers of the train will be able to see the insides of roughly a 100,000 homes. The current security measures that these places have or use will be rendered

ineffective. Churches, schools, Mosques, hospitals and other public buildings would become vulnerable to terrorist attacks.

Urban Heat Island Effect will be created because of the traumatization and removal of green spaces. The elevated via ducts would also as heater tubes and concentrate pollutants and increase the life span of various diseases. The temperature of the city would rise rapidly and to a great degree. The number of illness and deaths because of heat will multiply.

3653 trees will be cut because of the transit line; 2907 of which are full grown mature trees. (Figures from EIA report) this in itself speaks of how much negatively the environment is being effected and what disastrous results would be seen in the near future.

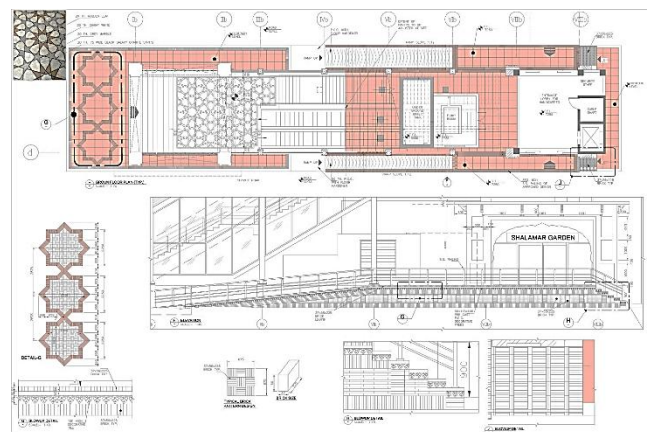
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VI. IMPACT ON HERITAGE

PCI does not include cost of damage prevention to building stock 400 years old & younger Loss of future revenue in tourism in Billions of Istanbul, Paris, Delhi & other cities have preserved their heritage and or 25 properties include sites protected under the National Antiquities Act 1975 and or The Punjab Special Premises (Preservation) Ordinance 1985 which state that no new construction can happen within 200ft of a listed site. At Shalimar Bagh the World mandates a 250' distance.

Figure 7: Metro line Train



Source: Rendering by Author

The OLMT alignment from Heritage Convention 1972 Chauburji to Shalimar passes through the most historic areas of the city oblivious to the specified distance on these locations. Key heritage sites being affected are listed. Security, Privacy & OLMT: 25.4 km of the track is elevated at a height of a 2.5-6 story building. The track is at points very close to buildings on either side 250,000 passengers will be able to see into 100,000 of homes Current Security measures will be rendered ineffective. Churches, schools, hospitals and public buildings will be vulnerable to terrorist attack.

VII. REVIEW OF IMPACTS ARISING FROM ORANGE CONSTRUCTION

The construction of Lahore orange Line has been arising various socio environmental issues since the day it commenced. Initially in the form of protests due to land acquisition to later, the protection of city's cultural heritage, orange Line Project Ever criticism. The political nature of the project and the lack of public awareness tolerance long-term development projects can be considered as the major reasons of these issues but the main reason is lack of proper implementation of impact mitigation.

measures suggested in EIA.

One of the worst problems faced by the citizens during the construction of Orange Line was traffic congestion. Hour's long traffic jams on major and crossings have become a daily routine for people due to the poor traffic management plan. Long queues of vehicles on G.T. Road, Multan road, Meeleod Road, Lakshmi Singhpura, Baghbanpura, Bhorwal chowk were witnessed all day long.

Apart from the troubles of the traffic blockages, the daily commuters suffered from different respiratory diseases, skin and eye infections due to the clouds of dust along the construction sites.

Citizens also complained that the transportation has become the biggest challenge for daily commuters due to congested, broken and bumpy roads particularly at night, as no street lights were present along most of the construction sites.

The construction of Orange line has claimed 13 deaths in various unfortunate accidents, which question the safety measures adopted for the safety of the workers during construction. On October 19, 2015 a citizen trying to overtake on the wrong side of the vehicle-mounted mixer lost control of his motorcycle, fell on the ground and was ran over by the mixer vehicle. In a similar accident on November 26, another citizen lost his life. On Jan 17, two workers died in an accident due to an electric shock they received when they were bringing a boring rig to the site, which accidentally came into contact with 11 KVA electric wire.

In another incident, a safety worker who was guiding an excavator was run over by the vehicle after he slipped. Another worker was run over by the excavator when he was walking past it after being hit by motor cyclist. In a misfortune accident on May 24, seven laborers died while sleeping when an under construction wall of a private warehouse fell on them due to heavy rainfall.

VIII. TOTAL MITIGATION MEASURES

All the impacts have been already stated in the descriptive form, for a quick information, are expressed in quantitative form. The total numbers of mitigation measures related to socio-environmental impacts mentioned in the ELA are different than those actually implemented on ground.

SR. No.	Impacts	Mitigation measure taken	Remarks
1	Road Accidents	No	The officials don't agree that the accidents occur due to construction, hence no measures taken as such
2	Traffic diversion plans and congestion	No	Major diversion plans were not communicated. Decisions were usually made instantaneously and mostly no wardens present to guide the road users.
3	Noise pollution	No	No measures taken. According to the official the noise level of these roads were already above the predicable level (45-55 dB) <u>Yasir, 2014</u>
4	Vibration	No	No measures taken on ground, only steel sheets installed along the

Source: NESPAK, 2016

Total mitigation measures mentioned in EIA	Total mitigation measures mentioned in ground
33	9

Source: NESPAK, 2016

IX. ACKNOWLEDGMENT

There are a total of 25 properties that also include sites protected by the National Antiquities Act 1975 and/or the Punjab Special Premises (Preservation) Ordinance 1985 on the route of OMLT. These acts state that no new construction can happen within 200ft of the listed sites. While at Shalamar Bagh as it is a World Heritage Site, the World Heritage Convention 1972 mandates a minimum distance of 250 feet from the site. The OMLT passes through the most historic areas of the city Lahore and pays no heed to these minimum distance requirements specified for these historic locations.

It crosses Chaburji, GPO, Anarkali, Lakhshmi Chowk, Railway station and Shalamar through Lahore's most historic and densely populated areas. It consists of 25.9 km elevated viaducts with heights varying from 59 feet to 26 feet and 1.7 km long underground section. It would impact the viability and value of the areas it passes by massively. Solid waste generation and management during the project are under question. Accidental spills or leaks of hazardous chemical during construction activities and machines could cause a major problem. The ground water will also be contaminated. And the foundations of historic buildings could be affected due to the underground tunnel.

X. ANALYSIS

SWOT Analysis of Orange Line Metro Train Project (Urban Scale – Architectural Perspective)

Introduction This report presents a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of the Orange Line Metro Train (OLMT) project with specific focus on its urban-scale and architectural implications, particularly in relation to heritage preservation, environmental impact, and urban planning. The analysis is based on the detailed case study of its impact on the historic Shalimar Gardens and surrounding sites in Lahore.

Strengths

Modern Mass Transit Solution: OLMT is Pakistan's first driverless and fully automated metro train, addressing Lahore's urgent need for efficient public transport for over 6.8 million daily commuters.

Improved Urban Mobility: Provides rapid, cost-effective transit, reducing commute times and road traffic congestion in densely populated urban zones.

Environmental Objectives: Aims to lower vehicle emissions, reduce reliance on fossil fuels, and contribute to improved urban air quality in the long run.

Economic Development: Can stimulate local economies through improved access and potential for transit-oriented developments (TODs) around metro stations.

Weaknesses

Heritage Site Encroachment: OLMT violates protective boundaries around multiple UNESCO-listed and historically significant sites, especially Shalimar Gardens, which undermines cultural heritage conservation.

Poor Implementation of EIA Recommendations: Out of 33 environmental mitigation measures suggested, only 9 were implemented, reflecting a major governance and compliance gap.

Security and Privacy Concerns: Elevated tracks running close to buildings expose residents to privacy invasion and make sensitive areas more vulnerable to security threats.

Visual and Architectural Disruption: The elevated viaducts ranging from 2.5 to 6 stories high alter

Lahore's historic skyline and architectural coherence, causing visual pollution.

Opportunities

Cultural Tourism Enhancement: Strategically designed stations and informative signage can promote tourism and awareness of historical landmarks near metro lines.

Urban Regeneration Catalyst: The metro project could serve as a driver for rehabilitating neglected urban zones, improving landscaping, lighting, and public amenities.

Green Infrastructure Integration: Offers an opportunity to incorporate green belts, vertical gardens, and noise barriers to restore ecological balance along the route.

Policy Reform Precedent: The challenges and public reaction to OLMT provide a valuable framework for revising heritage protection laws and sustainable urban development policies.

Threats

Loss of UNESCO World Heritage Status: International condemnation may result in Shalimar Gardens being placed on the endangered heritage list or delisted.

Environmental Degradation: Removal of over 3,653 trees and creation of urban heat islands pose severe environmental threats.

Legal and Civil Unrest: Public protests, litigation, and activism may delay future infrastructural projects or erode public trust in urban planning authorities.

Urban Displacement and Safety Hazards: Demolition of over 42 educational institutions and multiple worker casualties during construction question the project's social and ethical grounding.

Conclusions

Lahore excessive court docket (LHC) on Thursday remarked that it appeared that legalities had been distributed with in connection with the Orange Line Metro train (OLMT) undertaking seeing that its inception. Heading a division bench hearing several petitions at the aforementioned count number, Justice Abid Aziz Sheikh said the provisions of the Punjab Procurement policies (PPR) had now not been adhered with. Justice Sheikh stated it appeared that guidelines were there to be trampled upon. The decide made the feedback whilst thinking the alleged noncompliance with PPR guidelines while the challenge was assigned to the NESPAK which formulated its feasibility file in January, 2014.

As the listening to started, advise general (AG) Shakeelur Rehman started out quoting from the feasibility document at the mission by means of MVA Asia constrained. as the AG persevered, Justice Sheikh said the document had nothing to do with the case. He stated he did now not understand why the authorities had been banking on the file.

The OLMT project, while transformative in addressing Lahore's transit challenges, exemplifies the conflict between rapid urban development and architectural heritage preservation. A more balanced, inclusive, and regulated approach is essential for future infrastructure projects, one that equally weighs cultural, environmental, and public health concerns alongside urban mobility goals.

This SWOT analysis highlights the urgent need for integrated planning frameworks that prioritize both innovation and preservation in the urban fabric of historic cities like Lahore.

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