TAJ MAHAL – AN ANNOTATED BIBLIOGRAPHY

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TAJ MAHAL CONSERVATION COLLABORATIVE
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INTRODUCTION

The following bibliography has been commissioned by the Taj Mahal Conservation Collaborative as part of the ongoing programme for the conservation of the Taj Mahal and the gardens. The primary aim of this bibliography is to compile all available literature on the Taj to understand the extent of research already completed as well as source information.

Information on the Taj Mahal lies scattered all over the world in museums, archives and libraries. Records in the forms of drawings and photographs as well as scientific studies and conservation reports have been prepared over the past 160 years and the amount of information generated as a result of these endeavours is truly staggering. Keeping in mind the focus of the project, this bibliography has been divided into the following sections – a) works on the Taj – its architecture, construction and history, b) the Mughal gardens particularly those of the Taj as well as the Mehtab Bagh, c) scientific studies conducted particularly after the Supreme Court rulings for the preservation of the Taj, d) a list of visual records particularly photographs and drawings e) manuscripts and historical records relevant to the Taj Mahal and f) a time line of conservation works executed at the Taj.

The primary libraries visited for this purpose include the Central Archaeological Survey of India Library, ASI Agra Circle Office, ASI Delhi, ASI Dehra Dun, India International Centre and INTACH. Publications and reports have been listed and where available have been annotated. Online catalogues of various museums and libraries in Europe and America have also been referred to for this bibliography.
## TAJ MAHAL – ARCHITECTURE, CONSTRUCTION, HISTORY

<table>
<thead>
<tr>
<th>Author</th>
<th>Title and Notes</th>
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<tbody>
<tr>
<td>Akbarabadi, Muhammad</td>
<td>“Rauda-i-Mumtaz Mahal ma’ruf ba Taj Mahal” Agra, 1904</td>
</tr>
<tr>
<td>Muinuddin</td>
<td></td>
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<tr>
<td>Anonymous</td>
<td>“Description of the Province of Agra, 1791” Asiatic Annual Register, 1804</td>
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<tr>
<td></td>
<td>Provides a detailed description of the entire complex of the Taj Mahal</td>
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<td></td>
<td>Assembles for the first time all the known documentary sources for the Taj, consisting of references in the Persian court histories and other literary works, including European travel accounts, Mughal official documents and also the historical and Quranic inscriptions on the Taj Mahal itself/</td>
</tr>
<tr>
<td>Begley, W.E., Desai, Z.A.</td>
<td>“The Shah Jahan Nama of Inayat Khan” OUP, 1990, Delhi. The Padshah Nama written by Lahori and Waris was condensed by the court librarian Inayat Khan into what is known as the Shah Jahan Nama. An almost complete manuscript translation of this work was made by A.R. Fuller in 1851 and this has been revised and edited in this work by the editors.</td>
</tr>
<tr>
<td>(ed.)</td>
<td></td>
</tr>
<tr>
<td>Blair, Sheila S &amp; Bloom,</td>
<td>“The Art and Architecture of Islam 1250-1800” Yale University Press, 1995 Includes chapters on India that provide a context for the development of Mughal Architecture in India and</td>
</tr>
</tbody>
</table>
other chapters that survey Islamic art and architecture.

Brandenburg, Dietrich

Chaghtai, Dr. M.A

Chaghtai, Dr. M.A
“Pietra-Dura decoration of the Taj” Islamic Culture, XV, (1941)

Chaghtai, Dr. M.A
“Austin de Bordeaux and the Taj Mahal, Agra” Proceedings and Transactions of the Ninth All India Oriental Conference, Trivandrum, 1937 (1940)

Chaghtai, Dr. M.A
“Ustad Isa the so called Architect if the Taj” Proceedings of Indian history Congress, Allahabad (1938)

Chaghtai, Dr. M.A
“The Description of the Taj Mahal of Agra” Iqbal, Vol. V, Lahore, 1957

Chaghtai, Dr. M.A.
“A Family of Great Mughal Architects” Islamic Culture, 1937 Traces the family of the architect of the Taj Ahmad and his sons Lutf Allah, Nur Allah and Ata Allah

Chaghtai, M.A
“Taj Mahal”, Lahore, 1963

Chaghtai, M.A
“Is there a European element in the construction of the Taj Mahal?” Islamic Culture, Vol. 14, April, 1940

Chaturvedi, Pandit Umesh
“Illustrated Agra” Agra, 1974

Chowdhuri Jogindra Nath
“Mumtaz Mahall” Islamic Culture Volume XI, 1937 A brief biography of Mumtaz Mahall tracing her birth to her marriage to Shah Jahan and her death in Burhanpur. Also outlines the construction of her mausoleum at Agra

Cotton, J.J.
“General de Bogne and the Taj” Bengal Past and Present, Vol. XXXIII, Calcutta, 1927 Correspondence between Sir John Murray and General de Bogne in 1794 relative to the Taj at Agra and Shah Alam in Delhi.

Daneshvari, A. (ed)
“From Tamerlane to the Taj Mahal” in Essays in
Islamic Art and Architecture in honour of Katherine Otto-Dorn, Malibu, 1981

Desai, Dr. Z.A; Kaul, H.K

Official guide to the Taj Museum with information on exhibits housed in the various galleries

Duncan, E.A

"Keene's Handbook for visitors to Agra" Calcutta, 1909
Detailed description of the Taj Mahal

Gascoigne, Bamber

"The Great Moghuls" TBI, New Delhi, 1987
History of the Mughals including the development of art and architecture under the various rulers with a section on Shah Jahan

Goetz, H

"The Central Asian Mausoleum in India — the Tradition of the Taj Mahal" Islamic Culture, Vol.12 October, 1938
Reviews the Central Asian origins and influences of mausoleum architecture of the Mughals which culminated at the Taj Mahal

Grover, Satish

Second volume in a trilogy on Indian architecture focussing on Islamic architecture in India. Overview of architecture from the period under the Afghans to the Mughals — architecture of the Taj (3D cutaway of the mausoleum)

Gurner, C.W.

"Lord Hastings and the monuments of Agra" Bengal Past and Present, Vol. 27, 1924
Accounts of the conservation efforts made for the monuments of Agra prior to Lord Hastings. Includes a letter written on 4th April, 1815 from the Secretary to the Governor General (Lord Hastings) to the Commissioners for Ceded and Conquered Provinces outlining a conservation policy for the Taj and other monuments of Agra.

Hambly, Gavin

"Cities of Mughal India" Vikas Publishing House Pvt. Ltd. New Delhi, 1977
Overview of Mughal history and the development of cities of Mughal India including Agra

Harle, J.C.

Comprehensive guide to the study of Indian art and architecture starting from early Indian art to the Mughal period.

Havell, E.B.  
"The 'Taj and its designers' in The Nineteenth century and after reprinted in Essays on Indian Art, Industry and Education.

Havell, E.B  
"A Handbook to Agra and the 'Taj’” Sagar Publications, 1970  
A guide to the monuments of Agra with a section on the Taj.

Hoag, John D.  
"The Tomb of Ulugh Beg and Abdur Razzaq at Ghazni a model for the 'Taj Mahal’” Journal of the Society of Architectural Historians 27/4

Hodgson Col. J.A  

Hosten, Rev. H.  
"Who Planned the 'Taj'? in Journal and Proceedings of the Asiatic Society of Bengal, 6

J.H Major (John Hessing?)  
In “The Asiatic Annual Register for the year 1803” or a View of the history of Hindustan and the Politics, Commerce and literature of Asia, Cadell and Davies, Strand and Blacks and Parry. Leadenhall Street, London 1804  
A series of 4 letters written by Major J.H giving a detailed description of the city of Agra, the Fort, the Taj Mahal and Akbar's tomb at Secundra

Jairazbhoy, R.A  
Studies the design and layout of the tomb in relation to prototypes found in the East and West.

Jairazbhoy, R.A  
"The 'Taj and its Critics” East and West, 6, no.1, 1955-56

Kanwar, H.I.S  
"Taj Mahal - Most Fabulous Tomb on Earth” typed manuscript.  
Traces the evolution of the design of the 'Taj Mahal commencing with the origin of architectural elements such as the dome, arch, minarets and building in Islamic architecture, their Indo-Islamic counterparts and the respective development of these elements in the latter reaching its culmination in the 'Taj Mahal.
Kanwar, H.I.S

An article which provides historical as well as physical evidence of the existence of subterranean chambers beneath the main plinth of the Taj Mahal facing the river Jumna. Includes photographs by the author of the painted chambers as well as a section drawing of the chambers.

Kanwar, H.I.S

“Designer of the Taj Mahal”, France-Asie, XVIII, no. 171 (1962)

Kanwar, H.I.S

“Ustad Ahmed Lahori” in Islamic Culture Volume 48

Kanwar, H.I.S

“Harmonious Proportions of the Taj Mahal” Islamic Culture, Vol. 49, January, 1975
Demonstrates how the various elements comprising not only the imperial tomb but also the other components of the Taj Mahal complex are in complete harmony with each other. To achieve such harmony all the elements and components must necessarily be of certain definite dimensions in length, breadth and height both in terms of ground plan and elevation.

Kanwar, H.I.S

“The Site of the Taj Mahal, Agra” Islamic Culture, Vol, 49, October, 1975

Kanwar, H.I.S

“Cost of the Taj Mahal”, Islamic Culture, Vol. 50, April, 1976

Kanwar, H.I.S

“Geography of the Taj” The Indo-Asian Culture, New Delhi, Vo.XX, No.1, Jan, 1971

Kenoyer, G.


Keyserling, Count Herman Alexander

“Indian Travel – Diary of a Philosopher” Bharatiya Vidya Bhawan

Koch, Ibba


Lal, Kanwar

“The Taj” R&K Publishing House, Delhi, 1965
A comprehensive guide to the Taj Mahal which draws from historic sources and archival literature. Presents the story of the Taj including sections on Mumtaz
Mahal, the construction of the Taj, design and layout of the complex. Also touches on some of the controversies associated with the Taj such as the myth of the black Taj.

Lall, John; Dube, D.N

“Taj Mahal and the Glory of Mughal Agra” Lustre Press Pvt. Ltd., Delhi 1982
Briefly traces the history of the Mughals in India and accounts the lives of the six great emperors examining the development of the arts and architecture during their reigns.

Latif, Syad Mohammad

“Agra – Historical and Descriptive”

Luard, Lt. Col. C.E.; Hosten, Rev. Henry

“Travels of Fray Sebastian Manrique 1629-1643”

Majumdar, K.C.

“Imperial Agra of the Moghuls”, Agra, 1946

Marenravi, Sa’id Ahmad

“Guide to the Taj at Agra, fort of Agra; Akbar’s tomb at Secundra; and ruins of Fatehpur Sikri” tr. From Persian script, Lahore, 1869

Marenravi, Said Ahmad

“Muraqqa-i-Akbarabad” Agra, 1931

MARG

“Taj – A dream In Marble” Marg, Vol. XXII No.3,
June 1969
Special issue on the Taj Mahal which examines its history, architecture as well as myths associated with the Taj.

MARG

Volume XX No. 4, 1967 – Short article on the architecture of the Taj

Menon, K.N.

“The Taj at Agra” in March of India, New Delhi,
Vol.XII, No.7, July 1960

Mukherjee, S.C

“The architecture of the Taj and its Architect”, Indian Historical Quarterly, IX-4, 1933
Examines the theory of the design of the Taj by Jeronimo Veroneo and refutes it based on historical evidence.

Nadvi, Sayyed Sulaiman


Nath R.

Collection of twenty one research papers published by the author in various journals focusing on specific aspects of Mughal architecture including aesthetics of Mughal architecture with reference to the Taj

Nath, R.

"The Taj Mahal and Its Incarnation — Original Persian data on its builders, materials, costs and measurements" Jaipur Historical Research Documentation Programme, 1985
A detailed history of the construction of the Taj including data on materials, measurements, builders etc. Sourced from unpublished Persian manuscripts, imperial farmans and court histories.

Nath, R.

Examines the evolution of the tomb in India and evaluates inspiration drawn from indigenous sources starting from pre Islamic India to early Islamic and finally the Mughal tombs culminating with the Taj. Highlights the garden and water systems, ornamentation, design and layout of the Taj as well as some myths associated with it such as the second Taj, the third grave. Section on the sinking of the Taj.

Nath, R.

"Art and Architecture of the Taj Mahal",

Nath, R.

Decorative features in Mughal architecture particularly inlay work.

Nevill, H.R

Detailed description of Agra and the Taj Mahal

Nou, Jean Louis; Okada, Amina & Joshi, M.C.

Beautifully illustrated volume on the Taj Mahal with text providing a historical and architectural analysis of the Taj Mahal

Pal, Pratapaditya; Leoshko Janice; Dye III, Joseph & Markel, Stephen

"Romance of the Taj Mahal" TBI, New Delhi, 1989
Catalogue of an exhibition on the Taj Mahal organized by the Los Angeles County Museum of Art. The book
also looks at contemporary Mughal culture during the reign of Shah Jahan and examines the decorative arts, jewellery, textiles etc. of the period. A section on early European views of the Taj is also included.

Qanungo, S.N

"Architect of the Taj Mahal", Indo-Asian Culture, XI, no.4, 1963

Sanwal, B.D.


Sleeman, Lt. Col. W.H.

"Rambles and Recollections of an Indian Official" Lahore, 1888
Description of the Taj and its gardens

Solomen W.E. Gladstone

"Impressions of the Taj Mahal", Islamic Culture, Vol 1, April, 1927

Solomen W.E. Gladstone

"In the garden of the Taj Mahal" Islamic Culture, Volume 7, January 1933

Soundara Rajan, K.V

"Islam Builds in India – Cultural Study of Islamic Architecture" Agam Kala Prakashan, Delhi, 1983
Examines the cultural influences in the development of Islamic architecture in India

Spear, Percival

"Bentinck and the Taj" Journal of the Royal Asiatic Society, 1949

Tillotson, G.H.R.

"Mughal India" Viking, 1990,
An architectural guidebook for Mughal monuments in India with a section on Agra and the Taj

Twining Thomas

"Travels in India – A Hundred Years Ago" London 1893

Volwahsen, Andreas

Examines the evolution of the Indo Islamic styles through fusion of Islamic and Hindu architectural concepts. Covers the period from the Ghaznavids to the Mughals with a section on the Mughal Gardens, Plans of the Taj Mahal.

Wheeler, Mortimer (ed)

Splendours of the East – Temples, Tombs, Palaces and Fortresses of Asia” Hamlyn Publishing Group Ltd, 1970
MUGHAL GARDENS

Begley, W. E.  
"The Garden of the Taj Mahal: A Case Study of Mughal Architectural Planning and Symbolism  
History of landscape architecture" in Mughal gardens; sources, places, representations, and prospects  
Dumbarton Oaks colloquium; 16th  
Dumbarton Oaks Colloquium On The History Of Landscape Architecture, 1992

Bhagwat, Prabhakar B.  
"The Gardens of India: Historic gardens and Sites"  
ICOMOS, Colombo, 1993

Brookes, John  
Traces the development of Islamic gardens around the world with a section on the Mughal Gardens of India.

Crowe, Sylvia; Haywood, Sheila; Jellicoe, Susan; Patterson, Gordon  
"The Gardens of Mughal India – A History and a guide"  
Vikas Publishing House Pvt. Ltd. Delhi, 1973  
A study of the Mughal gardens from the time of Babar to Aurangzeb, with a section on the gardens of Taj Mahal. Layout plan of Col. Hodgson (1828)  
Also data on plants in Mughal gardens and list of plant names

Dixie, James  

Jairazbhoy, R.A.  
Studies the garden palaces built by Babar in Agra as well as those built during the reign of later rulers such as Humayun and Shah Jehan.

Kanwar, H.I.S.  
"Origin and evolution of the design of the Charbagh Gardens"

Lehrman, Jonas  
"Earthly Paradise – Garden and Courtyard in Islam"  
Thames and Hudson, 1980  
Overview of gardens and courtyards of the Islamic world as they exist today with a section on Agra and including the Taj. Brief description of the tomb and garden

MARG  
"Gardens of the Mughals" Vol XXVI No.1, December,
Wilber, Donald N. "Persian Gardens and Garden Pavilions" Charles E Tuttle Co. 1962
One of the earliest scholarly books on the gardens of Persia
<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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<tbody>
<tr>
<td>1972</td>
<td>Special issue on the Mughal gardens with sections on the tomb gardens as well as the water systems in the garden palaces. Plans and sections of the water systems at the Taj.</td>
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**MARG**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
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<tr>
<td>Moynihan, Elizabeth B.</td>
<td>&quot;Flora and Fauna in Mughal India&quot;</td>
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<td>&quot;Paradise as a Garden : In Persia and Mughal India&quot; George Braziller, New York, 1979 Explores the concept of the Paradise garden as it developed in Persia and the evolution of the char bagh in India. Of particular interest is the description of Babar’s garden at Dholpur identified and studied by the author. Also describes gardens of the Taj.</td>
</tr>
<tr>
<td>Stuart, Villiers C.M</td>
<td>“Gardens of the Great Mughals” Adam and Charles Black, London, 1913 One of the earliest European publications on the Mughal gardens presented as an account of visits to the gardens with a special section on the gardens of the Taj.</td>
</tr>
</tbody>
</table>
SCIENTIFIC STUDIES

NEERI

"Air Pollution Studies for Redefining the Taj Trapezium", 1993
The study sponsored by the Ministry of Environment focussed on redefining the trapezium and to evolve a Regional Environmental Management Plan within the impacted zone. Based on the study, a Air Environment Management Plan was drawn up for the redefined trapezium zone. The AEMP proposed actions at 3 levels — control at the source of pollution, control in the source-receptor pathway and finally control at the receptor site. An implementation plan for the same was included within the report.

Agrawal, O.P; Singh, Tej; Jain, Kamal K.; Kharbade, B.V; Joshi, G.P

"Studies on Material of Taj Mahal” NRLC, Lucknow, Nov. 1986
A study sponsored by the Archaeological Survey of India and conducted by the NRLC Lucknow. Through a series of scientific studies it aims at identifying the types of deterioration of the materials and the causes thereof. The following issues were examined in detail — types of discolouration on the marble, causes of discolouration, development of techniques for cleaning of marble surfaces without the use of hard brushes, causes for the formation of cracks and chipping of the marble and effects of pollutants on the Taj Mahal.

Agrawal, O.P

Reviews earlier studies undertaken on the Taj and examines the contribution of physical, chemical and biological factors to the decay of the monument.

Agrawal, O.P.; Singh, Tej; Jain, Kamal K. (ed) Grimstad, Kirsten

Marina del Rey: Getty Conservation Institute

Marble veneer of the Taj Mahal shows signs of physical weathering in the form of cracking, chipping, and bulging of marble slabs which have been caused mainly by the stresses due to the load on the marble slabs. Stresses due to swelling of iron dowels, jerks received during quarrying etc., also play an important role. Chemical action of rain water is also
contributing towards deterioration by preferentially leaching out mineral impurities.


It was noticed that the Taj Mahal marble was getting discolored acquiring a yellow appearance. It was feared that the discoloration was due to the effect of atmospheric pollution. Studies conducted at the NRLC indicate that the yellowing was due to several other causes but not due to pollution. The presence of acrylic resin on the surface of marble in several areas was detected. This could also have been one of the causes of yellowing.

Save Taj Mahal and people of Braj-Mandal 1978 Waltair: Andhra university

A study of environmental impact of Mathura refinery on Taj Mahal and its environment.

“Studies of lime plasters and mortars of the Taj Mahal” in ICOM Committee for Conservation: 8th Triennial meeting, Sydney, Australia, 6-11 September, 1987, Preprints/Marina del Ray, California: Getty Conservation institute, 1987 The Taj Mahal has been in the news for the last years due to the installation of a huge petroleum refinery in its vicinity. This monument has an internal lining of plaster which has failed due to mechanical causes. Samples of plasters and mortars from these places were studied to assess their state of conservation. From the detailed physico-chemical and instrumental examinations carried out no evidence of active deterioration was found.

The paper examines the impact of increased SO2 levels on the lime plaster at the Taj. Detailed physio chemical, petrographic, IR and SEM studies were carried out on these plasters and no evidence of degradation due to SO2 damage was found.

“Physico-chemical studies on mortars and plasters from the Taj Mahal”, 1986 Rome: Iccrom
Sample analysis of mortars and plasters from the Taj Mahal
(Agra, India) was performed to assess their state of conservation. Detailed investigation of eight samples was carried out using the following techniques: atomic absorption spectrophotometry, x-ray diffraction, scanning electron microscopy, petrography, infrared spectroscopy, colorimetry, and calcimetry. This is a detailed report including graphs and the photomicrographs of the examined samples. No sign of serious decay was found.

Aslam, Mohammad (Author) Rodrigues, J. Delgado.; Henrique, Fernando; Jeremias, F. Telmo (Editor)

"Studies on conservation of marble in Agra monuments"

Studies were carried out on the state of conservation of marble in Taj Mahal and Moti Masjid (Agra Fort). In addition to physicochemical investigations, the durability of weathered marble samples from the two monuments compared to fresh marble obtained from the Makrana quarry, was investigated. The efficacy of a few well-known stone preservatives for improving the durability of marble in an aggressive environment was studied. Environmental pollution levels in Agra both before and after the Mathura oil refinery was opened, their possible impact on the stability of the monuments, as well as pollution from other local sources are also discussed.

Bandhopadhyay, T.K

Comprehensive report collating and analysing existing information and commitments with a bibliographical list of reports and publications and views of experts. Examines the factors affecting air pollution as well as future plans for major producers, suppliers and consumers of different sources of energy.

Bhatia, Chandur

"Deterioration of marble due to physical reasons and its conservation: (Taj marble – a test case) in Conservation of Cultural Property in India, Vol. 27, 1994
Marble has been used extensively as a building material in ancient monuments. With the passage of time deterioration of marble is caused both by chemical and physical factors. The author has discussed exclusively the various physical factors responsible for deterioration of marble using Taj Mahal as a test case. The resultant effect of these factors and
the conservation methods adopted to retard further deterioration have also been discussed by the author. In the passing reference has also been made to modern buildings which face similar problems.

Central Building Research Institute

"Assessment of the impact of a proposed oil refinery on Taj Mahal in India" Durability of building materials Vol. 5 No. 3-4 April 1988

Detailed environmental impact studies were carried out to evaluate the effect of pollutants on the Taj Mahal (Agra, India), if an oil refinery were built 60 km north of the monument. The marble of the Taj Mahal is at present well preserved but the sandstone is showing signs of deterioration. The study made several anti-pollution recommendations to the owners of the proposed refinery.

Dept. of Civil Engineering, University of Roorkee


Foundation engineering investigations was taken up by the CBRI in 1986. Soil samples from 3 bore holes were analysed to determine their composition.

Dubey, R. N.; Thakkar, S. K.; Gupta, A.


Research sponsored by the ADA and US National park service to assess the general environment and traffic conditions in Agra as well as possible impact of the proposed development of the Taj National Park on the environment, traffic management and safety of the Taj Mahal. A series of 8 studies related to engineering were identified for the project. This included stress analysis of the Taj Mahal, studies related to building materials, geotechnical engineering, surface water studies, ground water studies including quality Assessment, air quality monitoring, solid waste management and general aesthetics.

Feilden, Bernard & Beckman, Poul

"Seismic analysis for safety evaluation of Taj Mahal monument" in World conference on earthquake engineering-11th


"The Taj Mahal – Agra- Uttar Pradesh” ICCROM,1987 The report was based on an ICCROM mission led by Sir Bernard Feilden and Poul Beckman to study the stability of the structure and foundations of the Taj complex and advise the ASI on preventive maintenance procedures. The mission concluded that there was no evidence of structural distress.
nor of foundation failure in the building. A geotechnical Survey was however, advised keeping in view the significance of the site.

Feilden, Bernard M.  

“Mission to India 4-13 December, 1978” ICCROM. Rome 1979

Gauri, K. Lal; Holdren, G.C., Jr  

"Pollutant effects on stone monuments" in Environmental science & technology Vol. 15 No. 4, April 1981 Description of the effect of atmospheric SO2 on marble causing black crusts and iron corrosion. Comparison of samples from Chicago and Taj Mahal. Trial to stop the project of building an oil refinery 30 km from the monument
Goyal P; Singh M P

“The Long-Term Concentration Of Sulfur Dioxide At Taj Mahal Due To The Mathura Uttar Pradesh India Refinery”

There was controversy regarding the impact of the Mathura Refinery on the Taj Mahal. Mathura is about 40 km from Agra, where one of the major tourist attractions in India, the Taj Mahal, is located. It is a topic of vital concern that the quantity of sulfur dioxide released from refinery stacks, either individually or collectively with the amount released from the local sources, would damage the Taj Mahal. To provide answers to such preliminary estimates of long-term concentrations, during premonsoon, winter, monsoon and post-monsoon, were computed at distances of 40 km from the refinery. Comparative studies have been made with different concentration formulae. The long-term concentrations in either season, individually or collectively with the local sources, do not appear to exceed the standards proposed by The Indian Standards Institution.

Graber M; Gupta A.K; Ghosh M.K; Goel A; Malik P; Ramani K.V; Khoshla CPS; Gusain RRS; Gaur AK; Ras AR

“Air-pollution from Iron Foundries in Agra and the Taj-Mahal”
Journal of Clean Technology and Environmental Sciences, 1992, v2, n3-4 (jul-dec), p169-185

Measurements of air pollution concentrations and emissions into the atmosphere carried out in Agra around the Taj Mahal in March and April 1987 revealed that SO2 emissions from the Agra iron foundry industry and the large oil refinery in Mathura did not, at that point in time, seem to threaten the condition of the marble of the Taj Mahal. Acid rain also did not then seem to affect the Taj Mahal marble. On the other hand, black soot and particulate matter emitted from the iron foundries and the small diesel electricity generators operating in the Agra area, and from diesel vehicles traveling in the vicinity of the Taj Mahal, do have the potential to cause noticeable soiling of the white marble of the Taj Mahal.

Gupta, A.

“Ecology and development in the Third World.”
Routledge -- London, UK, 1988

The book provides an account of the nature of ecological degradation associated with development in the Third World. It also reviews the steps that could be taken to prevent or reduce such degradation, usually a collection of technical, social and economic measures. Chapter 5 examines air quality with examples of the effects of air pollution on the Taj Mahal and in Bhopal, India.

Hangal, S. P

“Saving The Taj Mahal From Air Pollution” in International
conference on industrial pollution and control technologies, Allied Publishers, 1997

Hangal, S.P.; Harwit, E.

“Saving the Taj Mahal from air pollution” in Air & Waste Management Association 90. Annual Meeting Toronto, Ontario (Canada) 8-13 Jun 1997

The Taj Mahal, located in Agra, India, is facing the threat of deterioration from air pollution. The authors were involved in assessing the air pollution control options for iron and steel foundries in the Agra area through the sponsorship of the United States Agency for International Development (USAID) program TEST (Trade in Environmental Services and Technologies). There are in excess of 100 small foundries in the Agra area that may be significant contributors of sulfur oxide and particulate matter emissions. At the present time, many of these foundries have installed wet scrubbers. However, these scrubbers have had operational problems due to inadequate water supply and poor water quality. The foundries are currently evaluating other options to reduce air pollution. Even with ongoing efforts to reduce emissions, there are still many other significant air pollution sources in the area including a large refinery, thousands of poorly controlled vehicles and diesel emergency generators. These generators are prolific because of a severe shortage of power in the area. As a result, there is a link between the air pollution and the lack of a developed infrastructure (i.e., electric power generation). There is limited data available detailing source emission profiles to conduct a source apportionment study. The situation in Agra highlights the difficulties faced in developing countries in sustaining economic growth, preserving cultural heritage, as well as reducing pollution. The paper discusses the Agra foundries' attempts to reduce air pollution as well as describe other sources of air emissions in the area. In addition, several recommendations for further actions, including a proposal to conduct a source apportionment study were made.

Hicks, B.B.; Kumari, Manju (Author)
International Council on Monuments and Sites.
United States Committee (Corporate Author)

Washington: ICOMOS United States Committee

Marble discoloration at the Taj Mahal, Agra, India, appears
to be most prevalent in areas that are both shaded from early morning sun and protected from rainfall. An explanation, based on atmospheric modeling concepts, is presented that attributes, at least in part, the discoloration to the simultaneous occurrence of high concentrations of pollutants and moisture condensation on the marble surfaces in the early morning. Pollution from nearby sources is released in the vicinity of the Taj. Soon after sunrise, surface warming is known to cause a rapid increase in turbulent mixing, which draws the pollutants to the surface of the building. Since wet surfaces enhance the deposition of gaseous pollutants such as sulfur dioxide, it is hypothesized that the areas of marble still wetted by surface condensation will preferentially take up an early morning pulse of pollutants.

Jain, Kamal K.; Singh, Tej; Agrawal, O.P.

Torun: Nicholas Copernicus University

The corrosion of iron clamps and dowels is one of the major causes of decay of Indian monuments. X-ray diffraction and infra-red spectrophotometry studies were carried out on samples from the Taj Mahal in Agra, the Jaswant Thada in Jodhpur, Kusum Van Sarovar in Mathura, and Mahabodhi temple in Gaya. The paper discusses corrosion mechanisms and the problems of in-situ treatment of iron dowels and clamps

Joshi S D; Pandya G H; Phadke K M; Tajne D S; Jain A K; Gajrani C P; Yennawar P K

"An Investigation Into The Acid Content Of Aerosols In The Ambient Air At The Taj Mahal Agra India" in Environment Pollution 58 (2-3). 1989.
A chemical analysis of suspended particulate matter (SPM) collected near the world famous Taj Mahal monument at Agra has been carried out. SPM samples collected on glass fibre filters were analysed for water-soluble sulphate, nitrate, chloride and ammonium ions. The data were derived from over 200 samples (each of 24 h), collected continuously during the winter periods (October through to March) of 1984-85 and 1985-86. The SO42- and NO3- components are acidic in nature causing corrosion and effects on visibility, and so were studied in more detail. Mean values for SO42- and NO3- derived from two-year data are 7.2 \text{ \mu g m^{-3}} and 8.2 \text{ \mu g m^{-3}}, respectively. The SO42-/SO2 and NO3-/NO2 ratios observed indicate faster conversion
of SO2 to SO42- than NO2 to NO3-, the maximum levels being in January. Thus, both SO42- and NO3- results appear to offer more promising indices of air quality than do SPM data alone.


"An investigation into the acid content of aerosols in the ambient air at the Taj Mahal, Agra" in Environmental Pollution, United Kingdom., 58/2-3, 1989

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Kulshrestha U C; Kumar N; Saxena A; Kumari K M; Srivastava S

"Identification Of The Nature And Source Of Atmospheric Aerosols Near The Taj Mahal (India)". Environmental Monitoring and Assessment, 34, 1995

The chemical composition of aerosol samples collected at Agra near the Taj Mahal during April 1991-June 1992 was identified by wet chemical analysis. The average concentration of suspended particulate matter (SPM) was 368.5 µg m-3, ranging between 83 and 1305 µg m-3, depending upon the season. Elevated levels of Na, SO4, Mg, NO3- and Cl compared to levels reported worldwide were attributed to the suspension of soil particles, as well as industrial emissions. Geometric mean enrichment factors of elements indicated two groups; one having enrichment factors less than 7 which were comprised of Na, K, Ca, Mg, Fe, Al, Mn and Si (crustal) and the other having enrichment factors greater than 13 and which were comprised of Ni, Cu, Zn, Pb, and Cd (non-crustal). Principal component analysis revealed the association of the first principal component with soil-derived elements while the second, third and fourth principal components were associated with industrial
Kumar Nandini; Kulshreshta U C; Saxena A; Kumari K M; Srivastava S

"Effect of anthropogenic activity on formate and acetate levels in precipitation at four sites in Agra, India."


Twenty-four-hour precipitation samples from four sites: Dayalbagh (DB), Hari Parvat (HP), Taj Mahal (TM) and Udyog Kendra (UK) in Agra city, during the monsoon season (July-September) of 1991, were analysed for formate and acetate. Each site was representative of a different level of anthropogenic activity. The formate/acetate ratio observed appeared to be characteristic of the dominant activity at the site; the geometric means of the formate/acetate ratios calculated for individual samples were 0.99, 0.17, 0.83 and 0.21 for DB, HP, TM and UK, respectively. These corresponded to the level of pollution at the site. Direct acetate inputs from extensive combustion and automobile exhaust could contribute to elevated levels of the species at two of the four sites. Another possible indirect input could be from the alkaline hydrolysis of PAN, aided by relatively high pH values of rain water (volume-weighted averages = 6.79, 6.69, 7.22, 7.15) at the four sites.

Lal Gauri, K.; Holdren, G.C.


An oil refinery is being built nearly 30 km upwind from the Taj Mahal in Agra, India. This refinery is expected to emit 25-30 tons of sulfur dioxide daily, which is likely to travel towards the Taj Mahal from October to March due to the prevailing northwesterly winds (1). Such SO sub(2) emissions are expected to corrode the marble at the Taj Mahal in the same fashion that air pollution has contributed to the corrosion of marble at the nearly 70-year-old Field Museum of Natural History in Chicago. In December 1978, the senior (first) author of this paper collected a few marble samples at the Taj Mahal to compare their condition with the marbles exposed at the Field Museum of Natural History in Chicago and the Erechtheion at the Acropolis in Athens. Knowledge of the mechanisms of marble decay enables the conclusion that the marble at the Taj Mahal - in the wake of the effluents of industrial combustion expected processes, wood combustion and brick kilns respectively. The study indicates that near the Taj Mahal the dominance of natural sources may enhance the degree of deterioration of the marble surface if micro-climatological conditions favour its wetting. Effect of anthropogenic activity on formate and acetate levels in precipitation at four sites in Agra, India.
to pervade the environment of Agra - shall meet the same fate as the monuments of antiquity in industrial Europe and North America.

Lal, B.B.


Malik, Sardar Bahadur T.S; Bahadur, Nawab Zainyar Jung & Solaiman, Khan Bahadur Mohd.

"Final Report of the Advisory Committee on the Restoration and Conservation of the Taj Mahal at Agra" 1942

Report of the Committee established in 1942 to review the condition of the monument. Report presents an overview of previous documents pertaining to the repair and condition of the structure. Complete survey of the building to document all damages with recommendations for future monitoring and conservation.

Malik, Sardar Bahadur Tej Singh (Chairman)

Report of the Expanded Advisory Committee on the restoration and conservation of the Taj Mahal at Agra, 1943" The Advisory Committee was expanded in 1943 with the inclusion of 5 new members to review the report of the previous committee. The Expanded Committee agreed with the recommendations of the previous committee but stated that the cracks appearing in the marble facing were not due to any excessive stresses on account of loading of the structure namely its dead weight and wind pressure. Causes for damage were identified and recommendations for future conservation works made.

Ministry of Petroleum, Chemicals and Fertilizers


Nand, K.

"Role of natural dust and base cations in controlling the acidity of rain over India" in Air & Waste Management Association 89. Annual Meeting Nashville, TN (USA) 1996

The phenomenon of acid rain which was earlier restricted to a few selected areas in the world has also been reported from a few locations in India. In addition, people have now started apprehending about the widespread acid rain in India, specially over Taj Mahal (Agra) due to the release of pollutants from Mathura Oil Refinery. An analysis of rainwater samples collected in India from ten World Meteorological Organization's Background Air Pollution Monitoring Network Stations indicated that lowering of pH
to acidic values might be restricted close to highly industrialized cities only. Detailed analysis of rainwater samples indicated that pH of rainwater samples was quite high at locations where concentrations of base locations in rainwater was also high. In addition, calcium was found to be more effective in controlling pH of rain water than sodium and potassium. Quite interestingly, the pH in rainwater correlated well with the pH of local soil. The source offense cations in rainwater was identified to be the natural dust at various locations from where rainwater samples were collected. Wind blown dust from dry river beds, flood plains and beaches, ploughed fields, construction sites and desert regions are important sources of natural dust. Thus, if soil characteristics and dust load at various locations can be studied in advance, the likely pH of rainwater over a region can be predicted. The details of these studies are presented.

National Geophysical Research Institute

“Geophysical Investigations Related to the Preservation and Assessing the Stability of the Taj Mahal” Hyderabad, February, 1993

The study formed part of the CSIR investigation into the Taj Mahal and examined the foundations of the site including that of Mehtab Bagh across the river.

Prasad U

“Morphological changes in marble rocks of Taj Mahal due to atmospheric pollution” in Visesa Prakasana - Bharatiya Bhuvijnaniya Sarveksana, (16) 53-55, 1991

Raghavan, N.; Basu, S.; Goyal, P.

“A Gaussian model for predicting SO\textsubscript{2} concentration in the City of Agra” in Atmospheric Environment, Vol. 17, No. 11, 1983

Rao K S; Soin R S; Shivaji Rao T

“Air Pollution Threat To The Taj Mahal And Its Environ Due To Mathura Oil Refinery” Chem. Age India, 29 (8) 663-664, 1978


“Taj Mahal - An Appraisal Of Foundation Performance Case Histories In Geotechnical Engineering” in International Conference On Case Histories In Geotechnical Engineering, 1993; Vol 1, Rolla, MO, University of Missouri-Rolla, 1993

Rao, K.S.; Soin, R.S.; Shivaji Rao, T.

“Air pollution threat to the Taj Mahal and its environs due to Mathura oil refinery” Chemical age of India Vol. 29 No. 8 August 1978

Digital simulation studies indicated that the existing power
Rohatgi, P.K; Raju, C.B; Ray, A.K; Modi, O.P and Rao, U.M


Saxena A; Sharma S; Kulshrestha UC; Srivastava SS

"Factors Affecting Alkaline Nature Of Rain Water In Agra" Environmental Pollution, 1991, V74, N2, P129-138
Rain water was collected and analysed from a reference site, Dayalbagh and Taj Ganj, near the Taj Mahal in Agra. The ionic components Ca, Mg, Na, K, NH4, Pb, Fe, Zn, SO4, NO3, HCO3, Cl and F were analysed along with pH, alkalinity and conductance. The average pH of rain water at both sites is 7.05. There is a dominance of alkaline components, particularly Ca. The rain water chemistry shows the importance of calcareous soil-derived materials in controlling the pH of rain water.

Sengupta, R


Sengupta, R. (Author)

"Structural consolidation of monuments" Conservation in the Tropics, 1974
In this article the author uses two examples: the dome of the Taj Mahal and the Qutab Minar, where the facade stones have been affected by thermal action. Monuments on the seaside present another type of problem. The salt-laden air and wind-borne sand abrade the stones. The problems of rock-cut monuments are different from those of structural monuments.

Sharma, B.R.N.

"Some experiences in removal of discolouration from ancient marble and plasters" Conservation of cultural property in India, 1991 pp. 91-93
Experience of chemical treatment and preservation of various types of stone monuments over a span of forty years has resulted in unexpected observations of the deterioration of stone such as the marble of the Taj Mahal at Agra and the Bibi-ka-Makbara at Aurangabad. An interesting case of treatment was the removal of old paint layer from a marble image of Ganesh, which the sculptor had used to hide grey dark veins in the marble. Mechanical removal had to be restored to after finding the plants and cupolas and steel melting furnaces are the major sources of air pollution endangering the Taj Mahal and other historical monuments. The emissions of SO2 from the proposed Mathura oil refinery and fertilizer plants would increase the pollution level in this area. Recommendations to prevent the monument from deteriorating are discussed.
ineffectiveness of solvents to remove the deeply ingrained paint

Sharma, J.S.; Sharma, D.N.

“Atmospheric contamination of archaeological monuments in the Agra region, (India)” in Science of the Total Environment, 1982, Vol. 23/- (31-40)
An analysis of water-soluble samples collected from marble and sandstone of monuments for different ions have been done. The combustion, manufacturing the other polluting operations existing within Agra area have been investigated. The measurements of the flue gases amounting to $3.63 \times 10^9$ S.C.F. indicate atmospheric contamination and deterioration of archaeological monuments of Agra. It has been found that the principal sources of air contamination are the 325 iron foundries and 3 railway shunting yards located within 0.3 to 3.0 Km. of the main monuments. The topographical and micrometeorological conditions of the city have tended to favour and aggravate the concentration of effluents in the surrounding air of the monuments. The annual average existing level of SO$_2$ ranges from 16 to 20 micrograms/m$^3$. The seasonal distribution of SO$_2$ and suspended particulate matter in the air at Taj Mahal, Red Fort and Sikandra have been discussed and illustrated. It has been observed that there is substantial sulphur dioxide contamination existing at Agra. The maximum concentrations of SO$_2$ -inf 4 and NO$_3$ - amounting 0.46 and 0.38 respectively by weight percentage found existing at Red Fort cause efflorescence of sandstone.

Sharma, R.K.; Grover, A.C; Gupta, H.O

This paper reports on studies regarding the maximum impact of differential thermal dilation resulting in the loosening if stones and their final loss. The damage is more where the marble has been used in conjunction with sandstone and to a lesser extent in the case of composite stone inlay work of black stone in marble.

Sharma, R.K.; Gupta, H.O. (Author)

Apprehensions have been growing about the ruinous effects of air pollution on the milky white marble of the Taj Mahal since the commissioning of an oil refinery at Mathura. In order to have an environmental impact assessment of the ambient air quality at Agra, and to identify the factors responsible for the yellowing of the marble surface, the various meteorological parameters, particulate matter, sulfation rate and level of SO2 concentrations at the Taj Mahal, Sikandra and Red Fort, Agra are being monitored. This paper reports on studies of dust pollution that has been identified as the most severe problem at Agra, and as responsible for the soiling and yellowing of the white marble surface of the Taj Mahal by deposition of particulate matter

Sharma, R.K.; Gupta, H.O.; Veeraraghvan, R. (Author).

"Characteristics of accretionary deposits on stone surface structures due to change in environmental scenario around the monuments" Conservation of cultural property in India (0971-619X) Vol. 27, 1994

The phenomenal increase in the growth rate of industry and population in the recent past has resulted in the change in environmental scenario around the monuments. The monuments which were generally away from the reach of the public now have busy road sections all around and such a feature is much more pronounced especially in case of monuments located in Delhi, the capital of India. In this paper, the studies regarding the characteristics of the particulate matter deposited on the stone surface of different structures in Red Fort, Delhi have been reported. The SPM level in the ambient air around Red Fort, Delhi and Taj Mahal, Agra have also been compared to emphasise the need for taking further control measures by the concerned agencies

Sharma, R.K.; Gupta, H.O.; Tiwari, Shiv Kumar


The paper examines the surface characteristics of polished marble surfaces using SEM and IR studies to assess the role of oxalate film as artificial patina and infill material. The dissolution kinetics and surface reaction characteristics become more pronounced on the rough marble surface and accelerate the weathering mechanism. In some areas the exposed marble veneering slabs of the mausoleum have been observed to develop pitting. Laboratory investigations were carried out to improve the marble lustre with a view
Sharma, R.K; Grover, A.C; Gupta, H.O


The paper examines the safety evaluation of the Taj Mahal by in situ examinations and monitoring of the pattern/nature of the cracks developed in the marble veneering slabs. The presence of inherent impurities in the marble slabs and the impact of air pollution in causing deterioration or cracks in weaker zones have also been investigated.

Sharma, R.K; Gupta H.O & Maiti, S

Conservation problems of stone in Indian monuments as a function of building designs and functional environment in Conservation of Cultural Property in India Vol, 30, 1997

Examines the conservation problems of the monument as a function of its building design and functional environment. In the case of the Taj the effect of weathering is confined to the electrochemical corrosion of the iron clamping resulting in the development of cracks, localized stress and damage to the veneering slabs. The functional environment experienced by the outside marble and in the interior is different as the interior has greater accumulation of grease due to increased visitor contact.

Sharma, R.K; Gupta H.O; Tiwari, S.K

Synergic Human Factors in the Care of Agra Monuments — A Case Study in Conservation of Cultural Property in India, Volume 27, 1994, Indian Association for the Study of Conservation of Cultural Property in India, New Delhi

Sharma, S Kulshreshtha, U.C; Saxena, A.; Srivastava, S.S.

Bulk and Wet Deposition Chemistry at Agra Indian Journal Environment Protection vol. 10, no. 9, p677(6) Sep 1990

The chemistry of wet and bulk deposition collected near the Taj Mahal, Agra, India, during July-September 1988 is described. Samples were also collected at Dayalbagh, Agra, as a reference site. All of the major ions, except for potassium and chloride, were present at higher concentrations in deposition samples from Taj Mahal compared with Dayalbagh. Wet and bulk deposition at both sites have pH levels of 7 and 7.3, respectively. Soil dust is believed to be responsible for deposition neutralization at Dayalbagh, and soil dust and calcite released from buildings contribute to neutralization at the Taj Mahal site.
<table>
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<tr>
<th>Author(s)</th>
<th>Title and Source</th>
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<tr>
<td>Sharma, R.K.; Gupta, H.O</td>
<td>&quot;Aerometric Surveillance of Taj&quot; in proceedings of the National Conference on Environmental Pollution and Preservation of Historical Monuments, 1994 organised by the Indian Oil Corporation Limited. This paper reports the ambient air quality data monitored at the Taj Mahal in respect of dust fall measurement, suspended particulate matter, sulphation rate for the years 1989-92 and pattern of sulphur dioxide levels for the years 1988-92</td>
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<td>Environmental impact of Mathura Oil Refinery on decay of Taj Mahal, a sepulchral monument made of marble, is evaluated. Reports of committees of experts formed by Government of India to assess the adverse effect of hazardous fumes from oil refinery are presented. Pollution and damage caused by oxides of sulphur, oxide of nitrogen, hydrocarbons, carbon monoxide, dust, organic acids, and carbon-dioxide are studied.</td>
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<td>Shri Ram Institute for Industrial Research</td>
<td>Annual report on Air Pollutants Effect on Historical monuments&quot; Sponsored by the Department of Environment, 1985, 1986</td>
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<td>The various atmospheric pollutants which affect our monuments are discussed. The monuments and other material remains are not inert to permissible levels of gases and particulate matter. Concentrations of atmospheric pollutants equal to zero should be regarded as a safe level. The science of the decay of materials is very complex; as such, suggesting acceptable levels would prove detrimental to the objects in the long run. Once the process or effect of pollutants sets in, damage cannot be reversed. Famous Indian monuments and monuments in other countries which have been damaged by air pollution are discussed, as are the effects of air pollution on the Taj Mahal and some of the measures taken by the Archaeological Survey of India.</td>
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<td>The article describes the problems encountered by the Science Branch of Archaeological Survey of India in the</td>
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chemical cleaning of the surface of the Taj Mahal. The marble surface needs to be periodically cleaned of accumulations of dust, smoke, tar, etc. Due to meteorological and topographic conditions, the city is very hot and dry and is very much dust-laden. Their effects are manifested in the appearance of yellowish brownish accretions on the inaccessible portions of the Taj Mahal. Human vandalism also plays a part in the process of deterioration. The article describes the various steps undertaken by the Science Branch, and suggests remedial measures.

Singh, S.P.; Tandon, B.N.; Rana, K.S.; Ravi, Kant

"Chemical cleaning of marble surface of Taj Mahal using absorption clay pack method" Conservation of cultural property in India Vol. 16-17, 1983

The gleaming white marble surface of the Taj Mahal is affected by particulate matter settling on it. With time these suspended particles penetrate the texture of the marble surface and are difficult to dislodge by normal chemical cleaning methods. Experiments have shown that use of the absorption clay pack removed effectively such accretions.

Survey of India

"Report on the Verticality of Four Minars of Taj Mahal Agra including evidence on structural disturbance of the buildings" 1984

The study was undertaken by the Geodetic and Research Branch of the Survey of India who have monitored periodically since 1941. Based on their study it was concluded that the structure has remained stable in elevation from 1940 - 1976 within error limits of geodetic levelling. The tilt of all four minars it was noted was outward and could perhaps be attributed to the original design of the structure. All four minars were found to be stable upto 1976-77.

Tabasso Laurenzi, Marabelli, M.

"Effects of Air Pollution on the Taj Mahal and Suggestions for the Conservation of the Monument" Istituto Centrale del Restauro, Rome, 1987

Report based on a mission to the Taj to study the effects of Air Pollution on the Taj. Review of deterioration of marble and sandstone in other monuments as well as existing measures taken for monitoring air pollution and chemical conservation works undertaken by the ASI. Recommendations for further tests to be conducted as well suggestions for maintenance and monitoring.

Tabasso, Laurenzi; Marabelli, M. Marisa

"Conservation of Taj Mahal, India", 1987 Rome: ICCROM

Report of a mission to study the effects of air pollution on the Taj Mahal Agra (India) and to provide advice on measures to be taken for the conservation of the marble and sandstone of the monument. Results of the cleaning and the observations carried out on the different parts of the building, including the four minarets, compared with those from other monuments of the same period, led to the conclusion that the yellow shadow of the marble is mainly due to suspended particulate matter and also to the dust-fall impinging on the surface. No noticeable matter was observed on the marble surface. Infrared analysis of samples from various areas of the lower arches showed the presence of a poly-methyl-methacrylate, the ageing of which could have enhanced the yellowishness. The red sandstone used for some of the upper parts of the monuments appears heavily deteriorated. Suggestions for maintenance operations and further studies are included.

"Comprehensive researches on the effect of weathering pollutants e.g SO2 and particulates on the marble of Taj at Agra" a report submitted to the ASI, 1985

"Studies for the preservation of monuments in Agra from Mathura Oil Refinery air pollution: First and second report" San Ippolito (Pesaro) Tecneco, 1976

"Studies for the preservation of monuments in Agra from Mathura Oil Refinery air pollution: Third report" San Ippolito (Pesaro) Tecneco, 1976


"Performance Studies on the Superstructure of Taj Mahal" SIRC, Ghaziabad, 1994

The study forms part of a programme initiated by the CSIR to present a comprehensive project proposal for the Taj Mahal.

The study examined the exact geometry of the monument, mapping of cracks and their monitoring. No further widening of cracks was noticed. The study also monitored levels and tilts at critical points of the structure as well as an analysis of the superstructure of the building.

"Results of laboratory experiments with pollutants on
The mineralogical composition of marble of the Taj Mahal shows the presence of calcite (70-97%) dolomite (1-21%), and quartz (0.75-5%), besides apatite and magnetite as accessory minerals. Although the present levels of SO2 and other pollutants are well within the permissible standards, deterioration of the marble has set in as observed under SEM, in the form of pits, partial bending of its carbonate laminate, and presence of dust particles. Certain measures to arrest the present as well as the future anticipated rate of decay of marble rocks of the Taj Mahal include the preservation of the monument by coating it with a suitable transparent resin or plastic which is inert to the action of SO2. The northwest wind effect which is most critical for the Taj Mahal may be mitigated by erecting a wall as fencing at some suitable distance in the northwest of the monument covering its full length and height. Periodic dusting and washing, and removal of ingrained dirt and stains from its surface by use of neutral organic solvents have been suggested to maintain and conserve this magnificent monument.

"Ground probing radar investigations for foundation and other subsurface features at a historical site" GPR 2000: Proceedings Of The Eighth International Conference On Ground Penetrating Radar: Gold Coast, 23-26 May 2000

The ground investigations for a historical site of archaeological importance are usually a labour intensive and time consuming process. Exploratory diggings are most commonly employed to know about the buried artefacts or construction features. Many a time important features are not documented because such features are not easily accessible or the approach involves disturbance to the monument. A study was made with Ground Probing Radar (GPR) at Taj Mahal, one of the most cherished monuments of the Mughal period. The GPR techniques are comparatively new for the studies of foundation features of such monuments. In this paper, the results are presented from a GPR investigation with 100 and 200 MHz frequency antennae.
Important features detected from GPR profiling near the boundary wall and on the Mausoleum floor are discussed. The location of the foundation wells and stone pinning etc. was correlated with the borewell data. Some features identified by GPR, however, could not be confirmed due to intricate location of the subsurface features. The findings show that the GPR techniques with a large spectrum of the antenna frequencies can be used to investigate the details of subsurface features at historical sites.

Various Authors

"Notes and news" Puratattva Vol. 11, 1979-1980 pp. 107-165

Williams B

"Saving The Taj-Mahal" in Oil & Gas Journal, Vol. 93, No. 16 (Apr 17), 1995

Young, P.

"Pollution-fueled "biodeterioration" threatens historic stone"
Microorganisms appear to pose as great a threat to historic buildings, monuments, and statues as does acid precipitation, according to recent research findings. Air pollution from urban and industrial growth may be fueling these microbes and speeding the deterioration of venerated artworks and cultural treasures in many parts of the world - the Taj Mahal in India; the Acropolis and the Delos Sanctuary in Greece; stone Buddhas in Japan; cathedrals in Europe; and ancient temples in Cambodia, Vietnam, and Central America.

Young, P.

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precipitation, according to recent research findings. Air pollution from urban and industrial growth may be fueling these microbes and speeding the deterioration of venerated artworks and cultural treasures in many parts of the world - the Taj Mahal in India the Acropolis and the Delos Sanctuary in Greece stone Buddhas in Japan cathedrals in Europe and ancient temples in Cambodia, Vietnam, and Central America.

Young, Patrick

“Mouldering monuments” in New Scientist vol. 152 (Nov. 2 '96)

There is increasing evidence that airborne chemicals, both organic and inorganic, are serving as major food sources for a huge variety of fungi, algae, bacteria, and lichens that live on and damage stone buildings and statues. There is a growing consensus among scientists that, although acid rain causes stone degradation, hydrocarbons are responsible for causing even more damage. Complex microcommunities damage stone in a variety of ways, with some organisms creating surface deposits and others causing discoloration, pitting, or accelerated weathering. Conservators are coming to realize that they must limit biodegradation if they are to preserve cultural treasures such as the Taj Mahal, Westminster Abbey, and the Brandenburg Gate. However, preservation is a costly business, and inevitably, conservation societies will have to make choices about which stone structures and artworks to treat.

The ASI Air Pollution Monitoring reports are prepared by the Science Department of the ASI from the data collated through the Air Pollution Monitoring Unit located on the South East Burj of the Taj. These reports provide data on various meteorological parameters (rainfall, relative humidity, solar radiation etc.), particulate matter, sulphation rates, and level of SO2. Data on wind speed and direction, average dust fall, chemical composition of dustfall, SPM at the Taj and its chemical composition is also available with the ASI. Chemical conservation works undertaken on the Taj are also included within these reports. Reports for the following years


Sharma, R.K; Gupta, H.O “A Report on Air Pollution
Chaturvedi R.K; Tailor, P.N; Gupta P.C; Banerjee, D.

"Air Pollution Monitoring in the Ambience of the Taj Mahal – A Report 1996-1999"

data at Agra – 1993-1995"
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<tr>
<td>Edensor, Tim</td>
<td>&quot;Touring the Taj: Tourist practices and narratives at the Taj Mahal and in Agra&quot; University of Lancaster, 1996</td>
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<tr>
<td>Edensor, Tim</td>
<td>&quot;Touring the Taj: Performance and meaning at a symbolic site&quot; Routledge, London, 1998</td>
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The book identifies the different ways in which tourists approach the Taj Mahal and how they perform a diverse range of enactions at the site. It also examines the construction of the tourist space and how tourists themselves can be conceived of as performers within the tourist space.
VISUAL ARCHIVES

Collection of drawings and photographs at the Royal Institute of British Architects, London:

21142
[Taj Mahal, Agra, designed 1632-1653: detail of inlaid work of portal]. -
1 photoprint: albumen; 18 x 25 cm. 1890

21141
[Taj Mahal, Agra, designed 1632-1653: exterior view from riverside]. -
1 photoprint: albumen; 19 x 24 cm. 1890

21140
[Taj Mahal, Agra: view of entrance gateway designed 17th c]. -
1 photoprint: albumen; 20 x 25 cm. 1890

21139
[Taj Mahal, Agra, designed 1632-1653: interior view showing marble screen around cenotaph]. - 1 photoprint: albumen; 19 x 25 cm. 1890

21138
[Taj Mahal, Agra, designed 1632-1653: exterior view from south]. -
1 photoprint: albumen; 19 x 24 cm. 1890

21102
[Taj Mahal, Agra, designed 1632-1653: exterior view from south]. -
1 photoprint: albumen; 8 x 11 cm. 1890

RAN 5/J/11
Studies of decorative wall treatment in the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

RAN 5/J/2
Topographical drawing of the entrance gateway of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

RAN 5/J/1
Topographical drawing of the Mosque on the west side of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/3 (23)
Topographical drawing of the cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818
SB79/3 (22)
Topographical drawing of a tomb, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/3 (21)
Topographical drawing of the cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/3 (20)
Topographical drawing of the front of the cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/3 (19)
Topographical drawing of the front of the cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (18)
Topographical drawing of pietra dura ornament on the screen around the cenotaph, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (17)
Topographical drawing of pietra dura ornament on the screen around the cenotaph, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (16)
Topographical drawing of the railing around the cenotaph, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (15)
Topographical drawing of the tomb & screen of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815
SB79/2 (14)
Topographical drawing of the tomb & screen of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (13)
Topographical drawing of the tomb & screen of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (12)
Topographical drawing of the tomb of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (11A)
Topographical drawing of the tomb of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/2 (11B)
Topographical drawing of the tomb of Mumtaz Mahal, Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1815

SB79/1 (10)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1818

SB79/1 (9)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1818

SB79/1 (8)
Topographical drawing of the central octagonal chamber of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman, ca. 1818

SB79/1 (7)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (6)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (5)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (4)
Topographical drawing of the exterior of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (3)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (2)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

SB79/1 (1)
Topographical drawing of the Taj Mahal, Agra, India, by an unidentified 19th century Indian draughtsman,
ca. 1818

LS 20543-LS 20543/3
Taj Mahal, Agra, designed 1632-1653. - 4 photoprints: albumen; 23 x 29 cm. or smaller.
1880

LS 20525
[Taj Mahal, Agra, designed 1632-1653: exterior view from south]. - 1 photoprint: albumen; 22 x 28 cm. 1860
DRAWINGS AT THE INDIA OFFICE LIBRARY¹

1. The Taj Mahal, Agra, from the river
   Inscribed on front in ink: View of the Taaj Mahal at Agra from the river, in pencil: G. Steell
   1805 watermark 29 by 50 ½ ins.  Add. Or. 921

2. West side of the Taj Mahal, Agra
   Inscribed on front in ink: West Side of the Taaj Mahal at Agra
   1801 watermark 26 ¾ by 39 ¼ ins.  Add. Or. 922

3. Entrance door in the marble screen round the cenotaphs in the Taj Mahal, Agra
   Inscribed on front in ink: Entrance Door of the Marble Screen round the Tombs in the Taaj Mahal at Agra; on back in pencil ditto
   25 ½ by 32 ½ ins.  Add. Or. 923

4. Part of the pierced marble screen round the cenotaphs opposite the entrance door in the Taj Mahal, Agra
   Inscribed on front in ink: Part of the Screen round the Emperor's Tomb at Agra opposite the entrance Door; on the back in pencil: No.5 Part of the Marble Screen round the Tombs in the Taaj Mahal at Agra opposite the entrance Door. G. Steell.
   18 ½ by 26 ins.  Add. Or. 924

5. Side View of the Emperor Shah Jahan's cenotaph in the Taj Mahal, Agra, showing the pietra dura work
   Inscribed on front in ink: Side View of the Emperor Shah Jehan's Tomb at Agra in pencil; G. Steell
   1801 watermark 29 by 50 ½ ins.  Add. Or. 925

6. Pietra dura work and relief panels on the walls of the central chamber of the Taj Mahal, Agra
   Inscribed on front in ink: No.9 Sculpture and Inlaid Panels round the interior of the Taaj Mahal; in pencil: G. Steell
   22 ¼ by 23 ¾ ins.  Add. Or. 926

7. The mosque on the west side of the Taj Mahal, Agra
   Inscribed on front in ink: No. 10 The Musjeed on the West Side of the Taaj Mahal
   20 ¾ by 29 ¼ ins.  Add. Or. 927

8. Entrance gateway to the Taj Mahal, Agra The Mausoleum can be seen through the archway.
   Inscribed on front in ink: No.11. Entrance gateway of the Taaj Garden
   21 by 29 ins.  Add. Or 929

9. Interior of the Taj Mahal, Agra, showing the cenotaph chamber.
   Inscribed on front: Inside View of the Taaj Mahal

¹ Source: "Company Drawings in the India Office Library" by Mildred Archer
Taj Mahal — An Annotated Bibliography

10. Detail of pietra dura work in the Taj Mahal, Agra
   Inscribed on front: *A Representation of a Curious Piece of Inlaid Marble in the Hall at the Back of the Tomb in Taj Mahal*
   Water colour; 18 by 171/2 ins. Cream wash border with black rules
   Add. Or. 1910

11. Entrance gateway to the Taj Mahal, Agra
   Inscribed on front in English: *The Grand Entrance Gate of the Taj.*
   1813 water mark; 21 by 30 ins.
   Add. Or. 1762

12. Entrance gateway to the Taj Mahal, Agra
   Inscribed on front in English: *The Grand Entrance Gateway of the Taj at Agra*
   16 ¾ by 21 ½ ins.
   Add. Or. 1763

13. West Side of the Taj Mahal, Agra
   Inscribed on front: *The Taj WSW*
   1813 watermark. 21 ¼ by 30 ins.
   Add. Or. 1764

14. The 'Taj Mahal, Agra showing the mosque, assembly hall and mausoleum.
   Inscribed on front: *The Taj with the Musjid and Jumaut Khanu at Agra, founded by Shah Jehan; also: The Taje*
   1813 watermark. 21 ¼ by 58 ½ ins.
   Add. Or. 1765

15. West Side of the Taj Mahal, Agra similar to 3.; plan on back
   Inscribed on back in Persian characters: *Raudah imunawarah a^lfen* (The mausoleum from the outside)
   Add. Or. 1767

16. Interior of the Taj Mahal, Agra, showing the central chamber with the cenotaphs of the Emperor Shah Jahan and Empress Arjumand Banu Begam (Mumtaz Mahal)
   Inscribed on front: *Section of the Interior of the central chamber of the Taje.*
   21 ½ by 30 ins.
   Add. Or. 1767

17. Interior of the Taj Mahal, Agra showing the central chamber and cenotaphs.
   Inscribed on front: *Section of the Central Chamber of the Taj no.4*
   21 ½ by 30 ¼ ins.
   Add. Or. 1768

18. Detail of alcoves around the walls of the central chamber, Taj Mahal, Agra
   Inscribed on front: *Taje no.5*
   21 ½ by 17 ins.
   Add. Or. 1769

19. Relief Panel with vases of flowers from wall of central chamber, Taj Mahal, Agra
   Inscribed on front: *No.6
   16 ¾ by 24 ins.
   Add. Or. 1770

20. Detail of relief panel with vase design, central chamber, Taj Mahal, Agra
   Inscribed on front: *No.7 Taje. Vase and flowers sculptured on marble in bold Relief in one of the Compartments dividing two arches in the Central Chamber of the Taj.*
   Ink drawing; 17 by 11 ins.
   Add. Or. 1771
21. The screen round the cenotaphs, Taj Mahal, Agra
Inscribed on front: No. 8
21 ¾ by 28 ¾ ins.  
Add. Or. 1772

22. The top of the cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra
Inscribed on front: Emperor’s Tomb No. 9; on back No. 9 The Upper Part of the Emperor’s Tomb (i.e. top).
19 ¾ by 26 ½ ins.  
Add. Or. 1773

Inscribed on front in English: Emperor’s Tomb No. 10; in Persian characters; Marqad i mutahhar i hadrat Shah Jahan ab i ghaz az taal navightsab shud (the pure cenotaph of the Emperor Shah Jahan has been drawn lengthways) 1806 watermark 16 ¾ by 41 ½ ins.  
Add. Or. 1774

Inscribed on front: Emperor’s Tomb No. 11; on back: The Emperor’s Tomb facing the entrance 19 by 26 ins.  
Add. Or. 1775

25. Side Elevation of the cenotaph of the Empress Arjumand Banu Begum, Taj Mahal, Agra
Inscribed on front in English: Begum’s Tomb No. 12; incorrectly inscribed in Persian characters: Marqad i mutahhar i hadrat Shah Jahan ab i ghaz az taal navightsab shud (the pure cenotaph of the Emperor Shah Jahan has been drawn lengthways); on back in English: The Begum’s tomb at length. No. 12; in Persian characters; Qabr i Begum-Sahib bala az taal (The Begum Sahib’s grave above lengthways) 1806 watermark 161/2 by 42 ins.  
Add. Or. 1776

26. The top of the cenotaph of the Empress Arjumand Banu Begum, Taj Mahal, Agra
Inscribed on front: Begum’s Tomb No. 13; on back in English; The Upper part of the Begum’s Tomb (i.e top); in Persian characters: Lauh i balay i... Qabr i Begum-Sahib (The slab over the grave of the Begum Sahib)
Elevation of the end of the cenotaph of the Empress Arjumand Banu Begum, Taj Mahal, Agra
Inscribed on front: Begum’s Tomb No. 14; on back; The Begum’s tomb facing the entrance No. 14 22 ½ by 32 ins.  
Add. Or. 1778

27. General view of the Taj Mahal showing the mausoleum, mosque and assembly halls from the river; country boats in the foreground 1815 watermark  
Add. Or. 1747

28. Entrance gateway of the Taj Mahal, Agra  
Add. Or. 1751

29. Central chamber, Taj Mahal, Agra 1815 watermark  
Add. Or. 1754

30. Cenotaph of the Empress Arjumand Banu Begum, Taj Mahal, Agra 1815 watermark  
Add. Or. 1757
31. Cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra
   1815 watermark
   Add. Or. 1758

32. Details of pietra dura work from the slab on top of the Emperor's cenotaph and from the
    enclosing screen, Taj Mahal, Agra
    Cenotaph of the Empress Arjumand Banu Begum, Taj Mahal, Agra
   1815 watermark
   Add. Or. 1759

33. Four panels with floor designs in pietra dura work from the screen round the cenotaphs
    in the central chamber, Taj Mahal, Agra
   1815 watermark
   Add. Or. 1760

34. Tops of the cenotaphs in the Taj Mahal, Agra; above, the Empress Arjumand Banu
    Begum’s cenotaph; below the Emperor Shah Jahan’s
   1815 watermark
   Add. Or. 1761

35. Interior of the Taj Mahal
    Water colour; 29 by 18 ins.
   Add. Or. 953

36. The screen around the cenotaphs of the Emperor Shah Jahan and the Empress Arjumand
    Banu Begum in the Taj Mahal
    Inscribed on front; The Door and Screens round the tombs of Shah Jehan and Moomtaz
    Mahal
    Water colour 18 ¼ by 23 ins.
   Add. Or. 954

37. The screen around the cenotaphs in the Taj Mahal, Agra By a Delhi or Agra artist c. 1820
    Inscribed on back in Persian characters: Naqshah I majhirl raudah I munawwarah I Mumtaz
    Mahall wa-hadrat Shahjahan badshah I ghazI andaran I raudah I mutabharah (Picture of the
    enclosure of the illustrious tomb of Mumtaz Mahal and his majesty Shah Jahan conqueror
    of infidels, inside the sacred tomb)
    Water colour; 20 ½ by 27 ½ ins.
   Add. Or. 565

38. The Taj Mahal, Agra, and the entrance gardens with trees, cypresses and flower beds; a
    gardener with a basket of greenery on his head in the foreground
    By a Delhi or Agra artist c. 1820
    Water colour; 22 by 27 ¼ ins. Narrow Indian ink border between double rules.
   1816 watermark
   Add. Or. 567

39. Entrance gateway to the Taj Mahal, Agra
    Inscribed on front; Outer Grand Entrance to the Taj Garden; on back in Persian
    characters: Naqshah I kalain darwazah I raudah I munawwarah I Mumtaz Mahall u hadrat
    Shahjahan badshah I ghazi 21 (Picture of the great gate of the illumined tomb of Mumtaz
    Mahal and his Majesty Shah Jahan, King, conqueror of infidels)
    Water colour; 14 by 18 ¼ ins.
   Add. Or. 558
40. Entrance gateway to the Taj Mahal, Agra, with the mausoleum in the background
Water colour; 15 ½ by 25 ¾ ins. Watermark of 1816  Add. Or 566

41. General view of the Taj Mahal from the river showing the mosque, mausoleum and
assembly hall; a boat in the foreground
Inscribed on front in English: The Taj Mahal (sic) at Agra; in Persian characters; Raudah I
Arjumand Banu Begum mukhatab Mumtaz Mahall 'amal I Latif (The mausoleum of Arjumand
Banu Begam called Mumtaz Mahal. The work of Latif)  Add. Or 1791

42. The screen round the cenotaphs in the 'Taj Mahal', Agra
Inscribed on front in English: The Jalce or railing round the Tomb of the Empress (wife)
of Sha Jehan at the Taj Mhal at Agra; in Persian characters; Jali 1 andarun I raudah I
'Mumtax Mahall 'amal I Latif (The screen round the cenotaph of Mumtaz Mahal. The
work of Latif)  Add. Or 1792

43. Cenotaph of the Empress Arjumand Banu Begam in the Taj Mahal, Agra
Inscribed on front in English: Tomb of the Empress wife of Sha Jehan in the Taj Mhal, in
Persian characters; Qabr I Mumtzar Mahall 'amal I Latif (The grave of Mumtaz Mahal. The
work of Latif)  Add. Or 1793

44. Cenotaph of the Emperor Shah Jahan in the Taj Mahal, Agra
Inscribed on front in English: Grave of the Emperor Sha Jehan at the Taj Mhal, in Persian
characters; Qabr I Shahjahani badshah 'amal I Latif (The grave of the Emperor Shah Jahan. The
work of Latif)  Add. Or 1794

45. The top of the cenotaph of the Emperor Shah Jahan in the Taj Mahal, Agra. Inscribed on
front in English: The Top of the Emperor Sha Jehan's grave at the Taj Mhal; in Persian characters:
Laub I qabr Shahjahani badshah 'amal I Latif (The top of the grave of the Emperor Shah Jahan,
The work of Latif)  Add. Or 1795

46. Tops of the cenotaphs of the Emperor Shah Jahan and the Empress Arjumand Banu
Begum in the Taj Mahal, Agra  Add. Or. 1808

47. The Taj Mahal, Agra, showing the entrance gateway, mosque and mausoleum
on front in Persian characters; Naqshah 1 raudah I Taj ganj dar Akbarabad (Picture of the
mausoleum of the Crown Treasure at Agra) on back; The Tomb of Taj Mahal, Agra
Add. Or 3125 (Revised Foster catalogue, no. 744)

48. The Taj Mahal, Agra, from the river showing the mausoleum, mosque and assembly hall By
a Delhi or Agra artist c.1820-30
Inscribed on original mount: The Taj Mahal by an Indian artist, about 1828. The drawing
belonged to the late Colonel James Arden Crommelin. R.I. of Darjeeling (1801-93); on back of
picture: The Tahje Mahal at Agra. Drawn by a native
Water colour; 9 ½ by 13 ½ ins. Indian ink border and double rules. Water mark of 1817
Add. Or. 340
49. The screen round the cenotaphs in the Taj Mahal, Agra
By a Delhi or Agra artist c. 1830
Pen and ink and water colour; 18 by 24 1/2 ins. Narrow Indian ink border and rules. Water mark 1827
Add. Or. 990

50. The Taj Mahal, Agra, from the river, showing the mausoleum, mosque and assembly hall
By a Delhi or Agra artist, c. 1830
Inscribed on back in Persian characters: Naqshjah I raudah I Mumta^ Mahall u Shahjahan badshah (Picture of the tomb of Mumtaz Mahal and the Emperor Shah Jahan).
Water colour; 14 3/4 by 21 1/4 ins. Narrow Indian ink border
Add. Or. 561

51. The Taj Mahal, with trees on either side
By a Delhi or Agra artist c. 1830
Inscribed on back: The Taj Mahal at Agra. S View Taj
Water colour; 4 1/2 by 61/4 ins. Narrow ruled Indian ink border between double black rules.
Add. Or. 331

52. Entrance gateway to the Taj Mahal, Agra
Add. Or. 334

53. The Taj Mahal, Agra, from the river, showing the mausoleum, mosque and assembly hall
Add. Or. 366

54. The screen round the cenotaphs of the Emperor Shah Jahan and the Empress Arjumand Banu Begam in the Taj Mahal, Agra
Inscribed on front: Marble enclosure round the Tomb inside the Dome of the Tagh-Agra
Add. Or. 337

55. The Taj Mahal, Agra, with trees on either side
Inscribed on back: The Taj Mahal at Agra
Water colour 7 by 8 3/4 ins. c. 1835
Add. Or. 330

56. 2 Drawings of the Taj Mahal, Agra. By a Delhi or Agra artist. C. 1835-40
Water colour 3 3/4 by 4 1/2 ins.
The mosque on the west side of the Taj Mahal
Entrance gateway to the Taj Mahal
Add. Or. 328
Add. Or. 305

57. 14 drawings of monuments at Agra, Fatehour Sikri and Sikandra. By a Delhi artist c. 1835-40
Water colour; 7 1/2 by 9 ins. Water mark 1834
a) Entrance gateway to the Taj Mahal, Agra
Add. Or. 307
b) The Taj Mahal, Agra, from the river
Add. Or. 308
c) The Taj Mahal, Agra
Add. Or. 309
d) Side view of the Taj Mahal, Agra
Add. Or. 310
e) Interior of the Taj Mahal, Agra
Add. Or. 311
f) The screen round the cenotaphs, Taj Mahal, Agra
Add. Or. 312
g) The cenotaph of the Emperor Shah Jahan, Taj Mahal, Agra  
Add. Or. 313

h) The cenotaph of Arjumand Banu Begum, Taj Mahal, Agra  
Add. Or. 314

58. 5 drawings of Muslim monuments at Agra, Sikandra and Fatehpur Sikri. By a Delhi or Agra artist c. 1836
   Water colour; size of volume: 9 ¾ by 6 ins.
   Persian Mss. I.O.L. 2450
   f. 51 The Taj Mahal  7 ½ by 9 ¾ ins.

59. The Taj Mahal, Agra
   Probably by a Delhi or Punjabi amateur painter, 1897
   Inscribed on back: By the brother of Laeiq’s bearer. Umballa 1897
   a. Pencil and water colour; 13 by 16 ½ ins.  
   Add. Or. 754