



Research Paper

## A Retrospective Environmental Impact Assessment (EIA) for the RCL Beautification of the Taj Mahal and Surrounding Areas

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**ABSTRACT:** The Taj Trapezium Zone is a trapezoid-shaped, defined area of 10,400 Sq. Km around the Taj Mahal which serves as a buffer zone designed to protect this historic monument from pollution. This zone was established by the Central Government in 1998 by the virtue of the powers conferred to it by the Environment Protection Act 1986. The government's actions represented its response to growing threats of the impact of environmental pollution and acid rain and to the 1996 ruling by the Supreme Court of India which banned the use of coal in industries located in the vicinity of the Taj Mahal. Environmental Impact Assessments consider the biotic factors in equal relation to human and cultural preservation factors. This dynamic approach enables us to define the environment in relation to communities. This Executive summary includes the description and overview of the development of areas around the Taj Mahal by Raj Construction Limited. We have also looked into the positive and negative value of beautification of that area with respect to its environmental and social impact.

**KEYWORDS:** Environmental Impact Assessment, Taj Mahal, Activity-Impact Matrix

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### I. INTRODUCTION

Raj Corporation Limited is a professionally managed civil construction company that functions as an unregistered public limited company. It was incorporated as a public limited company in 2009, before which it functioned as 'M/S Rajesh Kumar' - a proprietary firm. The company started operation in Mainpuri but has now expanded to the whole of Uttar Pradesh. The erstwhile partnership firm was established in the year 2008 by Mr. Raj Bahadur Singh and Sarita Yadav who continue to serve as directors on the board of the newly formed company. Since its inception, Raj Corporation Limited has been engaged in the construction of infrastructure projects. It has gained prominence across the country particularly because of its civil structural work, and real estate development competencies. It now functions as a diversified construction conglomerate and has worked with the government of Uttar Pradesh and other local public authorities to develop real estate in the area surrounding the Taj Mahal.

The projects that Raj Corporation Limited was involved in around the Taj Mahal include underground cabling of all electrical wires, telephone wires, and CCTV wires. It is worked to lay down underground sewage and water lines. Roads were reconstructed to replace cement with red granite. Improvements extended to utilities as well- with the establishment of fire fighting water lines and fire fighting equipment in all public spaces. Development also included the construction of public conveniences including roadside lamps, benches, dustbins, waiting rooms, and even the ticket booking window of the Taj Mahal. The company also erected electric fences around the 4km radius of the monument, and built parking lots within that area. Lastly, in an attempt to beautify the area, all commercial locations which are most frequented by tourists were painted in red sandstone, whereas white was used in the beautification process of residential areas.

The primary reason for undertaking this project was increasing the attractiveness of the areas surrounding the Taj Mahal to domestic, and more importantly foreign tourists (Soni, 2016). The local economy of Agra is largely dependent on tourism, and foreign tourists have a bearing on the larger economy because of the positive impact of their transactions on the balance of payments. Even though the Taj Mahal is revered around the world as one of the most beautiful monuments ever built, Uttar Pradesh and Agra have gained a reputation of being unhygienic and undeveloped when it comes to public utilities and spaces (Madan, 1990). The harm done by this to the local economy and tourism & dependent industries is substantial. The most significant harm associated with development and beautification projects is their environmental impact- which degrades monuments in the long term (Srivastava, 2011). Emissions from local industries have led to the degradation and decolourization of the Taj Mahal over the past few decades, which ultimately prompted the

government to establish the Taj Trapezium Zone with controlled levels of industrial activity (*The Times of India*, 2008). The beautification process risks increasing the propensity of environmental damage temporarily.

## II. METHODOLOGICAL OVERVIEW

The environmental impacts caused due to the development of the project can be categorized as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the project whereas the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action. This Environmental Impact Assessment accounts for both direct and indirect impacts through an analysis of changes in population levels and lifestyles of stakeholders. Given that only a few years have passed since the completion of the project, the magnitude of this EIA is short and medium-term. The assessment of long term impacts necessitates a longer duration of the study. This Assessment considers both temporary as well as permanent impacts. Lastly, we look into both reversible and irreversible impacts.

The impact of different elements of this project on different parts of the environment have been represented in the Activity-Impact matrix below-

Project Components	Potential Impacts on Environmental Components by Project Activities									
	Land	Air		Water		Biodiversity		Social		
		Quality	Noise	Surface water	Ground water	Flora	Fauna	Livelihood	Traffic	Health & Safety
Underground cabling of all electrical wires, telephone wires and CCTV wires	✓	✓	✓	☐	✓	✓	✓	✓	✓	✓
Reconstruction of Roads	✓	✓	✓	☐	✓	✓	✓	✓	✓	✓
Introduction of Fire Safety Infrastructure and CCTV cameras	☐	☐	☐	✓	☐	☐	☐	☐	☐	✓
Improvement and Replacement of Utilities	✓	✓	☐	✓	☐	✓	☐	✓	✓	☐
Beautification and Painting	☐	✓	☐	☐	☐	☐	☐	✓	✓	☐
Development of Pedestrian and Perimeter Pathways	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrification of East Gate Road	✓	☐	☐	☐	☐	☐	✓	✓	✓	✓

## III. MATERIALS SUSTAINABILITY

Almost all construction material used in this project was purchased from local sources. Moreover, certain materials including sand, fine aggregates, bricks, and concrete were only purchased from government-approved authorized dealers and vendors as

- **Brass Compression Brand** - Brass is a copper-based alloy that does not lose its chemical or physical properties in the recycling process. Hence, it can be recycled an infinite number of times because of which it is advantageous from an environmental and economic perspective. Moreover, the recycling process for brass is less energy-intensive as compared to other metals and yields a lesser carbon footprint than aluminium and steel. Brass turnings can be reclaimed for 75-85% of the original value which is why the industry is dependent on the economic recycling of products, which in this case also yields environmental benefits.

- **Aluminium Lungs and Concrete Cables** - Aluminium is used extensively in construction works because it is lightweight, strong, and abundant. It is highly resistant to rust and corrosion caused by industrial pollutants and hence requires very minimal maintenance in the long term. Aluminium is also 100% recyclable through a process that requires 95% less energy than the production of metals. Almost 75% of aluminium which is in use globally has been recycled.
- **Copper Stranded Conductor** - Copper is superior to other metals in terms of its thermal and electrical conductivity capacity. Similar to aluminium, it is also 100% recyclable. It was extensively used in electrical system installations of new gates and parking lots.
- **Cement Mortar** - Cement Mortar and concrete are the most widely used elements for construction processes. Despite being durable and strong, the production of cement releases high levels of greenhouse emissions. Moreover, the usage of cement mortar to construct roads can hurt groundwater levels as it contributes to surface run-offs.
- **Ductile Iron** - Ductile iron is manufactured from 100 percent% recycled scrap iron and steel, and it continues to be recyclable after usage. Moreover, ductile iron pipe manufacturers usually have a “buy-back” policy on ductile and cast iron pipes that have been removed from service. Ductile iron pipes also have a larger inside diameter of the ductile iron pipe as compared to substitute materials, which makes them more energy efficient. Using Ductile Iron Pipe instead of PVC in pumping results in a 38% saving in energy consumption.
- **Stainless Steel Hydrant Valve** - Stainless Steel has 60% recycled content in it. It can also be recycled to retrieve its component metals, namely iron, nickel, and chromium. The production of stainless steel uses primary energy sparingly and saves non-renewable sources.
- **Sandstone** - Sandstone is an eco-friendly building material. It has a relatively low carbon footprint as it uses a very small percentage of the energy as compared to concrete. No chemicals are used in the production of sandstone which is why it creates no chemical waste. Lastly, all water used in producing stone can be easily recycled and reused.
- **Bricks** - Bricks are produced in India in traditional kilns in a process that leads to high levels of greenhouse emissions. However, they are organic and 100% recyclable. It is also easier for local authorities to dispose of and decompose bricks as compared to other materials.
- **Granite** - Granite, like all other natural stones, must be quarried which is high energy and water-intensive process. Granite mining and transportation make it even less sustainable. n: The installation process of granite involves the release of dust, VOCs, and other chemicals adhesives in high levels, which compromises public safety.
- **CobbleStone**- Cobblestone is 100% natural and sustainable. Its production and procurement do not involve the usage of petroleum-based resins. More cobblestone installation design uses a natural sub-base and natural joints lead to percolation and improvement in groundwater levels.

#### **IV. STAKEHOLDER ANALYSIS**

The stakeholders being analyzed through this report include local businesses of all scale and residents of the areas that were beautified. Even though construction and redevelopment activities contributed to local air, water, and sound pollution, these effects were short-lived. Moreover, this project has led to increased access to public utilities and reduced traffic congestion which have had positive impacts on the local environment and biodiversity. Degradation of the Taj Mahal due to air pollution is a pressing matter, one that threatens the local and national tourism industry. Moreover, a reduction in vehicular emissions is expected to improve the air quality surrounding the Taj Mahal in the long run. These improvements will be reflected in the standard of living and lifestyles of the local population.

The biggest impact of the Beautification Project, however, is being experienced by local businesses. The hospitality and retail sectors have experienced a boom in economic activity. Redevelopment of the roadways has made hotels in the areas more accessible. The Taj Gateway Hotel Oberoi's Amarvillas and The Retreat are amongst many hotels that now lie at the center of a booming tourist hub. The boom in tourism is also reflected in the growth of Emporiums such as Kalakriti, Oswal, and Saga. A boom in businesses is reflected in increased income and economic opportunities for residents across social class. The government of Uttar Pradesh has also initiated the construction of the Mughal museum in the locality. It is being designed by British architect David Chipperfield and is expected to further promote the tourism industry of Agra.

Agra has 432 identified slums and other settlements that exist in poor environmental conditions and lack basic utilities. The residents of these slums are low-income communities, most of which depend on tourism. The benefits of the beautification project can be traced to the intersection of international tourism, domestic culture, and improved economic activity, which trickle down to low-income residents of slums existing in the vicinity of the beautified areas. Popular tourist destinations including The Kalakriti Culture and conviction Centre, Taj Nature, and local restaurants such as Sheros (which is managed by female victims of acid attacks) have specifically benefited from better traffic, infrastructure and accessibility. Increased tourism has opened

new economic opportunities for local residents of areas in the vicinity of the project, many of whom have converted parts of their residences into guest houses or Air BnB's.

## **V. POLLUTION ANALYSIS**

This project involved no major construction and demolition work that could potentially cause any damage to ASI protected monuments. The impact during construction was localized and the short-term changes are reversible. Impact primarily stems from civil works, and the erection of the equipment and subsequent operations. Construction works involved site clearance, excavation, filling of earth materials, dumping of unusable debris materials, transportation of materials from production site to construction site, and other constructional activities and associated works like mobilization of construction equipment, setting up of different construction plant, setting up of workforce camp, quarrying, transportation of material, material storage, etc. These activities have certain impacts of varying magnitudes on different components of the environment.

### **Impact on Land and Soil:**

- Clearing and excavation of the land, roads, and depreciated utility structures. This is a temporary process that brings about an irreversible change. The restoration of depreciated structures and roads caused pollution in the short term but a positive effect on the stakeholders' well-being in the long term.
- Generation, storage, and disposal of spoils and debris due to construction activities- This is a temporary and reversible impact, and depending on the extent of construction activity.
- Contamination of project land due to leakage or spillage of fuel and lubricants, wastewater discharge from labor camps- This is also characterized as a temporary and reversible environmental change.

### **Impact on Air:**

- Dust Emissions during construction and demolition processes often got stuck in trees around the area of operations. However, the dust was restricted to a limited area and only affects it temporarily. Hence, its impact was temporary and restricted within the closed vicinity of the construction activities only.
- Generation of Exhaust Gases The Generation of exhaust gases is owed to the movement and operation of heavy machinery for construction. Toxic gases are released through the heating process during demolition and reconstruction. Although the impact will be much localized, it could have spread downwind if the wind direction and speed had been unfavorable. An increase in air pollution levels from mobile and stationary sources during the construction phase had a short-term impact on air quality. However, given that the commissioning phase was staggered and intermittent.

### **Impact on Noise**

- This Redevelopment process was characterized by high rates of noise pollution due to the movement of vehicles that transported construction material and the noise-generating activities themselves.
- Mixing, casting, and material movement are primary noise-generating activities that disturbed areas in the vicinity through the construction period. Construction activities produced noise levels in the range of 100 - 120 dB(A). However, the usage of proper protective equipment was mandatory for individuals involved in the construction and excavation processes in order to protect them from high volumes of noise.

### **Impact on Water Resources**

- The demand for water in the areas around construction sites increased during the development and beautification processes.
- There was some degree of contamination of groundwater due to leakage or spillage of fuel and lubricants from machinery and wastewater discharge from labor camps.
- Redevelopment processes have improved the water security for backward communities in this area by improving infrastructure responsible for supplying water.

### **Impact of Flora and Fauna:**

- There were no ecologically sensitive areas like national parks or wildlife sanctuaries and reserved forests within the 10-km radius of the project sites. However, there has been a loss of certain species near the project sites. This includes the loss of small shrubs and herbs at the time of demolition and excavation, and during the dumping of debris and construction waste
- Underground construction activities have caused disturbances in the local and underground ecosystems. However, these impacts were limited to the short term, and the flora and fauna in these areas rejuvenated after the completion of the development projects.

**Impact on Public health and Safety**

- Dust, gaseous pollutant, and noise generation within the congested area during the construction work affected the health of people residing nearby and that of certain workers.
- The Safety Risks to construction workers were particularly high. However, there was no serious threat to public health as the discharge of pollutants only led to mild cases of illness amongst the workforce and the local population.
- Traffic congestion also became common during the project, but the overall impact of the project on traffic has been positive, with redeveloped roads allowing for smooth movement of vehicles.

**DEVELOPMENT PHASE ASSESSMENT**

Project Components	Potential Impacts on Environmental Components by Project Activities									
	Land	Air		Water		Biodiversity		Social		
		Quality	Noise	Surface water	Ground water	Flora	Fauna	Livelihood	Traffic	Health & Safety
Surface Dressing of the ground	✓	☐	✓	✓	✓	✓	✓	☐	✓	☐
Dismantling Road Pavers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dismantling signage and hoarding	☐	☐	✓	☐	☐	☐	☐	☐	✓	☐
Excavating and refilling trenches	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stonework in the buildings and streets	✓	✓	✓	☐	☐	☐	☐	✓	✓	☐
Stone Slab Flooring	✓	☐	✓	☐	✓	✓	✓	✓	☐	☐

**VI. CONCLUSION**

Population concentration and the growth of tourism have presented acute problems regulated to environmental degradation in urban areas over the past few decades. This presents a threat to local ecology and biodiversity and gives rise to public health concerns (Mao, et. al., 2017). Sustainable Construction aims to reduce a project’s adverse impact on the environment and create a conducive space for urban ecological interactions. It includes using renewable and recyclable resources, reducing energy consumption and waste generation, promoting workplace safety, and protecting local flora and fauna. Improving environmental impacts of beautification and redevelopment projects hence demands changes in construction material, processes, and public awareness (Mao, et. al., 2017). Heavy machinery used in construction runs on fossil fuels, and prolonged processes lead to harsh environmental and public health outcomes. Solutions to this problem potentially lie in developing and implementing technology that enables the equipment to run on solar or other green energy forms.

Commercial concrete production entails high levels of greenhouse gas emissions which is detrimental to the fight against climate change. The usage of more sustainable construction materials presents greener alternatives to concrete in both residential and commercial projects, the usage of which leads to the emission of 2.8 billion tonnes of carbon dioxide every year (Jain, 2016). Recycled Plastic has emerged as a sustainable construction material that not only reduces greenhouse gas emissions but also utilizes non-biodegradable plastic waste (Kataria, 2018). Recycled mixtures including Ferrock and Timbercrete, when used in construction instead of concrete reduce the carbon footprint of the project. Grasscrete is the process of laying concrete flooring,



walkways, sidewalks, and driveways in such a manner that allows for the growth of grass or other. Not only does this reduce overall concrete usage, but it also improves stormwater absorption and drainage, and reduces the propensity of soil erosion (Ijla & Broström, 2015). Using bamboo instead of chemically produced alloys in street lights and gates can also reduce dependency on energy and resource-intensive processes. Increasing the usage of certain project components such as cobblestone, brass, and sandstone adds to the aesthetic value of culturally rich cities like Agra.

Sustainable practices such as efficient project waste management and workforce training could also improve the environmental impact of similar projects. Project and sustainability training would reduce the propensity of accidents in construction and demolition processes, which often have severe environmental and health consequences. Workers should also be provided access to safer and modern equipment, which adds to project efficiency and workplace safety. There is a need to improve the waste disposal system that deals with treating and discharge toxic construction waste (Ijla & Broström, 2015). Encouraging local communities to distance themselves from project sites reduces their exposure to environmental pollutants as well as potential accidents.

The beautification project handled by Raj Constructions had negative environmental impacts during the construction and development process. This impact, which affected the local population and biodiversity in the short run, was mostly caused because of the use of conventional construction and building materials that have a high carbon footprint (Bergin, et. al., 2014). Negating these impacts requires a fundamental rethinking of beautification and development, and a pivot to sustainable processes and recyclable, biodegradable materials. Similarly human resource training of contractual labourers, which has long been ignored in developing countries must be paid attention to (Kataria, 2018). Avoidable accidents further threaten local biodiversity and public health. The economic consequences of the project have been positive for all communities in the vicinity of the developed areas. The long term environmental and economic impact of this project are not yet ascertainable, and necessitate intensive, on-the-ground research.

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