THEORY AND PRACTICE OF HERITAGE CONSERVATION AND RESTORATION OF RASHTRAPATI NIWAS, SHIMLA

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Contents

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Haryana

I

Introduction

Shimla (31°61′ N 77°10′ E), the capital of the state of Himachal Pradesh, is situated on the south-western ranges of the Himalayas at an average altitude of 7,238 feet above mean sea level, covering seven Hills viz. Inverarm Hill, Observatory Hill, Prospect Hill, Summer Hill, Bantony Hill, Elysium Hill and Jakhoo Hill. The highest point is the Jakhoo hill, which is at a height of 8,051 feet.

To the north and east a network of mountain chains has snowy peaks- the mountains of Kullu and Spiti on the north, and the central range of the eastern Himalayas stretching east and south-east as far as the eyes can reach. Scattered over seven hills, today the town's dense mosaic of buildings runs up the southern slopes, while the northern slope is thickly wooded and in the process of development.

Shimla features a sub-tropical highland climate under the Köppen climate classification. The climate is predominantly cool during winters and moderately warm during summer. Temperatures typically range from −4°C (25°F) to 31°C (88°F) over the course of a year. The average temperature is between 19 and 28°C (66 and 82°F) in summer and −1 and 10°C (30 and 50°F) in winter. Monthly precipitation varies between 15 millimetres (0.59 in) in November and 434 millimetres (17.1 in) in August. It is typically around 45 millimetres (1.8 in) per month during winter and spring, and around 175 millimetres (6.9 in) in June as the monsoon approaches.

The average total annual precipitation is 1,575 millimetres (62 in), which is much less than most other hill stations but still much heavier than on the plains. Snowfall in the region, which historically has taken place in the month of December, has lately (over the last fifteen years) been happening in January or early February every year.

Shimla is well-connected with all major towns by road, air and rail network. National Highway 22 (NH 22) connects Shimla to the nearest city of Chandigarh. Himachal Road Transport Corporation runs daily bus services between Shimla to Delhi and other cities and towns of the state. Shimla Airport is at Jubbarhatti, 23 kilometres from the city and currently, there are no regular commercial flights to the city. However Chandigarh is the nearest major airport which is about 116 km away.

The scenic Kalka-Shimla Railway, a track covering a distance of 96 km through 103 tunnels, 969 bridges, 20 Railway Stations and five level crossings, was built in 1903 to connect Shimla, the summer capital of India with the rest of the country. It was opened for the general public only in 1906. The route is famous for its scenery and incredible construction. Kalka rail terminus has daily departures to major Indian cities. The city boasts a total of three railway stations with Shimla as the main station and two others located at Summer Hill and Totu (Jatogh) respectively. It is listed in the *Guinness Book of World Records* for the steepest rise in altitude. On 8 July 2008, the Kalka–Shimla Railway became part of the World Heritage Site of Mountain Railways of India alongside Darjeeling Himalayan Railway, Nilgiri Mountain Railway, and Chhatrapati Shivaji Terminus.

Shimla is in Zone IV (High Damage Risk Zone) as per the Earthquake Hazard Zoning of India. Weak construction techniques and an increasing population pose a serious threat to the already earthquake-prone region. There are no water bodies near the main city and the closest river, the Sutlej, is about 21 km away. Other rivers that flow through the Shimla district, although further from the city, are the Giri and Pabbar, both tributaries of the River Yamuna.

Shimla has some of the country's finest examples of British colonial architecture. Inspired by the Renaissance in England, is the grey stone former Viceregal Lodge/Rashtrapati Niwas (now the Indian Institute of Advanced Study), the neo-Gothic structures of the Gaiety Theatre and the former Imperial Civil Secretariat (now the Accountant General's Office). There are the Tudor framed Barnes Court (now the Raj Bhawan), and the distinctive Vidhan Sabha and the Secretariat of the Government of Himachal Pradesh.

Rashtrapati Niwas Estate is located on an extended plateau at the highest section of the western part of Observatory Hill with a lawn to the south and terrace gardens to the north and North West. The estate covers a huge expanse of land including the whole of Observatory Hill, Bentinck's Hill, Prospect Hill and a portion of the hills on which Peterhoff stands. This edifice was designed by Henry Irwin, an architect of the newly created Simla Imperial Circle of the Public Works Department of the then colonial government in India. It was built from 1885 to 1888 and the Earl of Dufferin, the Viceroy of India, was the first to occupy the new Viceregal Lodge.

In 1904, the estate covered an area of 331 acres upon which

Aerial view of Viceregal Lodge, Shimla
Source: IIAS.

stood 26 houses accommodating 840 persons of whom 40 were Europeans. Among the houses in the grounds of the estate which are occupied by members of the Viceroy staff are Squaire Hall, Colonel Hon'ble E. Baring' hospitality and later as Controllers House; Curzon House, residence of the Military Secretary of the Viceroy; Courteen Hall, office of the Military Secretary to the Viceroy; and quarters for the clerks, electricians, the band, the bodyguards and police guards. The annual upkeep of the entire estate amounts to little short of 10,000 pounds. It is quite befittingly the only building in Shimla that occupies a hill by itself.

The main complex is oriented at approximately 10 degrees east of the true north with the main entrance porch roughly in the Centre of the south façade, the Council Chamber in the north and the Public Entry Building in the east, with a later addition linking the east wing of the main block with covered porches and stepped terraces.

While the main block consists of three storeys and the east wing two storeys, the use of the hillside on the north could accommodate a five storeyed Kitchen wing containing the kitchen, laundry, scullery, wine cellar, etc. The façade of the lodge is impressive and imposing. The roofline is broken up with curbed gables, domed towers and prominent chimney stacks. The gardens surrounding the main building have been developed in various ways. Open

General view from southwest.

lawn and a group of trees at the western corner is located on the south of the main building, beyond which is a formal rose garden and a path leading to the conservatory at a lower level, the outer edges of which are defined by retaining walls with arched parapets. General view from southwest.

The Viceregal Lodge has been the venue of many important decisions, which changed the fate of the sub-continent. This was the venue of the Simla Conference in 1945. In 1947, the decision to partition India and carving out Pakistan and East Pakistan (now Bangladesh), was also taken here.

After independence, the Lodge remained the summer retreat of the President of India. In the early 60s the then President of India, Dr. S. Radhakrishnan and the Prime Minister, Pandit Jawaharlal Nehru decided to make it a scholars' den where the best minds would find an ideal retreat. That is when the Indian Institute of Advanced Study moved into the Lodge in 1965.

Obviously enough, some of the interiors had to be changed to accommodate the needs of the Institute. The State Drawing Room, Ballroom, and Dining Room, for example, have been converted into a library; the Viceroy's office is now the IIAS Director's office; and the conference hall is now a seminar room for research scholars. The Institute seems to be the perfect setting for lively intellectual debates and discussions.

Henry Irwin's name on the main elevation on the left.


SITE PLAN
OF
VICEREGAL LODGE (RASHTRAPATI NIWAS)
SHIMLA (HIMACHAL PRADESH)
SCALE 0 50 100 Metres
N
VICEREGAL LODGE
OFFICE
PROPOSED AREA FOR PROTECTION

The approach is from three sides, one climbing along the densely forested northern face of the hill, through a gatehouse on the east and the other connecting the complex with Boileauganj at the south-western base of the hill, this was perhaps provided at the time of construction of the main building. The third one is linked with Summer Hill. The second one is also extended to provide access to other residential buildings within the Estate.

At present, vehicular access is terminated at the area between the main complex and the original fire station and swimming pool building (now converted into ticket sales counter and fire café with limited parking for vehicles belonging to the Institute and visitors. The main east access road bifurcates at a lower level to provide direct access to the main entry porch of the Council Chamber which is at present not in use.

In the year 1997, on the directions of the Hon'ble Supreme Court of India, Viceregal Lodge/Rashtrapati Niwas was declared protected as a monument of National Importance under the provisions of Ancient Monuments and Archaeological Sites and Remains Act, 1958 vide Gazette notification No. S.O. 2957 dated 11.11.1997, covering an area of 25 acres of land including the structures on the eastern side i.e. up to Gurkha Gate and Glass house on the south west (see Site Plan).

The other buildings are within the prohibited and restricted areas of the monument. Prior to its protection as a monument of national importance, the maintenance of the entire buildings in the Estate was the responsibility of the Central Public Works Department. At one time the Indian National Trust for Art and Cultural Heritage (INTACH) had the charge of conservation of the main building as a historic heritage. Being a living monument, administrative control of the building rests with the Indian Institute of Advanced Study and the two agencies, ASI and CPWD are involved in the maintenance of the monument.

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II

Historical Background

The early history of Shimla is limited and the vast track of the area occupied by the present-day Shimla city was dense forest and only the Jakhoo temple and a few scattered houses existed during the 18th century. Shimla was named after a Brahmanical goddess, Shyamala Devi, an incarnation of Kali. The present-day Shimla was invaded and captured by Bhakti Thapa of Nepal in 1806. The British East India Company took control of the territory as per the Sugauli Treaty on 2 December 1815 and it became effective from March 1816 after it was ratified by the King of Nepal. 'Semla' was first mentioned in the diary of Scottish officers, the Gerard brothers, dated 30 August 1817, as they surveyed and mapped the newly subjugated hill states. Most of the hills were retained as bases for British military posts. For helping the British during the campaign, the Maharaja of Patiala was given land around Shimla and was also allowed to purchase other tracts.

In 1819, Lieutenant Ross, the Assistant Political Agent in the Hill States, set up a wooden cottage in Shimla. Three years later, his successor and the Scottish civil servant Charles Pratt Kennedy built the first pucca house in 1823, Kennedy House, in the area near what is now the Himachal Pradesh Legislative Assembly building. He was posted as garrison officer and thereafter as political agent and Commanding Officer of the Nasiri Battalion stationed at Sabathu. The accounts of the Britain-like climate started attracting several British officers to the area. By 1826, some officers had started spending their entire vacation in Shimla. By 1827, Captain

Kennedy claimed to have achieved the subjugation of the hill territory and developed a 12ft wide road between Pinjore and Bushahr.

In the year 1827, Shimla was chosen as summer retreat of the British after the visit of Earl Amherst (1823-28), the 8th Governor–General of India, who arrived with an entourage supported by 1700 coolies. He stayed for the summer at Kennedy House. Lady Amherst wrote in the journal that "it is not inaccurate to say that Lord Amherst invented Simla. But he was the first Governor General who made it a place of retreat from the discomfort of the plains. He set the fashion." A year later, Lord Combermere, the Commander-in-Chief of the British forces in India, stayed at the same residence. During his stay, a three-mile road and a bridge were constructed near Jakhoo.

In 1830, the British acquired the surrounding land from the chiefs of Keonthal and Patiala in exchange for the Rawin *pargana* and a portion of the Bharauli *pargana*. Thereafter, there were regular visits of the Governors-General and Commanders-in-Chief of British India and Shimla thus became a hill station famous for balls, parties and other festivities. Subsequently, residential schools for pupils from upper-class families were established nearby. By the 1830's, a township of thirty British-owned houses was scattered over the Shimla track and by 1859 the town gave the appearance of a conical hill covered with white bungalows and a white church. The city also became a centre for theatre and art exhibitions. As population increased, a number of bungalows were built and a big bazaar was established. To cater the needs of the growing European population, the Indian businessmen, mainly Sud and Parsi communities arrived in the area.

Thereafter in 1831 Lord William Bentinck (1828-35) visited Shimla and he acquired 4,000 acres of land for the government and made Shimla an established hill station. He shifted to Bentinck Castle. In 1836, his successor Lord Auckland (1836-42) chose a residence on the north eastern spur of the Shimla hill, which, during the summer of 1838-39 was known as Auckland House and was used by him and his sisters. On 8 May 1838, he held a durbar at Auckland House where all the hill chiefs were received for the first time and on 24 May 1838, the anniversary of Her Highness the Queen of England's birth day was celebrated at the House. In September 1833, the first funfair was held at Annadale, an open space used for sports and recreations, to raise funds for a girl's school at nearby Sabathu,

On 9 September 1844, the foundation of the Christ Church was laid. Between 1849 and 1851, Lord Dalhousie (1848-56), the 13th Governor-General, spent three consecutive summers in Shimla. Subsequently, several roads were widened and the construction of the Hindustan-Tibet road with a 560-feet Dhalli tunnel was taken up. The construction of this tunnel was started by Major Briggs in 1850 and completed in 1851-52. Lord Dalhousie was succeeded by Earl Canning, the 14th Governor-General and Ist Viceroy of India, and he arrived in Shimla in April 1860 and resided at Barnes Court. The 1857 uprising caused panic among the European residents of the town, but Shimla remained largely unaffected by the rebellion.

Earl of Elgin & Kincardine (1862-63), the 2nd Viceroy of India who arrived in Shimla on 4 April 1863, was the first Viceroy to move into Peterhoff, which then belonged to General Innes and was sold from his estate to the Maharaja of Sirmour. In the year 1864, Shimla became the Summer Capital during the time of Sir John Lawrence (1864-69), the 3rd Viceroy of India, earlier Chief Commissioner of Punjab. He claimed that he could do more work in one summer's day in Shimla than he could in five in Calcutta. At that point Shimla was a small settlement high in the Himalaya foothills and far from the seat of power in Calcutta. For almost six decades, Governors-General and Viceroys had moved from one unsuitable accommodation to the other during summer months in Shimla. A succession of buildings such as Bentinck Castle, Auckland House and Barnes Court were used as the Government House in Shimla, the summer capital of the British Empire in India. For the next 20 years, successive Viceroys made Peterhoff their summer residence. At that point of time all government offices were on rented private accommodation. Later, Peterhoff on Mount Pleasant became the Viceregal residence.

In 1876, Earl of Lytton (1876-80), the 6th Viceroy of India, made his first visit to Shimla. The place struck him as 'mere bivouac' and he was dismayed at the makeshift temporary arrangements. He found Peterhoff unsuitable, uncomfortable and cramped, describing it as 'a sort of pigsty'. He started the process of the creation of the new Viceregal Lodge by selecting the site on the summit of Observatory Hill in western Shimla.

In the year 1877, the Simla Imperial Circle of the Public Works Department was established and Captain H.H. Cole was directed to prepare the design for the new lodge while he stayed in England. He drew a fairy-tale palace, exhibited at a fine arts show in Simla in 1878. Cole was replaced by Henry Irwin as architect for the design and L.M. St. Clair of the Simla Imperial Circle was selected as executive engineer for supervision of construction of the Main Building. However, the scheme for construction of the new Viceregal Lodge was shelved by the India office and Lord Lytton's successor, Marquis of Ripon (1880-84), the 7th Viceroy of India.

Lord Ripon continued Peterhoff as Viceroy's residence. But the next Viceroy, Marquess of Dufferin (1884-88), the 8th Viceroy of India, was quick to revive the scheme. He had a choice of three plans - the Cole and Irwin's designs as well as Irwin's design for a restructured Peterhoff. The scheme for the construction of new Lodge on the Observatory Hill was revived with the change of new Secretary of States for India, Lord Randolph Churchill. It was Lord Dufferin who is believed to have himself suggested the main plan of the building and supervised at every opportunity. He constantly modified and examined all the drawings, visiting the site daily. In addition to the changes desired by the Viceroy for functional and aesthetic reasons, other modifications during construction were considered necessary by the Engineers and also by the India Office due to site conditions, the non-availability of materials, the required speed of construction and the escalating costs.

Finally the work on the site began in 1886. The summit of the Observatory hill was levelled out to create a wide plateau on which to build. But this also revealed a surface of crushed shale that was fissured and cracked in every direction, so concrete was liberally used so as to create a strong base for the foundation. The incline of the hill was used as part of the building's design; viewed as cross-section from the side, Viceregal Lodge descends the mountain side like three downward steps, the hill's contour was employed to allow for the building's different heights. While the main block consists of three storeys and the east wing has two storeys, this use of the hillside meant a five-storey north wing accommodating the basement which contained the laundry, kitchen, scullery, wine cellars and linen and china stores. Built on the side of the precipice, this block commenced three storeys below the ground level of the main block and east wing and when viewed from the north-east, the building presented itself as a lofty mediaeval castle.

The construction of the main block of the Viceregal Lodge, including the Kitchen wing, took over a period of three years between October 1886 and September 1888 at the cost of Rs. 9,70,093/-. For two seasons Lord Dufferin visited the site almost every morning and evening and many alterations and additions on the main building were undertaken till the time of completion. Lady Dufferin recorded that "D. took Hermei and me, all over the house in the afternoon. We climbed up the most terrible places, and stood on single planks over yawning chasms. The work people are very amusing to look at, especially the young ladies in necklaces, bracelets, earrings, and tight cotton trousers, turbans with long veils hanging down their backs, and a large earthenware basin of mortar on their heads. They walk about with the carriage, and seem as much at ease on top of the roof as on the ground-floor; most picturesque masons they are. The House will really be beautiful, and the views all around are magnificent. I saw the plains distinctly from my boudoir window, and I am glad to have that open view as I shall not then feel so buried in the hills."

Finally on 23 July, 1888, the Viceroy of India, Lord Dufferin moved into the new Viceregal Lodge only a few months before their departure from India. He was succeeded by Marquis of Lansdowne (1888-94) and Earl of Elgin (1894-99) and followed by Lord Curzon (1889-1905) at the age of thirty-nine. Considerable changes were made in the interior as well as in the exterior of the building after the great earthquake of 1905. Subsequently this magnificent building was occupied by 13 Viceroys as the seat of empire till 1947 and modifications and alterations were made by successive Viceroys. The Council Chamber currently is being used as Library and the Public Entry Building, as accommodation for the Fellows. Terrace gardens were built in the year 1913 and 1927. The other important buildings are the Old Observatory House (present fellows' guest house); Fire station and Swimming Pool Block (now is being used as ticket sales counter); Glass House, and a host of residential houses in the complex occupied by members of the Viceregal staff including Square Hall; the Controllers House at the northern extremity of Bentinck's Hill, present residence of the Director IIAS; Curzon House, burnt down in 1888, was rebuilt by Lord Curzon on a site once occupied by a house called Lansdowne House and later the residence of the Military Secretary and now under the Judicial Academy of the State; Courteen Hall, original office of the Military Secretary to the Viceroy and now occupied by the Fellows as residence; quarters for the clerks, electricians, the band, the bodyguards and police, etc.

On 14 June, 1945, the 19th Viceroy, Viscount Archibald Wavell's in a radio broadcast, called for what was termed the Simla Conference, to propose the reconstitution of the Viceroy's Executive Council. From 25 June to 14 July 1945, the Viceregal Lodge was host to the 'Simla Conference' which was attended by major political leaders from various communities and political parties such as Pt. Jawahar Lal Nehru, Maulana Azad, C. Rajagopalachari, Liaqat Ali Khan, Bhulabai Desai, Master Tara Singh, Sardar Vallabhbhai Patel and Mohammad Ali Jinnah. However, Mahatama Gandhi was not a delegate to the conference though he was consulted by the Viceroy and the Congress Working Committee. In May 1946, there was again a series of meetings at Viceregal Lodge as part of the Cabinet Mission to India to discuss the British plan for India's independence. The British Cabinet Commission members, Lord Patrick Lawrence, Sir Stafford Cripps and A.V. Alexander held meetings with Maulana Azad of the Congress and Mohammad Ali Jinnah of the Indian Muslim League. The building has an immense historical significance and is a landmark in modern Indian history with some of the most important political leaders and personalities of the 20th century having visited it.

The last Viceregal occupant was Earl Mountbatten of Burma, for the short period of 1947, before India gained Independence. His tenure is inextricably linked with the history of India as he presided over the transfer of power from the British Empire to this country along with the partition of India.

After Independence, the Lodge became part of the Estate of the President of India and was renamed as Rashtrapati Niwas. In 1951, this building was the venue of the UN Regional Youth Welfare Seminar which was held in the Council Chamber , equipped with leather covered seats, chairs and desks, all of which appear to be still existing at the Lodge.

In the year 1964, Dr. S. Radhakrishnan, the second President of the Republic of India, handed it over to the nation for higher studies by setting up the Indian Institute of Advanced Study. Accordingly, on 20 October 1965, the Indian Institute of Advanced Study was formally set up and continues to function as a centre of advanced study and research in humanities and social sciences through occasional seminars, symposia, conferences, lectures, discussions and special courses of studies, among other academic activities, in which scholars from India and abroad take part and also through regular organized research undertaken by the fellows in their chosen fields of study. The IIAS also encourages multi-disciplinary approach to all projects taken for detailed academic investigation and aims.

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III

Architectural Features of the Building

Rashtrapati Niwas or The Viceregal Lodge is a beautiful example of colonial architecture and the style chosen for the design of the main building was a free interpretation of the Elizabethan or English Renaissance style. In the completion report, Henry Irwin says that "although the detail is not elaborate, the general features of the style are used both in the exterior and interior detail." Later, residents compared it to a "Scotch Hydro", and even to Penton Ville Prison, with its crenulated tower and forbidding grey facade of local stone. The Main Complex was built to work in a certain way for the convenience of those who used it, and it has been altered to meet changing functional needs.

The main complex is oriented at approximately west-south-west and east-north-east with front elevation facing south-south-east. The building is about 85 m long and 34 m wide; the western part has three storeys and the remainder is two-storeyed. The rear of the eastern part of the main block, the five-storeyed Kitchen Wing, projects about 12m, stepping down northern hillside. At right angle to the rear elevation, the Council Chamber projects 40 m with an average width of 27 m. The main entrance porch is roughly in the centre of the south façade. Public Entry Building is on the east north-east, a later addition linking the east wing of the main block with covered porches and stepped terraces. To the east of this complex is the Swimming Pool block and still further east, the Old Observatory House, now being used as a guest house.

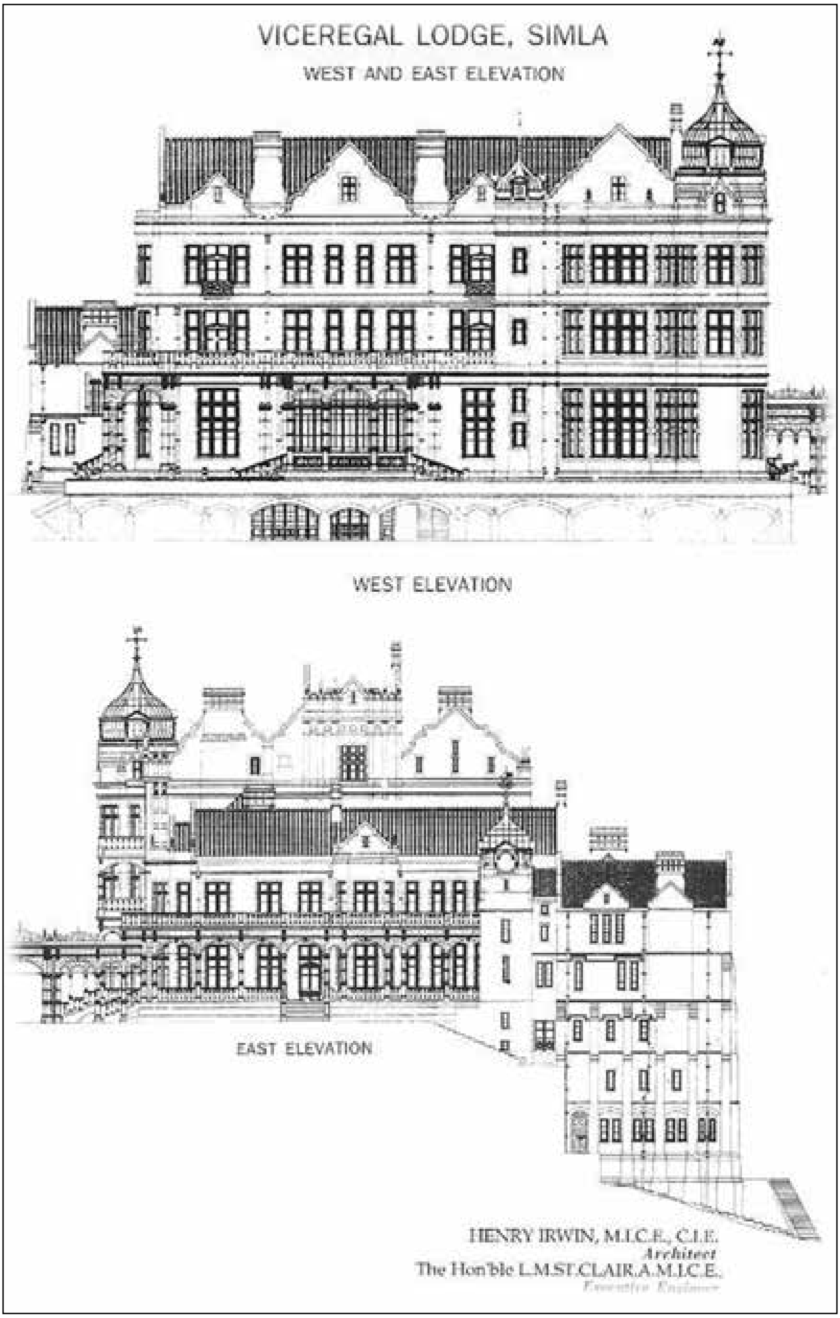
The building is two to three-storied with multilevel basement in some part constructed in load bearing structure with combination of stone arches; Jack arched roofing; lime concrete vaulted roofing. Walls are mainly made of stone masonry using blue colour chisel dressed Barog stone. The interior of the building is provided with high quality wood finish using Burma teak wood and walnut roof ceilings, etc. The masonry used in the walling is in light blue limestone and wrought stone work in sandstone of fine light grey tint. The walling stones were quarried to Shimla from nearby whereas the cut stones were brought from Kalka. Mullions and transoms of the windows were of dressed sandstones and the roofs of the verandas at different levels had sandstone arcades and a few places ornamented with wrought iron beams at right angles to the facades.

A distinctive feature of the flat arcade roofs is the Hayward's glass prisms which are inset into the roof structures within iron frames or directly in the concrete slab to diffuse the rays of the tropical sun. To protect the wide openings of the façade bracketed stone *chhajjas* were later added.

The structural system employed for the main block and east wing of the main building consists of load bearing stone masonry external walls, brick or double leaved internal walls with a combination of steel framing, wooden trusses and unreinforced lime concrete vaults for the rooms and floor structure. The building also demonstrates many innovations in construction technology with the use of brick as a replacement of stone. Quarry faced limestone blocks with sharp arrases have been combined in a sensitive manner with carved sandstone columns, arches, window mullions and transoms and decorative elements. Later, sections of the building and areas where repair has taken place can be distinguished by the unusual use of plastered brick treated to resemble coursed stone.

The most impressive space in the building is the grand entry hall having a grand and lofty space that was specially designed to create a grand impact on the visitor.

This three-storeyed high gallery, measuring 50ft high, 18ft wide and 90ft long, was covered with a skylight to allow in light from the top and is surrounded on first and second floors by an


VICEREGAL LODGE, SIMLA
WEST AND EAST ELEVATION
WEST ELEVATION
EAST ELEVATION
HENRY IRWIN, M.I.C.E., C.I.E.
Architect
The Hon'ble L.M.ST.CLAIR.A.M.I.C.E.

arcade within which is a corridor communicating with apartments on these floors. The wooden columns are solid deodar, but have the mouldings and panels in walnut. The arcades are very effective, the pillars being moulded and ornamented. The arches are deeply moulded with carved keys in walnut. At the level of the first floor, carved teak brackets project from cornices from which electric lamps are suspended. The ceiling is panelled and divided in squares with boldly moulded ribs and have glass which admits day-lights through a large glazed lantern.

One of the main features of the building is the pitched pan tiled roof punctuated with towers of different designs at three locations, elaborate masonry gable walls and chimney stacks. These pitched roofs are of large span and have deodar trusses of different types as the support structure over which are laid CGI sheets with wooden battens on which heavy interlocking clay pan tiles are placed.

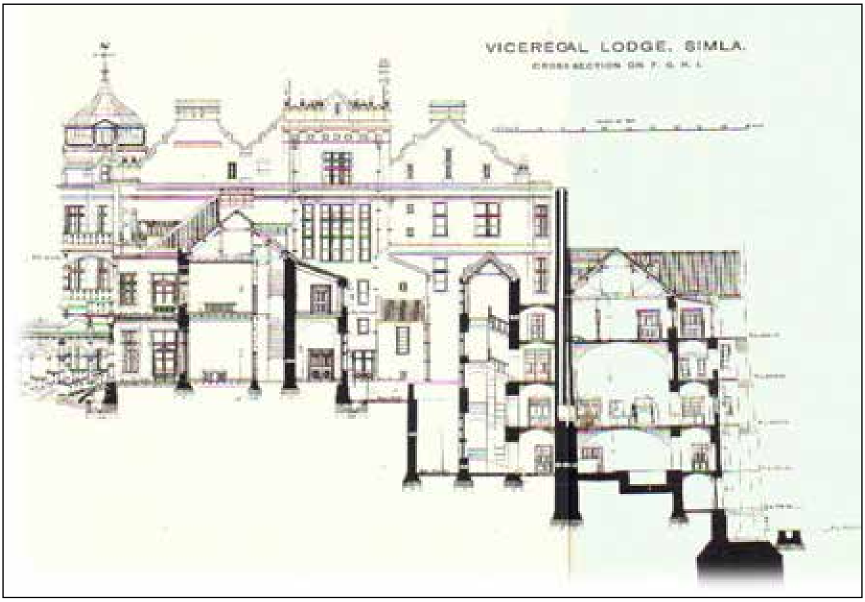
Flat roof and terrace slabs in the main block are of concrete cast in panels and supported on iron girders which are covered with plaster. The roof-line is broken up with curbed gables, domed towers and prominent chimney stacks. The main chimney flues in the Kitchen Wing are of stone and brick masonry.

The roof over the Entrance Portico is a projected section with diagonal rafters, raised away from the plane of the main roof in imitation of a hipped roof with faulty design of support structures in the absence of wall plates which are required to distribute the load from the roof trusses on the walls. The two most common truss types used are king post truss over the gallery area and queen post truss where the collar beam is supported by two posts and diagonal struts from the tie-beam in the three wings of the main block. The wooden components making up the roof structure are kept in place by steel plates and bolts. The roof of the South-West tower and South-East Bell Tower are of lead sheets supported on a complex interlocking curvilinear domed structure of deodar wood meeting at a central point against a central post. The external surface of the domed roof of the South-West Tower is covered with embossed metal plates in a fish scale pattern.

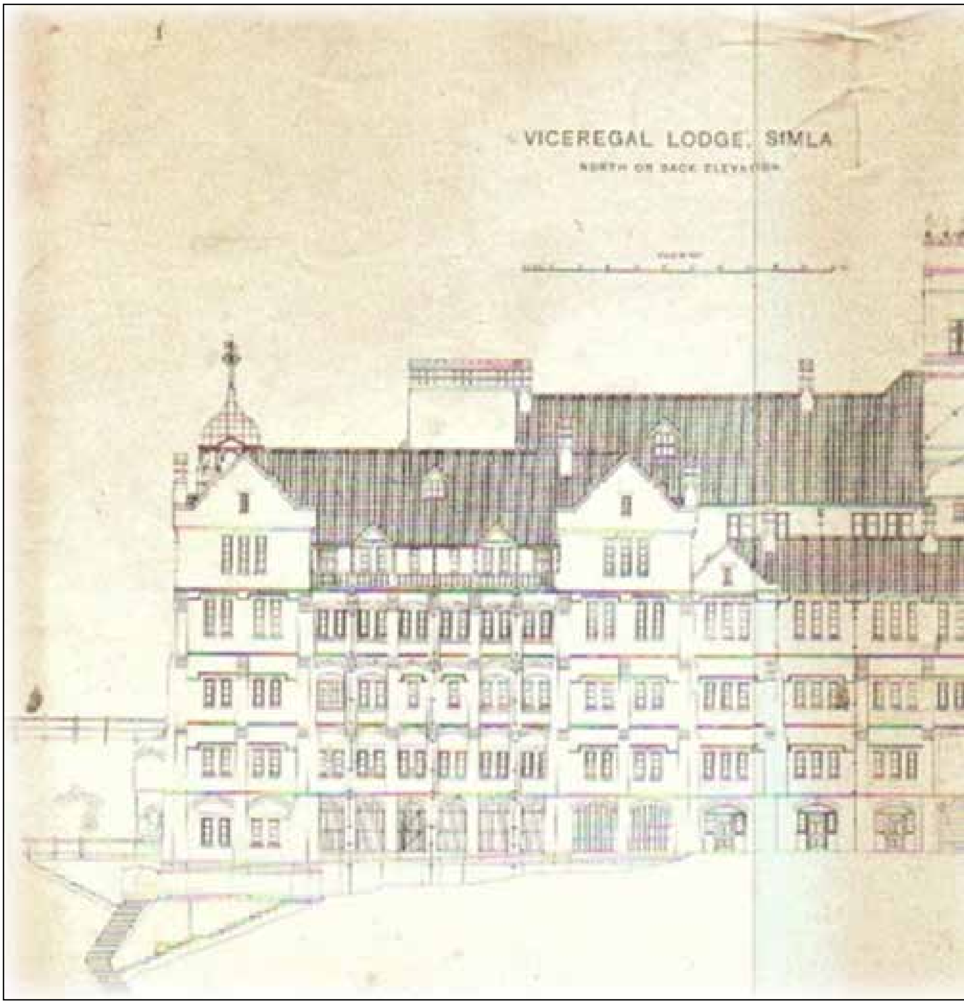
The Central tower which contains the water tanks has been provided with tie rods at the upper two levels to prevent outward movement of the walls. It has flat accessible concrete slab roof supported on iron girders with a decorative parapet wall with stone finials on either side of the central gable section.

The exterior load-bearing walls of all the buildings are usually of stone masonry and vary in thickness due to numerous offsets and mouldings; in one of the area at the junction of the East Wing and the main block the wall thickness is about 1.9 m. The external facing of these walls is about 18cm wide courses of quarry faced limestone blocks with sharp arrases enabling fine joints. For carved stone work details such as those around openings, fine grained sandstone has been used.

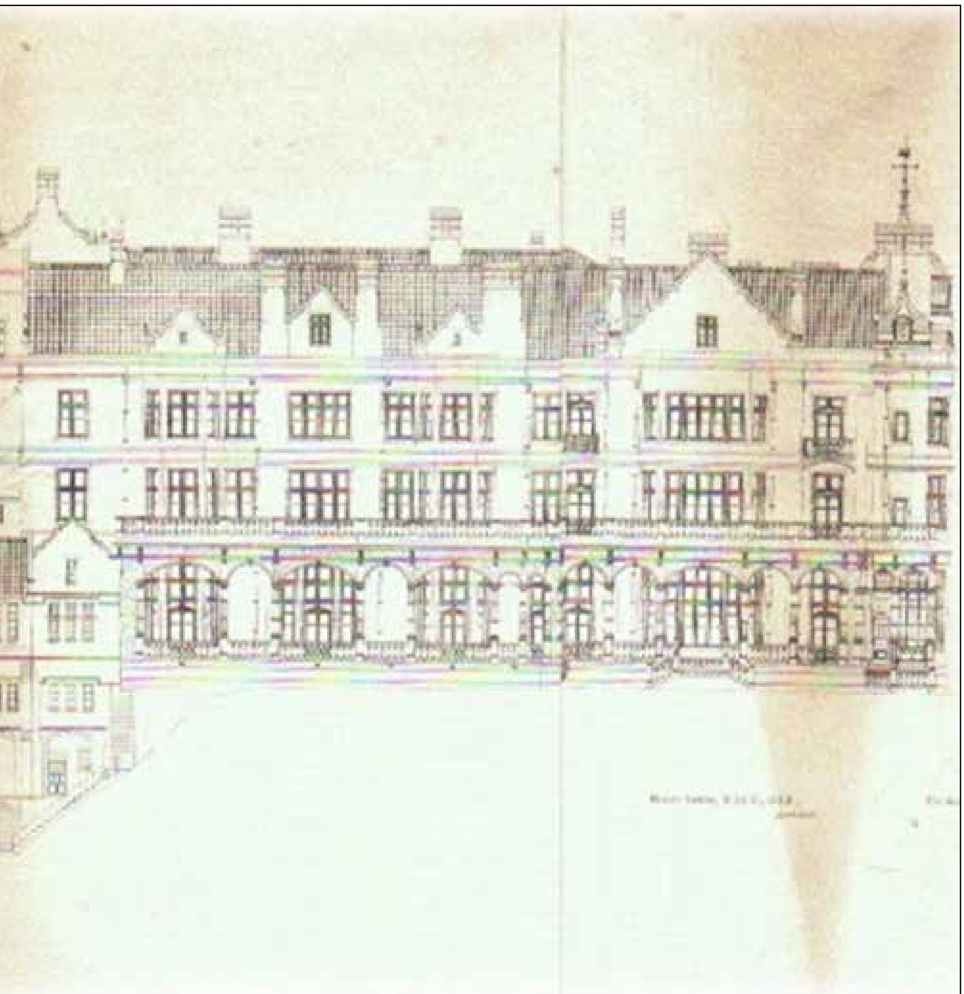
The main external and internal load bearing walls on the ground floor are usually of simple and solid construction, relying on the mass of stone masonry to prevent direct water penetration and density to act as the load bearing element in the areas where steel framing has not been used. At the first floor level of the East Wing, brick and timber framed walls have been used. In the upper floors

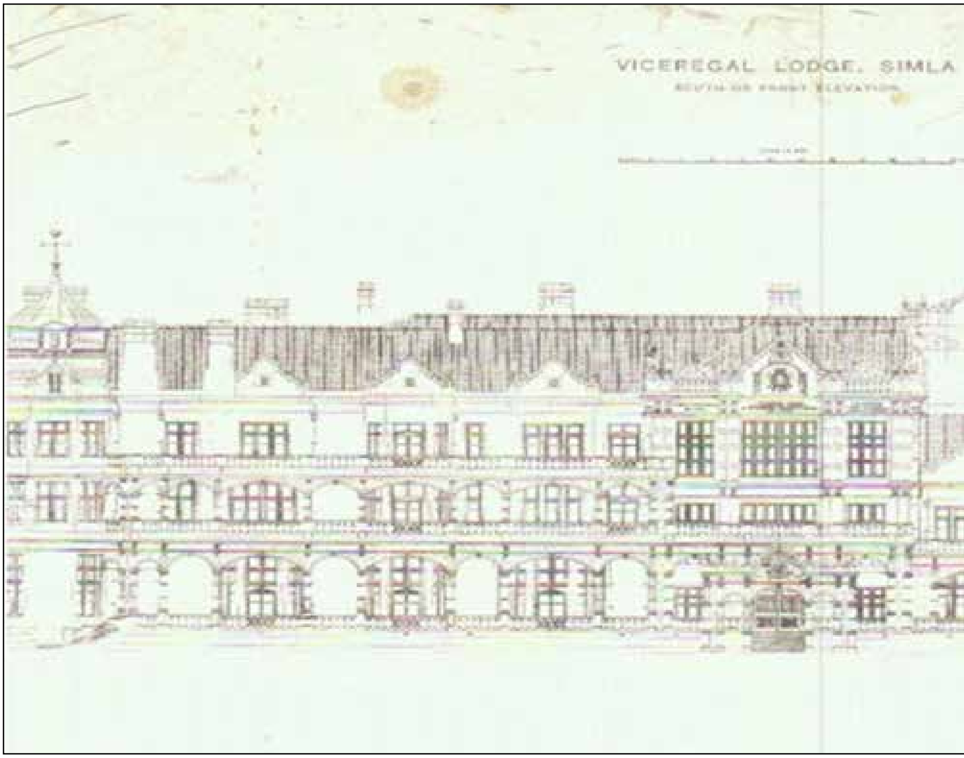


and kitchen wing, double leaf walls with an inner brick backing and an external stone masonry facing are used. The overall thickness of the double leaf walls varies at different locations. The two walls are bound together with lime or cement mortar. The building is provided with stepped foundations on concrete footings. The kitchen Wing was provided with an excessively wide and deep foundation due to slippage in the area.



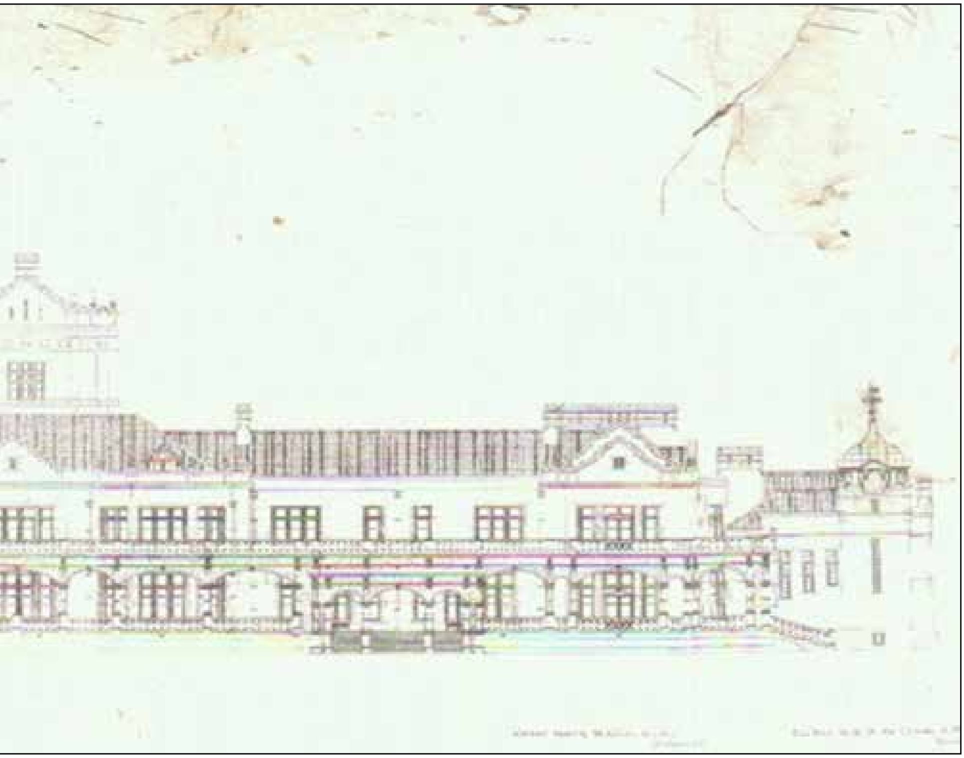
The internal walls on the upper floors, partitioned walls in one place on the ground floor of the kitchen wing and three places on the ground floor of the east wing are of bricks plastered on both sides. The lower levels of the Kitchen Wing are of rough coursed rubble stone masonry, plastered on both sides in varying thickness. The internal walls in the lounge area between the main block and the Council Chamber are a mixture of brick and stone





masonry walls covered with cement plaster resembling coursed stone masonry. The external wall on the west of the Council Chamber has pilasters of cut stone with ornamental niches. The walls of the Public Entry Building are of the same stone masonry on the exterior and plastered brick on the interior. Gable walls are stone masonry and are given a complex outline with ashlar stone copings and carved stone finials.

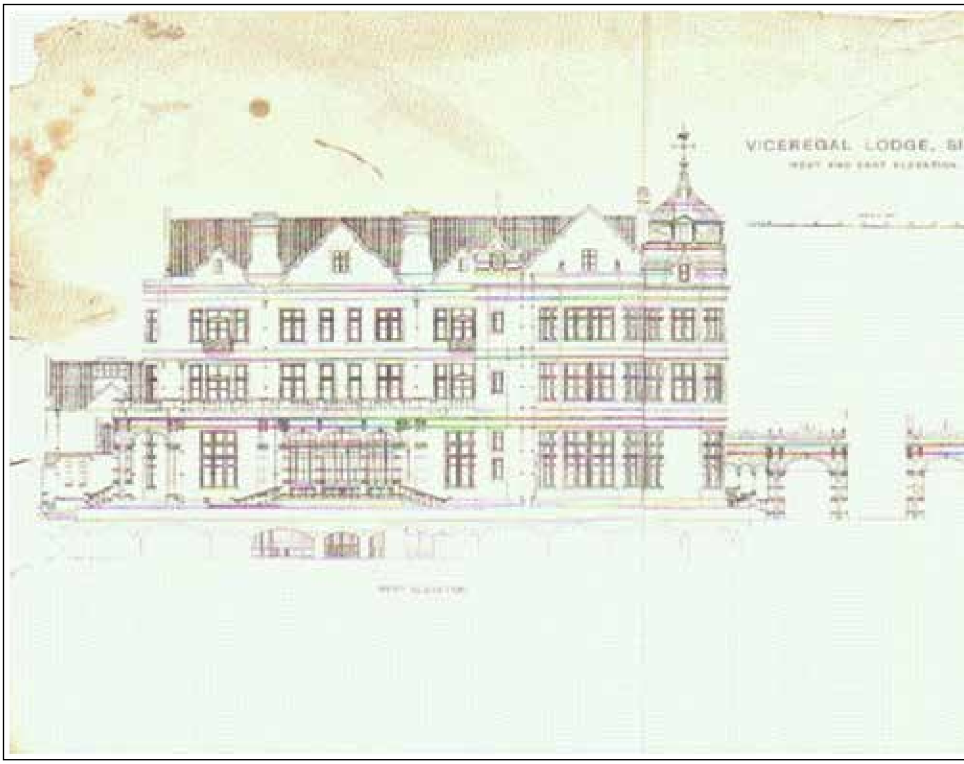
The windows and door openings are of a large span with stone lintels and intermediate flat arches with decorative carved key-stones. Large central king mullions are used to reinforce wide windows and mullions and transoms have traditional hollow chamfers and moulded profiles. These intermediate mullions sub-divide the window openings into bays with narrow proportions and hinged casement windows fill the space between mullion and transoms with glazing in rectangular pattern.



The projected oriel windows of the Bell Tower and the Council Chamber, the central entrance door of the main building, arched windows and north entrance door of the Council Chamber, and the folding doors between Ball Room and dining rooms with brass espagnolette bolts are special elements. Brass handles, latches, sash and casement fasteners and casement stays of the period are provided in the main building. Teak and deodar are used for the door and windows joinery in the main building with metal frames being used in the Council Chamber and Public Entry Building.

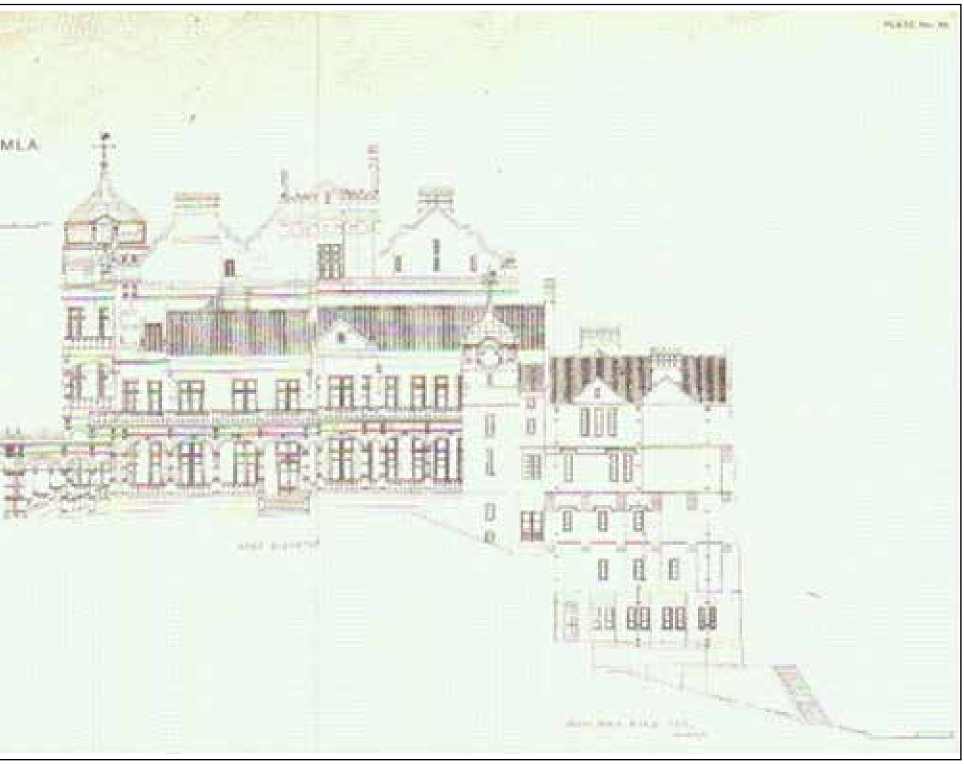
The floors of the state rooms were of teak and other rooms in the main building had deodar boards laid over joists or wrought iron girders. The floors of the service areas and verandas were originally stone flags on a lime concrete base some of which have been replaced by terrazzo flooring.

The south facing entrance portico sees the visitor into the recep-



tion hall. The hall is marked by a grand staircase which springs from the right and spirals up three full floors. Facing the main entrance is the grand fireplace. Inside, the main hall is panelled in teak. The double-galleried corridor off to the left is lit by mullioned windows and a glass ceiling, and leads to the ballroom, now the library of the Institute of Advanced Studies. A gallery with well-appointed teak panelling is the central space of the building around which the other rooms are arranged.

The façade of the lodge is impressive and imposing. Verandas and terraces surround the entire building at different levels. The columned arches along the façade are echoed in the arches of alternating widths supporting the verandas. On the upper floors were the Viceroy's office and rooms. In the morning room and visitors' lounge on this side, finishing touches like a walnut ceiling with



a Kashmiri design, lavish wall-coverings, some of which remain more or less intact, an original chandelier and so on, can still be seen. A large picture of the Vicerine, Lady Elgin, hangs over the fireplace of the visitors' lounge. Those at the lower level link the Lodge to the magnificent grounds while those on other floors provide superb views of mountains.

The top floors are reached through a timber flight of stairs from the main entrance hall. On the first floor to the left are the offices of the Academic Resource Officer followed by that of the Private Secretary to the Director and the Director's office. On the north are the bedrooms of the then Viceroy and the Vicerine and other rooms for guests. The second floor has many suites with attached toilets. A long corridor in the ground floor is on the eastern side, the roof of which is supported by stone pillars and part of the roof is made of glass panels with prisms set in alternate lines. The top of the main building has gable tin roof covered with brick pan tiles.

The wooden stairs continue to the first and second floors, all the treads being of teak, as well as the newels and handrails. The balusters are of solid walnut. The carriages and concealed portions of the framing of the stairs are deodar. Staircases can be complex elements of a building, being made up of a number of parts and raising a number of repair and maintenance issues. Treads and risers are held in place in horizontal and vertical grooves cut into the stringer and then strengthened by the insertion of glued wooden wedges where they meet. The risers are set between consecutive treads and are usually fitted to the treads in a grooved joint, strengthened by small wooden wedges glued to both on the underside. The tread projects slightly over the top of the riser, known as nosing. The stringer which is set against the wall is known as the inner wall string and that which runs up the outside and holds the baluster, the outer string. Newel posts located at the top and bottom of a flight of stairs or at right angled changes in direction perform the function of transferring the weight of the stair to the floors and provide secure support for the balustrades. These are fixed to a newel post at the top and bottom of the staircase to provide extra strength. The staircase in the South-West Tower is of a similar construction and material; the staircases in the service areas are of painted wood of simple type or are masonry staircase. The building was equipped with the most fascinating and elegant internal finish and furniture. Most of the furniture is historic in nature and represents colonial furniture in India.

Deodar wood had been used in the veranda pillars, truss partitions, floors of the ground, columns, arcading, cornices, hand rails, gallery, veranda joists, roof of the building, partition walls, newel and strings, ceilings, door and window frames and skirting. However, teak wood had been extensively used in planking in floors, skirting and wainscotings, casing to doors on the ground floor of the main block, window sashes, internal and external doors and windows. Oil paints had been used on wood work, ceiling of the verandas and east wing while distemper was used on walls.

Metal RS joists and girders have been extensively used to support floors and the flat roofs of the main building, the Council Chamber and the Public Entry Building, while cast iron elements including spiral staircases at different locations, grills and wrought iron balconies were a part of the original west and north facades. Hayward's glass prisms are inset into the roof structures within iron frames of the flat arcade roofs. The pitched tiled roof punctuated with towers of different designs at three locations, elaborate masonry gable walls and chimney stacks are other features of the building.

In so far as the interior is concerned, it is the elaborate woodwork that has stood the real test of time. Along with the panelling and pilasters, the staircase with its heavy newels and handrails is remarkable. A massive shipment of teak was procured from Burma for this purpose and supplemented, wherever required, by local cedar wood (deodar) and walnut. During the time of Marquis Curzon, many parts of the building came in for major refurbishing. The carving in the dining room was completed, and a replica of the screen that stood behind the Emperor of China's throne was added. In the old Council Chamber, that later became the billiards room, portraits of every Governor-General and Viceroy were hung. A collection of Indian arms was displayed on the walls of the main gallery where their impressions are still visible. This building had been constructed in a unique fashion in which a lot of open terraces all around the building at different levels had been provided, which quite likely could not withstand the humid climate of Shimla.

Like all building elements, the most common type of stairs are of masonry blocks, rectangular in section and are often constructed with the front of one step supported on the back of the lower step, but sometimes the step is rebated into the one below. These range from simply a few masonry blocks rising from ground surface levels to much grander structures designed to make a statement at the entrance to a building. Originally, steps are constructed with a very slight slope to shed water from their horizontal surfaces and the nosing (top edge) is often rounded or chamfered to prevent impact damage, but is sometimes left square. When the steps have to bridge a void, they are built over a supporting arch. The other elements of the external stone steps are balustrades and handrails on one or both sides for safety.

The building is one of the finest Victorian edifices, with surviving Victorian services such as the first mechanized kitchen, separate rooms for storing table linen, plates, china and glass; laundry; an enormous wine cellar; a room for empty cases; boilers for central heating and running hot and cold water in the bathrooms, including two tanks under the front lawn for storing waste and rainwater. The Lodge had its own steam generator, and was the first building in Shimla to employ electric lighting installed by a London firm, Messers Siemens Brothers in 1888. The original light panel is still in place with an added fuse box. The power was obtained from three 30 horsepower engines, driving three dynamos. There is a force pump which fed the boilers of these engines, and pumped up the daily supply of water to the house. There were about 1000 lamps, the majority being of 16 candlepower.

The other Victorian and Edwardian service systems installed in the main building are heating apparatus for the drying room in the Laundry level. No piped system for space heating was provided in the original design. The hot and cold water systems are all by wrought iron pipes, the supply being from 12 wrought iron tanks in the tower with 400gallons capacity each, total 4800 gallons, all connected by pipes and having stop cocks by means of which any one tank or set of tanks can be cut off for repair or cleaning etc.

Cooking gas system was used originally as the main oven appears to be a coal fired one. A small locked enclosure was provided at the sub-basement level below the Kitchen area of the Kitchen Wing. Gas pipeline was leading up to the Kitchen stove. Ice machine and storage facility was installed at the Kitchen level of the Kitchen Wing in the rooms at the extreme northwest end of the central corridor, and is an extremely interesting and well preserved example of pre-WW2 Refrigeration equipment. Later, the scullery was converted into ice making room with an ice pit and refrigerating equipment along the windows to the north and the wall to the west. The space for the kits was lined with cork, provided with special insulating doors, and sub-divided in to three chambers with windows sealed off and refrigeration equipment located against that wall.

Fire-fighting system comprises of internal and external hydrants in arched stone niches and well-designed internal fire boards was part of the original service infrastructure in the main building and also connected with the Council Chamber. Some of the more fire prone construction elements such as the wooden panelling were treated or backed with fire retardant materials. The fireman's room had been provided in the original corridor at the ground floor level connecting the Kitchen and east wings with an alarm bell in the fireman's quarters on the estate. A system of 16 fire hydrants outside and 15 inside the main building was connected with the underground rainwater and grey water storage tanks located to the southwest, north, northeast and east of the main building through a peripheral sub-surface drain running around the main building. A system of well-designed fire boards including alarms, house pipes, fire blankets, etc., connected with the water storage tanks in the central tower (capacity 78000 litres) was placed within the main building at different locations. The service networks have been modified over the years. A sprinkler system has been installed in the Attic. Fire extinguishers and boxes located at intervals along the central corridor have been installed in the Public Entry Building. The original fire-fighting system is still operational.

The gutters and down spouts of cast iron with hopper heads/ leader heads and ornamental bracket fasteners were manufactured by McFarlane. The square section downpipes discharged into a concrete drain surrounding the plinth and conveyed the water to storage tanks for the garden use and water supply to the Laundry. There were four of these tanks with an average capacity of 45,612 cubic feet. Sub-surface rainwater drainage system with brick wells to serve as indicators of the blockage in the system, running partially under the building and emptying in to underground storage tanks used for the garden and fire-fighting purposes. The underground rainwater harvesting tanks are placed at a sufficient distance away from the building, though the service areas and rainwater drains may be a source of water logging and dampness as they are not properly maintained and are also within or close to the building.

Though a telephone system was not included in the original design, the internal room panelling was designed in such a way that the removable skirting boards enclosed a space which was used to conceal the wiring for call bells and telephones.

So far as sewage disposal system is concerned, as per reports, only two bathrooms were fitted with water closets. These had proper pipes, traps and ventilating pipes, and the soil pipe ended in a latrine down the hill. Sweepers' stairs were attached to all the other bathrooms for manual removal of waste. The bath water was carried in pipes to the underground storage tanks. Bathrooms were provided with enamelled cast iron and porcelain fittings.

Fireplaces have been an integral part of the building and due to a wide range of different fireplace designs and features, they became highly decorative and the focal point within a room. All fire places are lined with Minton's tiles, and the Kitchen is lined with white glazed Minton's tiles, 6 ft. high, all round the walls. All have the same basic elements, the hearth, the grate, ash tray or bucket, chimney piece, fenders, canopy, etc. The hearth is the area in front of the grate and chimney opening which prevents burning material which might fall from the grate causing a house fire. The grate is used to contain the fuel and burning material of the fire and comes in a variety of styles. Grates are most commonly made of cast iron and must be chosen carefully to fit the opening of a fireplace. Ash trays appear beneath the grate to catch ash and make its disposal easier. These are often incorporated as part of the grate with some hearths also having built in ash buckets which can then be removed and emptied when full. Fenders are designed to ensure that burning material does not spill from the hearth into a room and thus prevent other combustible items from contacting the fire. They are most commonly made from steel or brass although other materials such as iron are sometimes used.

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View of the façade on south side

Back view of the Public Entry Building

Upper portion of the Bell tower, presently Tagore Centre

Council Chamber, view from the west

Band Porch and south-west tower, view from the west

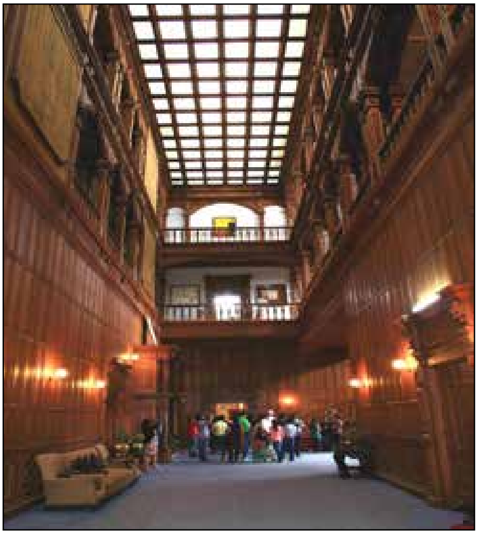
Public Entry Building, view from the east

(a)

(b)

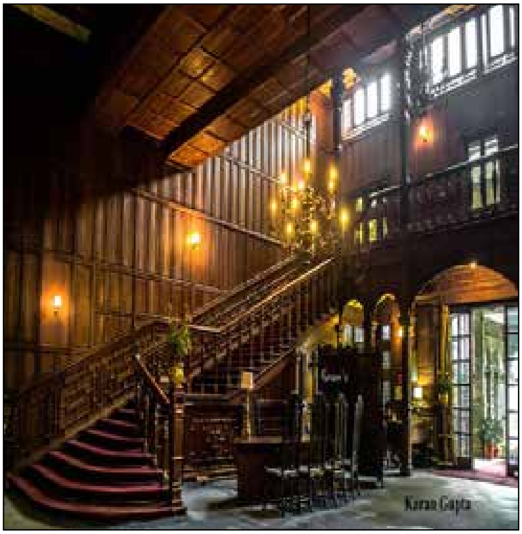
(c)

View of the façade and main Entrance Porch from the south



View of the Entrance Hall

View of the gallery at first floor level.



and wooden staircase

(a)

(b)

(c)

Stone stair and railings over parapet walls

View of north Entrance Porch

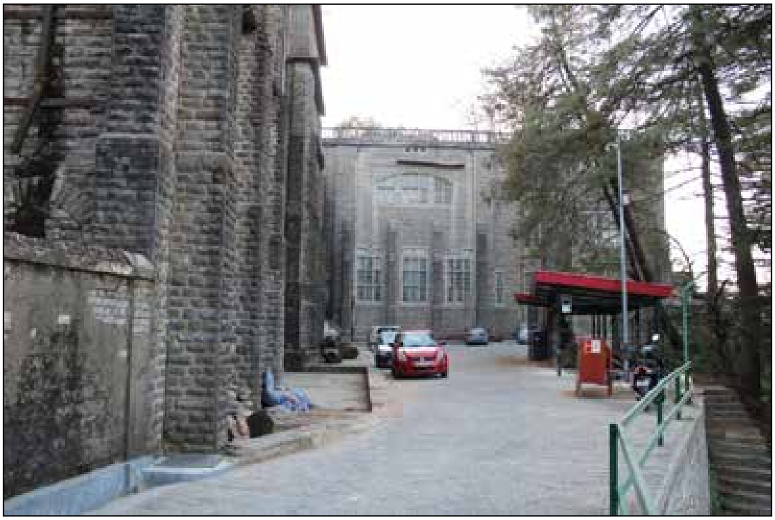
View of west façade and Band porch

View of south west Tower and Carpenter's workshop at basement level

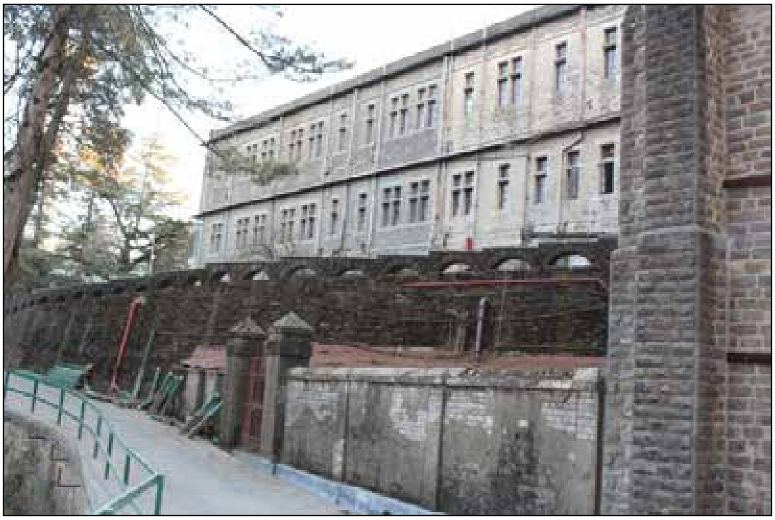
View showing arcade at first floor level above Band porch

Exterior view from the north showing top two floor levels with chimney stacks

Exterior view from the south showing covered verandas and arcades



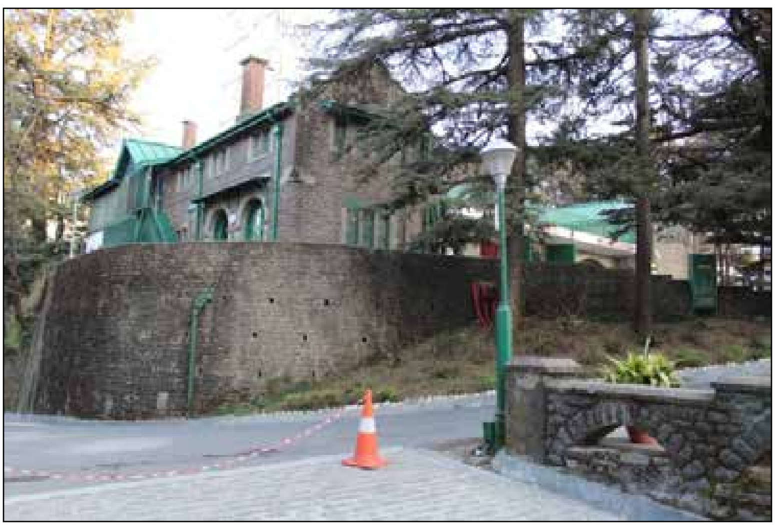
Side view of the Kitchen Wing and Council Chamber



View showing: Public Entry Building

View showing: Council Chamber

View showing: Public Entry Building



Post Master's House and Fire Station building

Door and window fittings

Different type of fire places

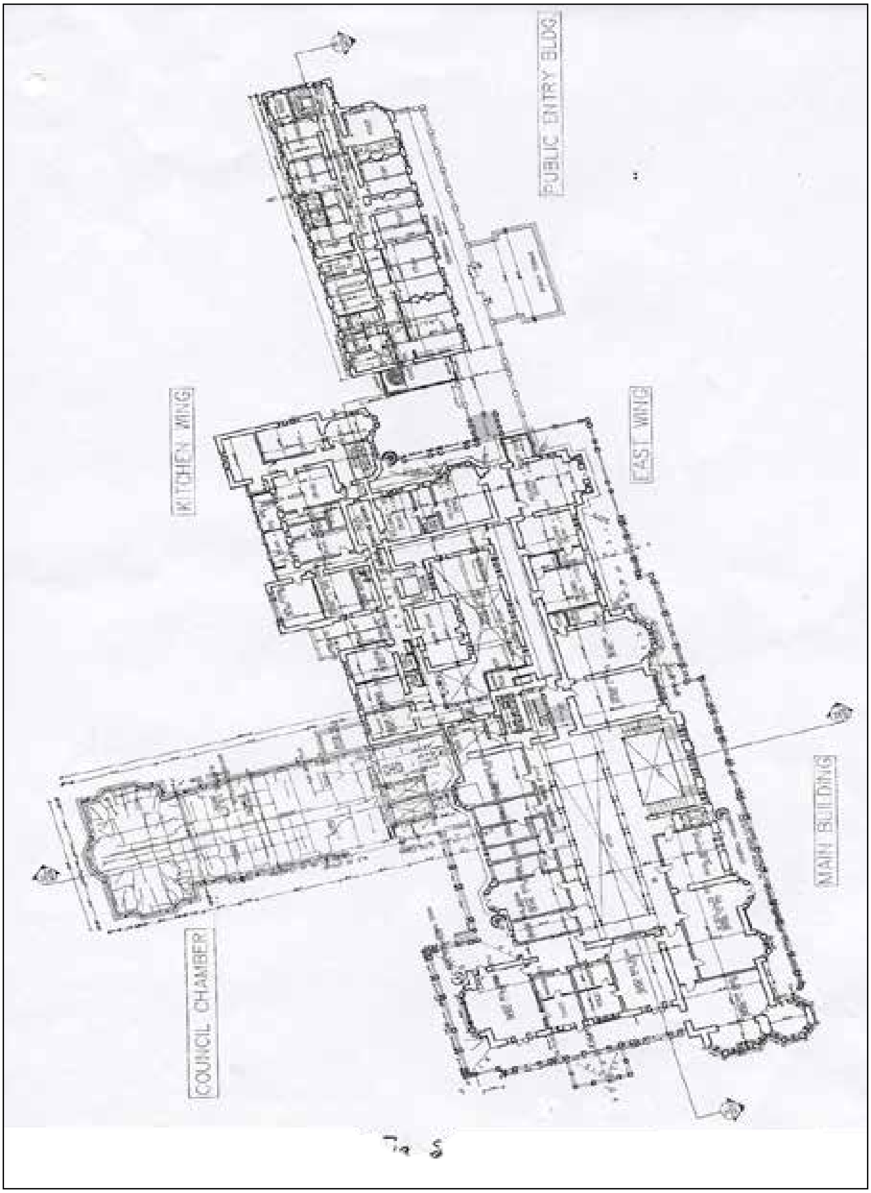
IV

Building Layout

The main building, roughly rectangular, is oriented west-south-west and east-north-east with the front elevation facing south-south-west. The south- western portion has three-storeys whereas the remaining has two storeys. The three-storeyed Main Block is articulated with exterior design and decorated with carved stone elements such as arcades, projected windows, towers, turrets and porches. While the east wing, also double- storeyed, is set slightly back from the line of the main building and is of lower height. Similar rectangular form, design elements and materials continue between the Main Block and the East Wing.

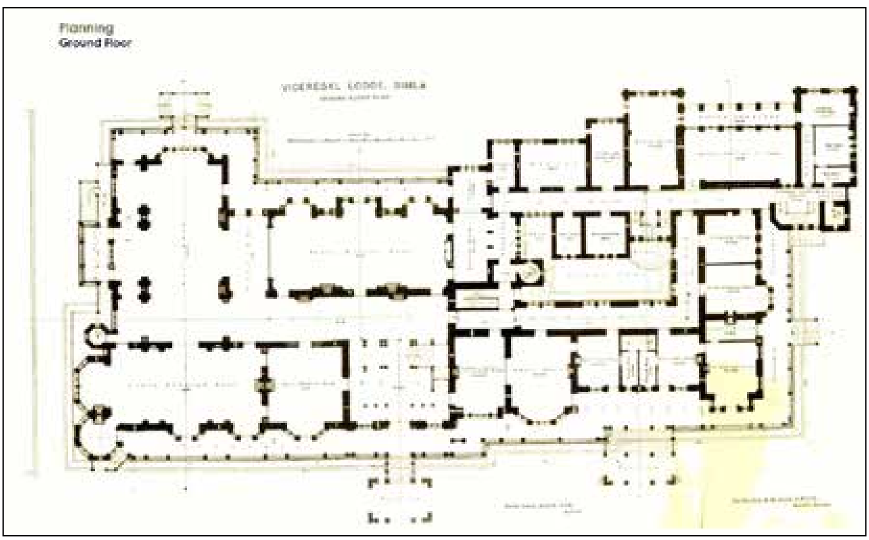
The East Wing is set slightly back from the line of the main building and though also double-storeyed, is of lower height, rectangular form, design elements and materials. The section of the south façade located in the entrance area is given additional emphasis by symmetrical treatment of the tiled roof above and by the main entrance porch which projects at the ground floor level.

The steep escarpment at this side was taken advantage to provide a Kitchen Wing of five stories at a lower level than the other two interconnected sections of the main building. Exterior treatment of this area reflects the service function of this section, and is austere and functional, relieved only by the buttresses and projected wings -- probably a structural necessity -- with the Bell Tower as a terminating feature on the south-east.

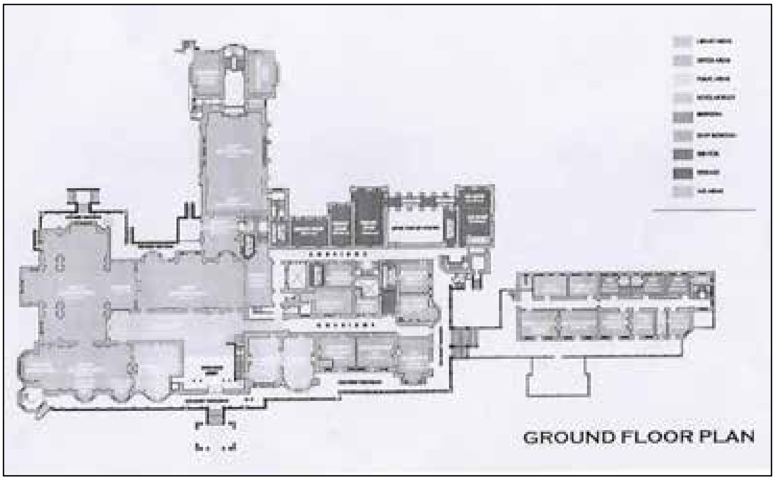

PUBLIC ENTRY BLDG
KITCHEN WING
EAST WING
MAIN BUILDING
COUNCIL CHAMBER

A. Main Entrance Portico, Entrance Hall, Gallery and Rooms on the ground floor of the Main Block

The entry to the main block is through an Entrance Portico which projects from the centre of the Entrance Hall and is connected to the South Arcade by a flight of steps. It is enclosed by a triple arcade. The roof is flat and supported on triple columns with stone masonry walls at the corners. The north and south sides have a wide central arch flanked on either side with narrower ones, while there is single wide arched opening on the east or west sides. The flat wide arches have steel ties at the springing points which date from the time of construction. The columns carrying the arches are articulated in to three progressively narrower sections with a pedestal, base and a simple moulded capital from which the arch springs. On the exterior, arches have pilasters which support the architrave, frieze and cornice of the stone parapet wall and above them are the stone finials and carved decorative elements.



Ground Floor Plan of Viceregal Lodge as per planning under Phase-I of 1888



Internally, the entrance hall and the gallery on the ground floor are the principal features around which the main rooms are arranged. It is entered through a wide doorway with decorative carved stone pilasters supporting a broken pediment with a balustrade balcony and a flat arched window opening above. It measures 30 feet wide and 39 feet long with the main staircase being located at the north-east corner. The hall is panelled in wood with a decorative linen-fold motif, has teak flooring and a triple height ceiling.

The hall and the gallery are now almost one space with some demarcation due to the arcades at the upper levels. It also provides access to the Seminar Room on the west and the Council Room on the east. Lift shaft and lobby have been carved out from the Seminar Room and are accessible through a door from the entrance hall. The present lift was installed in the year 1977 after auctioning the original one installed sometimes in the early 20th century. The entrance hall has a wooden arcade which gives some support to the landing of the main ceremonial staircase. A small room has been carved out under the staircase for the use of the security personnel.

The Gallery (measuring 18 feet wide, 90 feet long and 50 feet high) rises to the full height of the building with arcaded corridors at the upper levels and is top lit. It opens onto the Ball Room through an arched opening which was originally provided with plush curtains. To the north there is also a 12 feet wide opening leading onto the vestibule between the Ball Room and the dining room; all these spaces are now used for the library. The door on the south leads to the Seminar Room and the State Drawing Room which has also been converted into the Library. The ceiling is divided into squares with moulded wooden ribs which are filled with ground glass panels to admit daylight from the clerestory above. Electric lamps were suspended from the keys of the arches in the arcades above and carved teak brackets for lights were projected from the cornice at the first floor level. The carved teak brackets have now been removed, though some old light fittings are still in place. At night the gallery space is illuminated by 150 lights concealed above the glass ceiling. The gallery space is teak panelled with large velvet panels originally used to display antique swords and shields. In front of the entrance doorway on the north wall is the ornamental fireplace.

The Gallery corridor is 10 feet wide at the upper floor level and provides access to the rooms on these floors, and to the Prince's corridor on the East Wing through a door on the east. There is an arcade with two rows of wooden columns with mouldings and ornamental panels of walnut. The arcade was designed in the Elizabethan style with deeply moulded arches and carved keys of walnut. The carved teak wood brackets which projected at this level for suspended electric lights have been removed. The flues of the Dining Room chimneys are located between the pillars on the north side gallery. The ceiling has trusses exposed on the north side.

The ground floor was largely designed for the purpose of state functions, public gatherings and entertainment. The principal wing of the building to the west was centred on a grand atrium space, three-floors high and covered with an innovative glass ceiling under a large skylight that flooded the interior with light. The Small Drawing Room, State Drawing Room, Ball Room with Band Porch, Vestibule and State Dining Room are arranged off this central atrium. The entire western half is planned as an entertainment area for grand receptions, banquets and state ceremonies. Located to the west of the entrance hall is the Seminar Room (Small Drawing Room) which is accessible both from the entrance hall and the main gallery through ornamental doors. This room has been modified for the lift lobby and now occupies an area of 899 feet from original rectangular room. The room has been symmetrically designed with entrance doorway on the north aligned with projected window on the south and the entrance doorway on the east and two doorways aligned with the centrally placed fireplace on the west wall. The ceiling is coffered. This room also has 5 feet high painted wooden panelling above which cloth was hung at a later date. The State Drawing Room (present Library and Photocopy Room) covers a huge area of about 2278 square feet and is located on the south-west section of the main block and is accessible from the gallery through a doorway in the north as well as from east wall. It is also connected with the Ball Room through an arched opening. It is provided with a semi-octagonal bay window with a built-in seat on the west and two three-sided projections on the south wall. The corner octagonal tower is accessible from the chamfered south-west corner of this room. The interior is treated with pilasters on the wall supporting the main beams of the ceiling which are iron girders encased in moulded wood. The ceiling compartments are further sub-divided into square coffers by moulded wooden beams. The pilasters have carved capitals and panels and the walls have 5 feet high wooden panelling painted white.

A wooden closed string staircase with moulded handrail and ornamental turned balusters is at the level of octagonal room. The space under the staircase is enclosed by a wooden partition to form a small storage space. The large window openings are provided with wooden panelling and a door provides access to the south arcade. To the north is the Ball Room and Band Porch. The Ball Room measures 70x30 feet with a side annexe to the west by large double piers forming a series of alcoves. It covers an area of 3345 square feet and the ceiling height is about 20 feet 3 inches. The Band Porch measures 21x30 feet projected from the centre of the side annexe. Access is through a decorative arched opening from the gallery and it is also connected to the State Drawing Room through an arched opening in the south wall and to the State Dining Room through a vestibule with large folded doors. The main room is rectangular with the band porch projecting to the west and a three-sided bay window to the north which is in line with the arched opening to the State Drawing Room on the south. The west side Annexe had a central section with triple arched openings on open terrace with external stairs. This was later enclosed and modified to form a band porch and the arches were replaced by typical windows with lintels and stone mullions. The Annexe and the Band Porch section of this room are supported on the west vaults which are located below this area. There is a separate entry from the west garden to the Band Porch through a stone masonry staircase. The corners of the projected band porch have been tied at four levels with steel flats bolted into stone masonry of the exterior. The external symmetrical staircase has been modified and now leads down into the vaults from the south side only. An opening, which led to the octagonal turret located in this section and later removed, has been walled up but the stone framing is visible on the exterior. The teak wood floor of this area was supported on iron girders with a crawl space below and the ceiling supported on iron girders resting on piers and these are encased with moulded wood panels and the intermediate space treated as a coffered ceiling with similar moulded beams. The Ball Room has wooden panelling to a height of 5 feet and the piers and walls supporting the main beams have pilasters with carved caps and panels.

The vestibule area covers an area of 1068 square feet and is located between the east of the Ball Room and the State Dining Room and also connected with the main gallery by 12 feet wide opening. The doors on the north wall lead to the north terrace and folded doors were provided in the east wall so that the opening could be used as a proscenium of the stage for amateur theatricals which would be located in the State Dining Room.

The State Dining Room is located in the south-west section of the main block and to the north of the main gallery from which it is accessible through three ornamental doorways. It is also connected with the ball room through an arched opening. On the north the room has three deep projected windows, the eastern-most one of which now provides access to the Council Chamber lounge. The area of the room is 1793 square feet and it has a ceiling height of 20 feet 3 inches. The room is panelled to a height of 10feet in teak wood and the upper 2 feet are enriched with pierced Elizabethan strap-work carrying the armorial bearings of the former Governors–General and Viceroys has been modified into simpler panels. The walls are divided by the wood encased pilasters supporting the ceiling beams. The ceiling panels are further ornamented with geometric pattern. The special features of this room are the carved mantel-pieces, door entablatures and carved brackets supporting the beams over the three bay windows on the north side.

To the right of the entrance gallery on the East Wing, there are five rooms, the original Council or Red Room, Private Dining or Billiard Room and ADC Room and the office of the Private Secretary to the Viceroy on the south side of the ADC's corridor. All the rooms, except the room for the office of the Private Secretary, are being used as period museum. The Council Room has an area of 598 square feet and is accessible from the entrance hall of the main block as well as from the ADC's corridor to the north. It is connected with the ADC's room on the east. It is a rectangular room with an ornamental fireplace in the centre of the west wall and has a projected window to the south. The decorative Kashmiri style walnut wood ceiling is a special feature of this room. The ADC's room has an area of 680 square feet with a three-sided bay window and is accessible from the south arcade as well as from the internal corridor to the north. There is an ornamental fireplace in the centre of the east wall. Both the rooms have polished deodar wood panelling 5 feet high, deodar flooring and good natural light with ornamental wooden ceiling. The decorative fireplaces in the east and west walls are the main features of these rooms.

The original Private Secretary's Room is on the south-east corner of the east wing of the main block and is being used as the office of the present Secretary. The access is from the east arcades and covers an area of 476 square feet and has rectangular projected window to the south and a fireplace in the centre of the west wall. The opening in the north as well as on the west wall is now temporarily closed. Both the original cloak rooms on the north of the ADC's corridor have now been converted to toilets with all modern facilities.

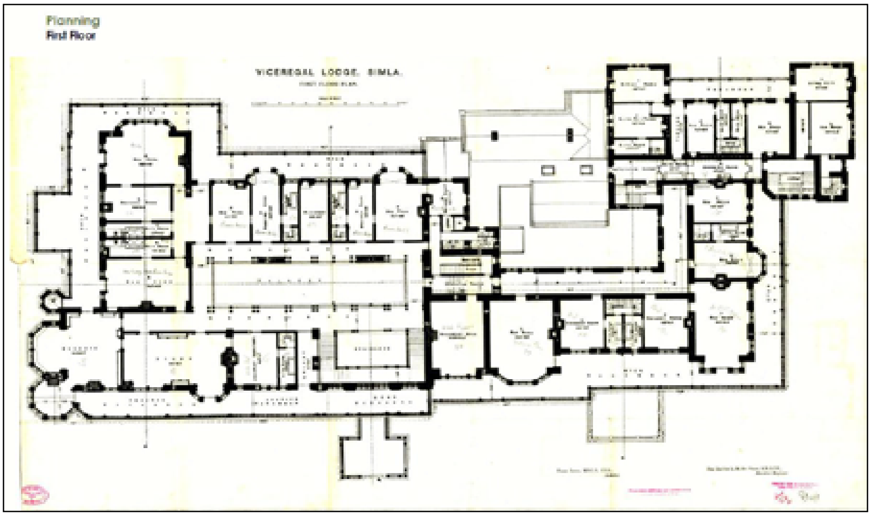
ADC's Corridor (clerk's office) is located to the north of the Secretary's room and has now been converted into a lobby on the east side of the building which links the internal corridor with the east arcade. On the north of this lobby is the Housekeeper's room. It is roughly square with an octagonal projected window on the east. There is a fireplace in the centre of the south wall. Behind this line of offices, along the north-east of the building is the service wing, to serve the main building and state rooms. These include stores for silver, china and glass, plates, table linen and pantry. Residential suites are for the steward and housekeeper, office of the clerk and a dispensing room as well as service room. There is also provision to summon staff for service through wells and separate service corridors, staircases and entries for service staff. It is also connected to the spaces on the north and west and the main access originally from the west is now located in the centre of the projected window. The Stewards Room is located to the south of the Kitchen Wing and access is from the internal Kitchen Wing corridor as well as from the east. A narrow window on the east has also been converted into a door. The east windows have wooden architraves and unusual curtain rails. The room has a wooden false ceiling and a fireplace in the centre of the north wall. The original passage connecting the ADC's corridor with the internal Kitchen Wing corridor has been partitioned into two rooms; one is being used by the fireman and the one to the south, as a store.

B. Rooms on first floor level of Main Block

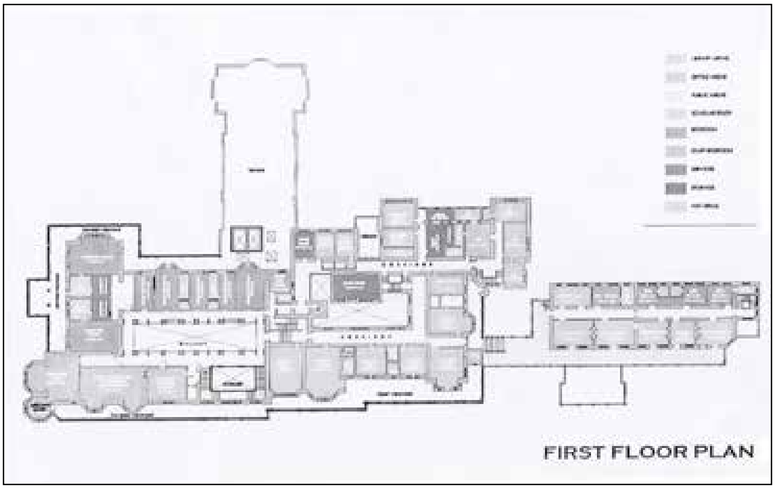
The grand staircase in the entrance hall leads to the first floor which had an upper gallery overlooking the gallery arcades and the entrance hall. Of the framed newel type, the handrail is moulded with ornamental balustrades are of teak wood while the balustrades are of solid walnut. The concealed portions of the stair framing are of deodar. Upon ascending the stairs, to the west of the lift lobby is the room of Assistant Secretary to the Viceroy, and is now being used as the Office of the ARO. Its entry is through a door opening off the south section of the gallery arcade. The room occupies an area of 494 square feet and is also connected with the adjoining room through a door to the west and interconnected with the Viceroy's Study Room. The Viceroy's Study Room is at present occupied by the office of the Private Secretary to the Director and the entry is through two door openings onto the south of the gallery corridor. It is provided with two three-sided projected windows on the south with a door opening out onto the south arcade in the centre of the east bay. The west bay has now been modified to provide a narrow door on the south-west. The room had a 4 feet high polished deodar panelling with a built-in bookcase on the south. The walls are divided by pilasters supporting a cornice and a frieze. The original ceiling had a geometric pattern with wooden mouldings. The room had two fireplaces with carved teak wood mantelpiece. The panelling, bookcase, pilasters and walls are now painted white. The Viceroy's study was fitted with wall to wall book cabinets and rich teak wood panelling. Later, during Lord Curzon's time the ceiling was replaced by a Kashmiri *khatambandi* ceiling pattern. All the woodwork has been painted over in white oil paint. The door to the west end of the Study room opens into the boudoir. This room is irregular and it has large mullioned windows and an octagonal alcove. Doors open off it to the covered veranda on the south and an open terrace on the west. A glazed door opens off this room onto the south and west arcade which was originally panelled up to a height of 4 feet with tapestry covered walls and is now panelled completely and painted. The decorated moulded ceiling had panels in white and gold. The boudoir and the octagonal rooms are being used as the office of the Director of the Institute. To the north-west of the building are the personal suites of the Viceroy, Vicerine and guest rooms are on this floor. The Viceregal suites are arranged on the west face with magnificent views of the hill and doors that opened on to open verandah. While on the north side of the central gallery are the rooms for the guests. The open space/lobby connecting the southern section of the gallery arcade to the north-west of the main block is the Viceroy's bed room, bath and wardrobe. This room is rectangular with doors in the north and south walls from the corridor or lobby to the north of the north-west corner of the gallery corridor. The Vicerine's suite with separate dressing room is on the north-west corner of the building and has a large projected window in the centre of the north wall. The access is through north-west corner gallery.

Originally there were only two bedrooms on the north-east of the corridor or the lobby, one on the north-west and the other on the north-east portion of the main block. Both the bedrooms are attached with dressing rooms and bathrooms. The wardrobe is between the dressing rooms and attached bathrooms. The two dressing rooms and wardrobes have now been converted into bedrooms for the guests of the Institute. The entry to these rooms is provided from the north gallery through the north wall. The breakfast room is to the right of the gallery through the original Prince Corridor, above the Council and Private Dining Room. The corridor outside this room was lined with a floor-to-ceiling cabinet with glass shutters for storing crockery, etc. Due to a level difference of 5 feet, this corridor is also connected to the gallery arcade with a flight of steps.

The Breakfast Room/Prince's Sitting Room, presently Fellows' study room, is in the south-west corner of the East Wing and is accessible from the east wing corridor with a door opening onto the southern terrace, having a connecting door to the adjoining room in the east wall. The Prince's Bedroom with attached toilet and wardrobe, at present Fellows' lounge, has a large projected window in the centre of the south wall and a fireplace in the centre of the east wall. The access is from the corridor and is also connected with the adjacent room. This bedroom is also connected with the original Dressing or Sardar Room with bathrooms on the east side. The original dressing or south bedroom with attached bathroom. The south-east corner is the East Bedroom and a new



First Floor Plan of Viceregal Lodge as per planning under Phase-I of 1888

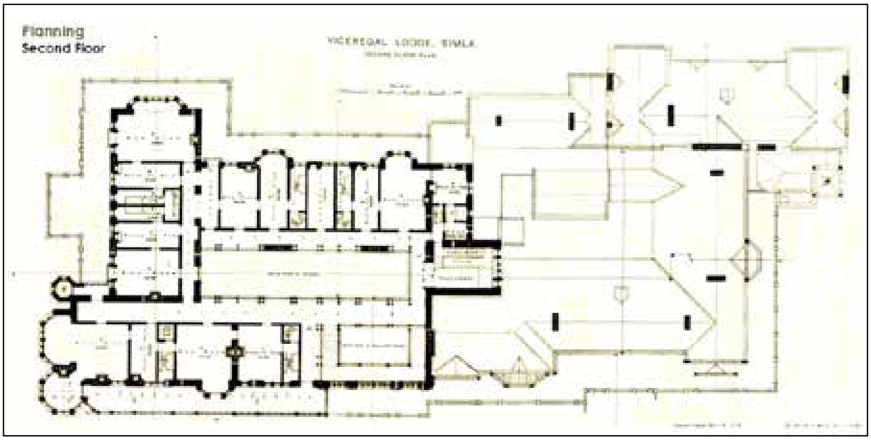


bathroom is provided on the east side of the building. The entry to the room is from the corridor through the south wall and there is a projected window on the south-east corner on south arcade. All the three rooms are being used as study rooms for the Fellows.

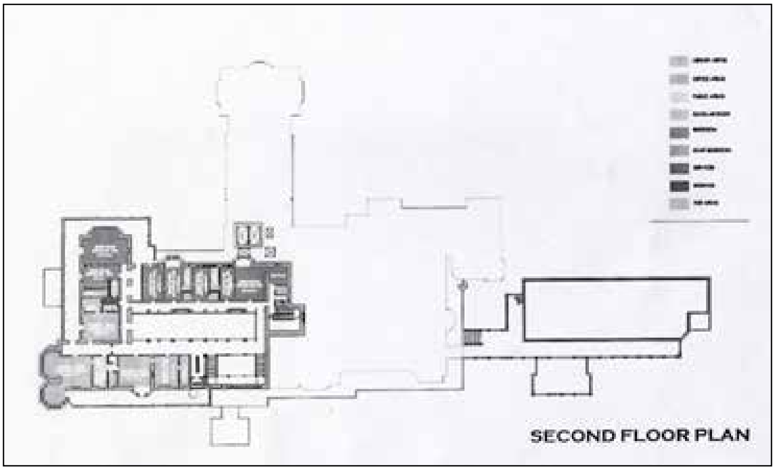
On the north-east of the corridor, the rooms for the offices of the Comptroller and the Assistant Comptroller of Accounts are being used as the office of the Accounts Officer and his staff of the Institute with minor alterations.

C. Rooms on the second floor level of the Main Block

The second floor in the main block continues the pattern of bedrooms arranged around the central gallery. It had six large bedrooms with attached toilets and dressing room. During Lord Dufferin's tenure, his two daughters had their bedrooms on this floor. The rooms are spacious with beautiful views and each room had its own dressing room and bath fitted with state of the art plumbing. The service area did not go up to the second floor and there were series of staircases leading up to the Attic space for maintenance. To the left of the wooden staircase on the south corridor of the central gallery are three rooms, the entry of which is from south wall. These rooms are now being used as Fellows' study rooms. Towards the north-west are three rooms with attached bath rooms. Fellows are accommodated in these rooms while the north-west corner room is being used as conference room. The rooms on the north-east, along the north corridor of the central



Second Floor Plan of Viceregal Lodge as per planning under Phase-I of 1888 gallery, are used for the Institute's guests. These rooms are entered through doors on the north wall and come attached with bathrooms.



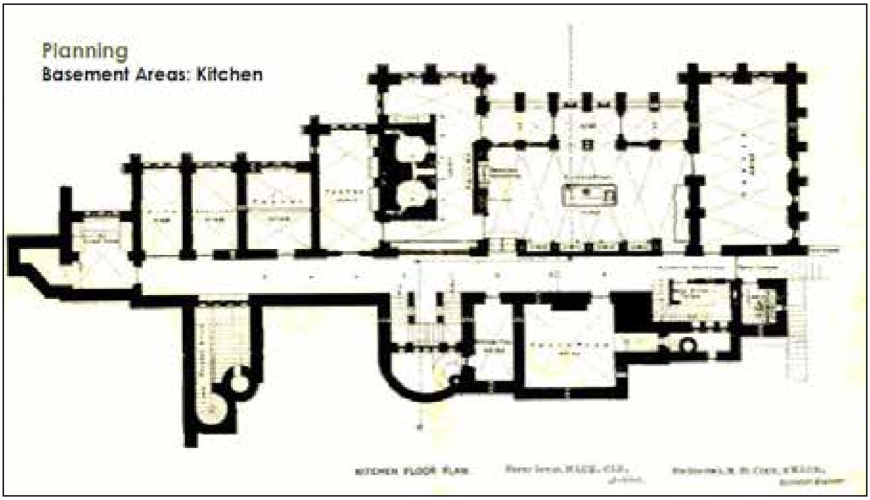
D. Rooms at Kitchen Wing level:

The north-east part of the first floor above the kitchen and Steward's Room had rooms for maids and servants, connected to the lower floors through separate servants' staircases. Between the East Wing and the Kitchen Wing, the space occupied by the south courtyard, toilets, service area and cloakroom has now been converted to provide toilet facilities for the main building and the floor level is raised by almost 3 feet, leaving only a small service area of 7x9 feet open to the sky. This courtyard formed an integral part of the drainage system of this section of the building with a sub-surface drain being connected to the brick-wells in the adjacent service areas and ultimately to the perimeter drains. This area is the troublesome source of water-logging under the building due to disruption and choking of the original drainage system. One of the internal spiral staircase is connected to the Princess corridor level and the west passage of the Kitchen Wing, with the service area to the north and it was also a part of the old sewage system. This stepped courtyard occupies an area of about 180 square feet and is provided with a brick-well at the south-east corner. The sewage line and rainwater drain are provided under the stairs in this service area and lead to manholes in the Kitchen Wing corridor at the Laundry level, and finally to the perimeter sewage line and sub-surface rainwater drains. Service area was originally rectangular with a large semi-circular brick well and occupied an area of 170 square feet. A WC has been built at present in the south-west corner.

The built form of the Kitchen wing is determined by site conditions, the steep escarpment at this side being taken advantage of to provide a wing of five stories which still remains at a lower level than the other two interconnected sections of the main building and separated from them by a courtyard. Exterior treatment of this area reflects the service function of this section, and is austere and functional, relieved only by the buttresses and projected wings, probably a structural necessity, with the Bell Tower as a terminating feature at the south-east corner.

The access to the ground floor of the Kitchen Wing is through an internal staircase located at the junction of the Main Block, East Wing and the Kitchen Wing. The stair-well occupies an area of 128 square feet and the painted, wooden, turned balusters and simple handrails are of deodar. Then there is a passage on the west side connecting the internal corridor of the Kitchen Wing with the ADC's corridor of the East Wing. It is divided into two sections and provides access to the serving room on the west and a spiral staircase with windows in the east looking onto the service area.

The cupboards containing the combination fuse switch and distribution board for this and the upper floors of the main building are located in the centre section of the passage. On the west of the passage is the rectangular Serving Room with doors opening on to the State Dining Room on the west and the opening to the north which leads to the Council Chamber Lounge area and a door on to the passage on the east. Sinks are provided in the alcoves



Basement Plan – Kitchen Level of Viceregal Lodge as per planning under Phase-I of 1888

in the east wall and there is a wooden false ceiling and terrazzo floorings. From here, the Staircase Lobby leads to the Council Chamber Lounge.

In the North-west corner of the Kitchen Wing is the Abdar which is accessible from the internal corridor and has a false ceiling of arched corrugated sheets. The west window on the north wall is found closed. To the east is the Pantry and access to it sis through two doors from the internal corridor of the Kitchen. There is an old stove located in the centre of the north wall between two triple bayed windows and the room has an arched corrugated metal false ceiling.

The next rooms towards the north-east are the original China and Glass Rooms and Plate Rooms to the north of the internal Kitchen corridor. In the second room the sinks are fixed against the central section of the north wall with a ledge of the windows on the west. The Butter Corridor is located to the north of the double height Kitchen space, consisting of six vaulted bays with painted wooden partition and is in the second bay from the east.

The original Stewards and Comptroller Quarters, passage, sitting rooms, bedroom, bathroom, porch landing, etc. located on the eastern part of the Kitchen Wing are being used as Tagore Centre. The stone-paved wide passage provides access from the internal corridor of the Kitchen Wing to the two rooms in the northern part of this section. The porch landing is partitioned from the internal corridor with a wooden panelled partition. The walls in this area include stone, double leaf brick with stone facing and brick partition walls. This portion of the building has been repaired thoroughly, but the top pitched roof is yet to be taken up for replacement of decayed and damaged terracotta tiles, dislodged flashing sheets, and wooden members of the attic.

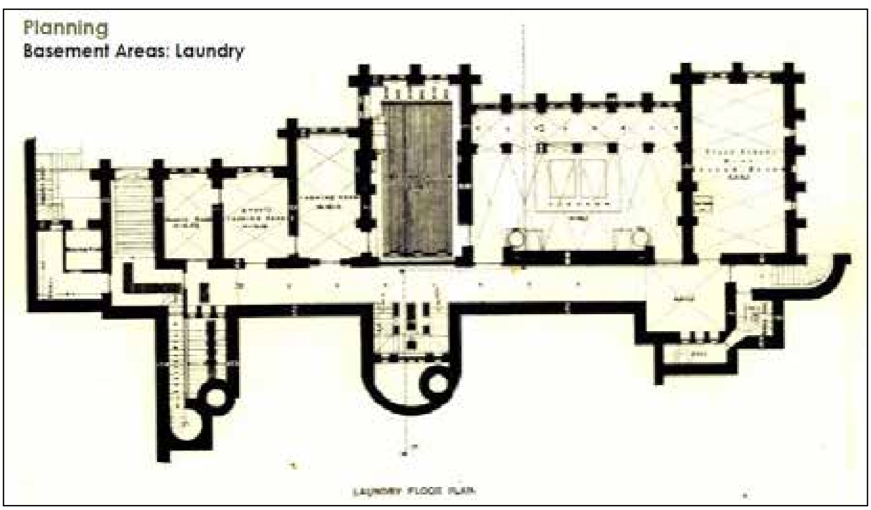
The wooden framed staircase with turned balusters leads from the internal corridor at the ground level to the set of rooms located on the mezzanine level of the east section of the Kitchen Wing. Another wooden staircase located within the Bell Tower of the Kitchen Wing connects the ground level with the intermediate landing of the staircase and leads to the setoff rooms located at the mezzanine level of the east section. The levels of the Bell Tower below this have a spiral masonry staircase which has been closed off by wooden boarding at the ground level.

The stone masonry staircase located in the centre of the internal Kitchen Wing corridor to the north of the service area connects the mezzanine level. The internal Kitchen corridor occupies an area of 875 square feet and is roofed with lime concrete unreinforced vaults of varying sizes, the walls are of brick masonry. On the south of the internal corridor there are rooms for dispensing and table linen rooms, both occupying an area of 230 square feet and 136 square feet respectively.

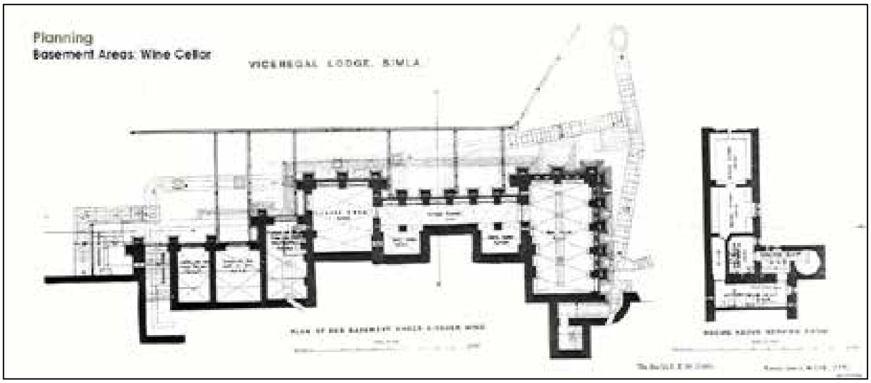
At the first level of the basement is the Kitchen, a grand double height space with a central oven range, four coal ovens and one shook jack for roasting. It was fitted with a dumbwaiter lift to carry food to the principal floor and was fitted with a variety of hooks for hanging pots and pans, tables for food preparation and separate sections for hanging meat and poultry.

To the right of the Kitchen is the larder. Across the corridor are the cook's rooms and a room for storing fuel. Under the staircase opposite the Kitchen door was a small office for the cooks and down the corridor is a separate room for food preparation and support activities such as the pastry, scullery and lamp rooms. Later the scullery and lamp rooms were changed to accommodate the ice cream machine and refrigerant piping, perhaps by early 20th century. The kitchen is used as a canteen while other spaces are vacant due to the poor structural conditions.

The laundry level of the Kitchen Wing is located below the Kitchen floor and had a series of rooms including separate areas for laundry, drying, dhobi and for ironing. There is also a store godown and urinals for the staff. Laundry was uniquely mechanized with a large drying room that had the entire floor with hot air pipes above which was a kind of a charpoy system of wooden frames laid across as fretwork to allow the hot air to rise through cloths laid flat on this frame or hung on strings and allowed to dry by blowing hot dry air. These rooms are unutilised due to poor conditions.



Basement Plan – Laundry Level of Viceregal Lodge as per planning under Phase-I of 1888



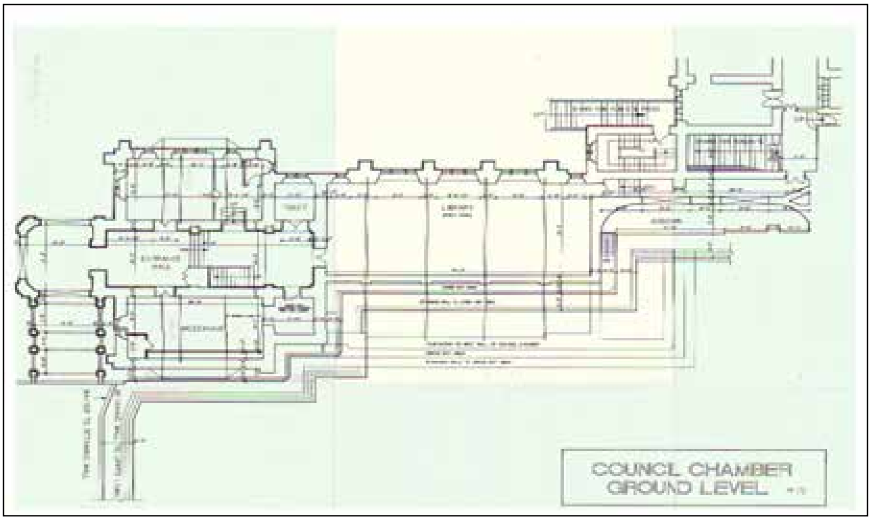
Basement Plan – Wine Cellar Level of Viceregal Lodge as per planning under Phase-I of 1888

Wine Cellar in the basement level of the Kitchen Wing is located at the lower basement with a bottling plant, stores for the empty wine cases, lumber room to stock wood for fuel. There are boilers placed in the lower basement with furnaces to heat up the pipes for hot water as well as the drying room of the laundry. There are rooms for servants off duty in the basement.

The western vaulted chambers are partly being used as a Cafe run by a private occupier and partly served as carpenter's workshop and stores for unutilized wooden furniture and other wooden members. These chambers have severe active structural defects due to foundation settlements on the western side and also leakage from top, etc. The original vaulted chamber had been extended with flat roofs.

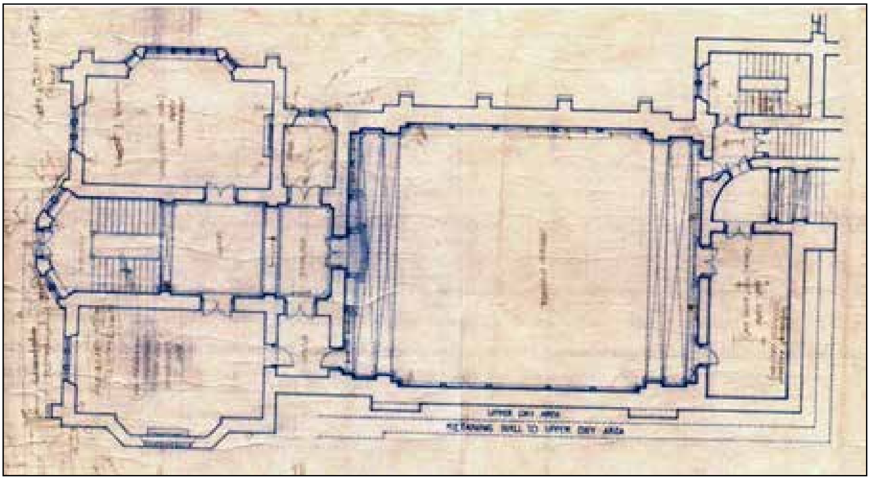
E. Council of State Chamber

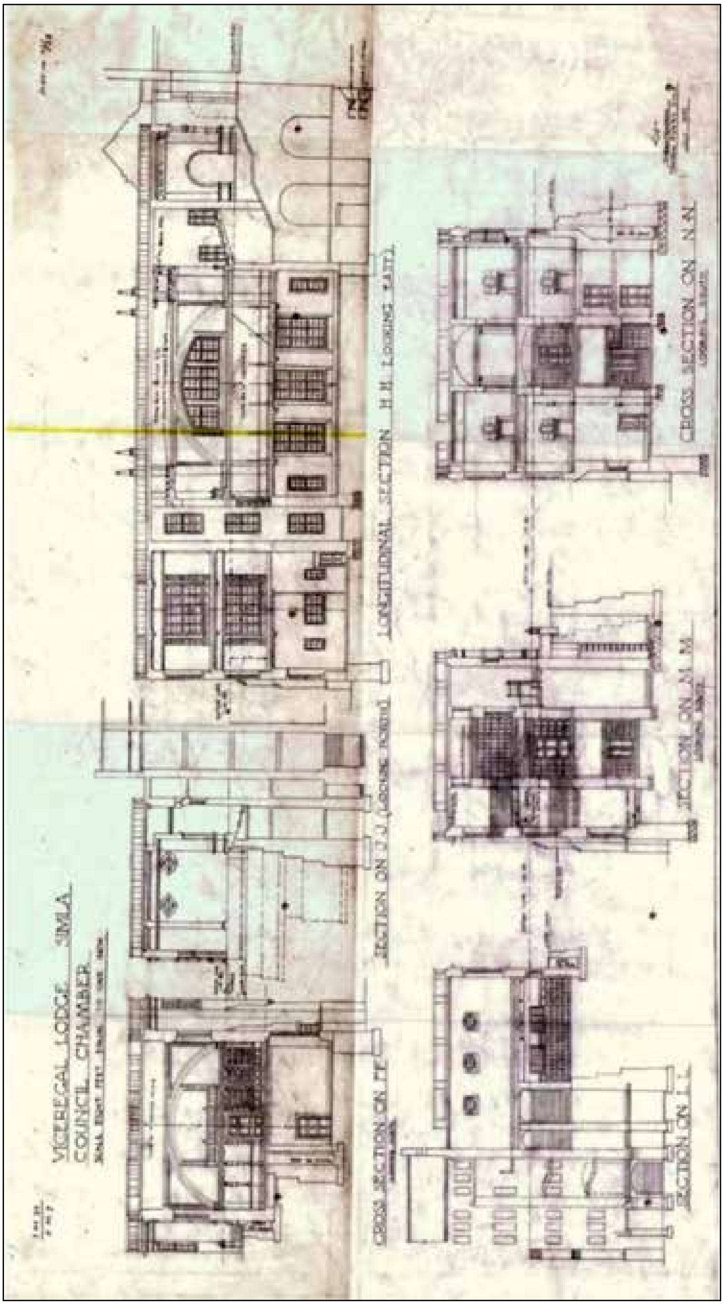
Council of State Chamber covered an area of 11224sq.ft and is located on square section in area with sharp drop edges prone to slippage. As per the drawings for this section of the building, it is dated from 1911 to 1938. The internal layout is dated 1942. As the foundation and basement plan, elevations and sections are dated 1911, and the detailed cross and longitudinal section are dated



1936-38. In all probability the building's main council chamber was built between 1911-1913. However the lounge connecting the main block and the council chamber was roofed in 1936 and details such as internal screen walls were completed in 1940.

The Council Chamber was originally designed in I911 and the construction was probably finished by 1913 as shown in the




VICEREGAL LODGE SIMLA
COUNCIL CHAMBER
CROSS SECTION ON N.N.
SECTION ON M.M.
SECTION ON L.L.

original section of the building and also indicated in the Survey of India map of 1914-15. However, the Council Chamber lounge connecting the main building and the Council Chamber was roofed in 1936 and details such as internal screen walls were completed in 1940.

The Council Chamber is located to the north, linked to the main block with covered porches and stepped terraces, and it comprises of a rectangular block with the northern portion which contains the ancillary areas being wider and projecting on both sides.

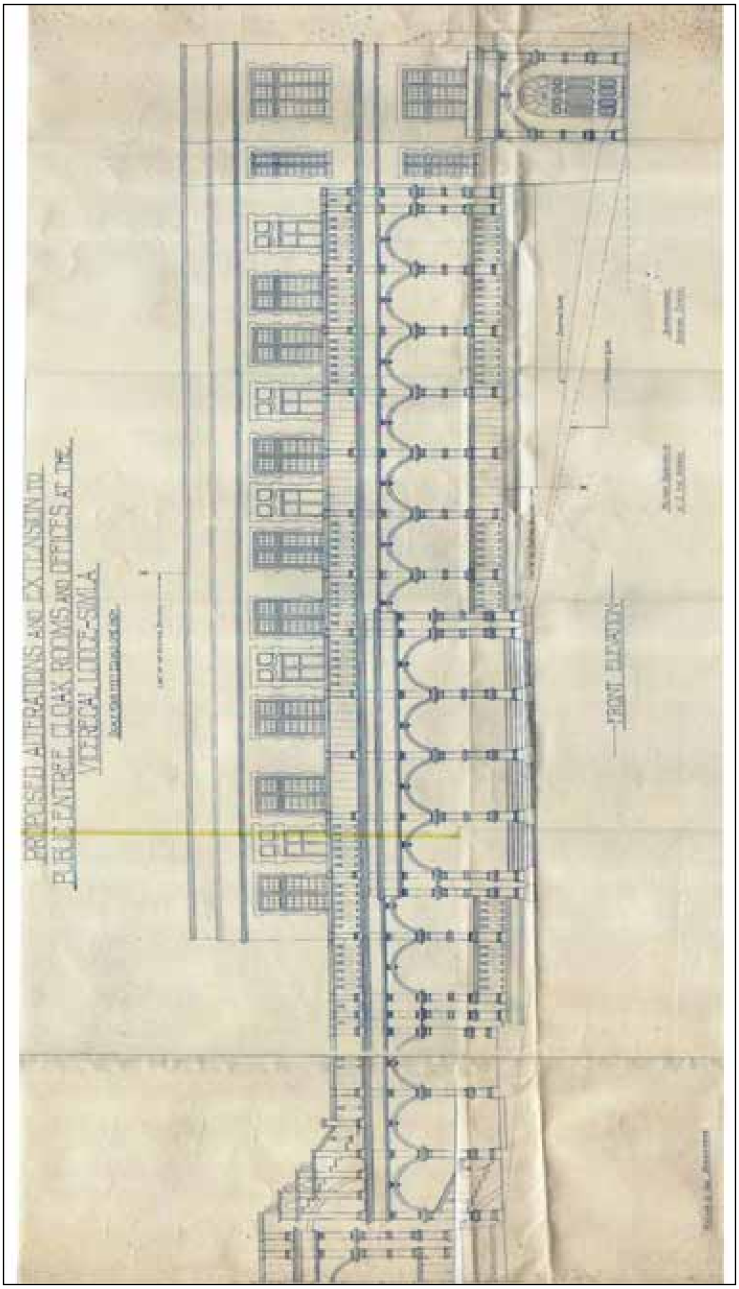
The construction of the Council Chamber and Public Entry buildings was taken up keeping in view the consequences of the defects which were already apparent in the main building as well as of improved construction technologies.

Due to the use of similar stone for the external facing and decorative elements and minor changes in detailing, they form a visually coherent complex of interconnected but separate structures in the complex. In the roof, riveted steel beams have been used. The fine entrance hall is beautifully built and finished with its gallery leading to the ball room. The entire portions along with the Council Chamber are being used as Library of the IIAS.

Alterations to the Council Chamber were carried out according to the drawings showing internal layout dated 1942 and the detailed cross and longitudinal section drawings dated 1936-38. The flat RCC roof slab of the Council Chamber with terracing above is supported on a system of composite iron girders with edge drains and C.I. pipe outlets embedded in the external wall. Another feature of the flat roof is the use of Hayward glass prisms with iron frames just above the lounge lights.

F. Public Entry Building

A corridor connects the main building with the three storeyed Public Entry Building having rooms on either sides of the central corridor. On the upper floors, the rooms with attached toilets are being used by the Fellows, partly residential and partly for studies. The Public Entry building is a rectangular structure with an

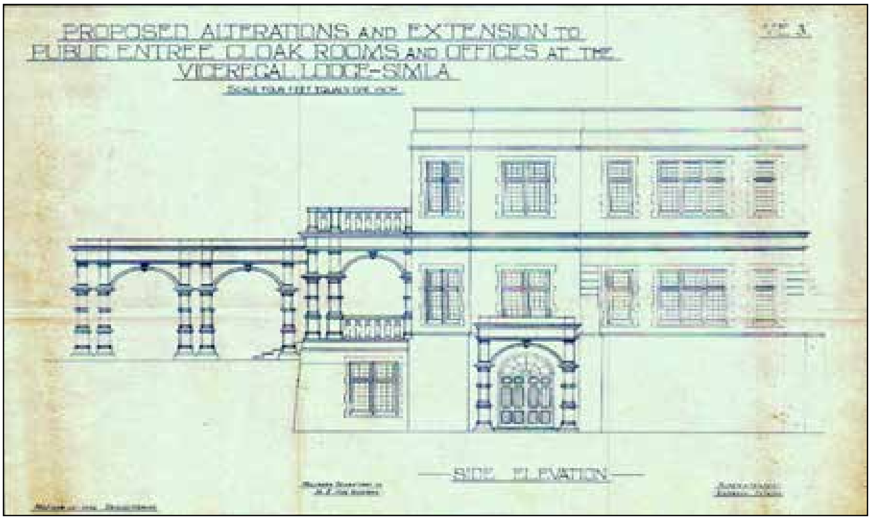

PROPOSED ALTERATIONS AND EXTENSION TO
PUBLIC ENTRANCE, CLOAK ROOMS AND OFFICES AT THE
VICEREGAL LODGE-SIMLA
FRONT ELEVATION

arcaded veranda and porch on the south and a narrower chamfered section containing the main stairs to the east. This building uses materials similar to those as the main building with simplified detailing of the openings. Its internal layout reflects the slope of the site, the south-east corner and part of the north provided with basements. The roof is flat, supported on iron girders encased in plaster. The construction of the western section of the Public Entry building cannot be dated with certainty as there are no drawings or inscriptional evidence relating to this.

However the Survey of India map dated 1914-15 showing this section of the building indicates that it was constructed prior to 1914, probably at the same time as the Council Chamber. Alterations such as the extension of the building to the east are indicated in the drawings dated 1926. Later alterations to the Public Entry Building, such as the basement extension, are not indicated on these drawings.

The Main Entrance Porch on the ground floor level is in the centre of the south façade. It is a 4x2 bay arched portico with the corners of the outer south bays emphasised with triple columns and stairs leading up to the south arcade in the north bays. The porch has a flat roof and the stone parapet wall is provided with decorative carved stone elements. The south arcade provides access to the rooms on the south side at this level. The corners of the arcade have triple columns and the flat roof is supported on girders encased in concrete. The arch at the east end has been walled up. The porch on the west connects this building with the East Wing of the main building with a flight of steps. It is a flat roofed arched structure linked to the west arcade. The roof of the linear arched bays is supported on iron girders encased in concrete. The west arcade is 4x1 bays and it provides access to the central corridor and the northern section of the building at this level. The elaborate entrance doorway is provided on the east wall with wooden staircase connecting the ground and first floors in this section of the building.

The entire rooms on either side of the internal corridor on the ground floor are being used as offices of the Institute including the



Dispensary. Access to the rooms on the north side of the internal corridor is from the west and also from the east through the wooden staircase. The rooms on the south side are accessible from the inner corridor as well as from the south arcade. The door on the south wall has a double bayed window to the east. The original passage connecting the south arcade with the internal corridor has been turned into the Secretary's office by blocking the arched opening into the corridor with a cupboard. The room has doors on the north and south and windows on the other two walls. The lobby at the west end of the building is separated from the corridor by a partition wall with a door and provides access to toilets in the north. There are three toilets, of which the first is provided in the area formally occupied by an internal staircase and is being used by both the staff and visitors. The second one was on a portion of the original structure and has marble flooring, wooden ceiling and wooden partitions. The third is adjacent to the men's toilet. Apart from the above, there are three bedrooms being used by the Fellows. These toilets have attached bathrooms and closet space on one side. Access is from a door on the south wall and two double bayed windows on the north. The bathrooms have old fittings.

One of the bedrooms with attached bathroom is located over the boiler room and has two built-in cupboards.

The entry to the first floor level is both from the east as well as from the west. The east entry is through a wooden staircase while in the west there is one spiral wrought iron stairs. This has been enclosed within masonry walls with atypical windows on the north and west and a door opening onto the south terrace. The rooms are arranged on either side of the internal corridor. The west section of the internal corridor has wooden flooring whereas the east section has concrete floor slabs. The rooms are provided with bathrooms, built-in cupboards and radiators. One of the rooms also has a fireplace. Fellows Study Rooms are located on the south side of the internal corridor and also open onto the south terrace. An open terrace is located above the south arcade enclosed by the typical stone balustrade.

Entry to the basement level is on the south-east corner through a well-proportioned arched portico which also provides access to the main internal staircase of the later extension and to the Stores area through doorways with semi-circular arched fanlights. These arched doorways with simple key-stones and projected ashlar door surrounds are in the north and west stone masonry walls of the portico. The external flat arches on the east and south of the porch are provided with steel ties at the springing point of the arch and vertical braces and have ornamental carved keystones with a floral motif. The stone parapet wall is relieved with string courses and the typical frieze which forms the upper part of the columns supporting the arches. The Internal Staircase is in the centre of the east face of the building and the lobby is accessible from the exterior from the south and is linked with a corridor leading to the Store through a door on the west. The wooden framed newel staircase has carved newel posts, turned and carved balusters and a moulded handrail. The staircase lobby is a triple height space with no windows at this level, but at the upper levels there are windows with typical moulded transoms and mullions on the east and south facades. The Boiler Room for the heating system for the building, the vertical riser supplying the radiators in the corridors and the rooms at the two upper levels are located at the north-east corner while the water tanks are also in this corner on the roof terrace. One of the stores has three interconnected rooms with arched openings on the west of the entrance portico. Another Store is at the north-west corner of the building and is accessible from the exterior through an opening with roll-up steel shutters on the north flanked by windows on both sides. The store has an arched corrugated false ceiling.

G. Heritage Landscaping within the estate

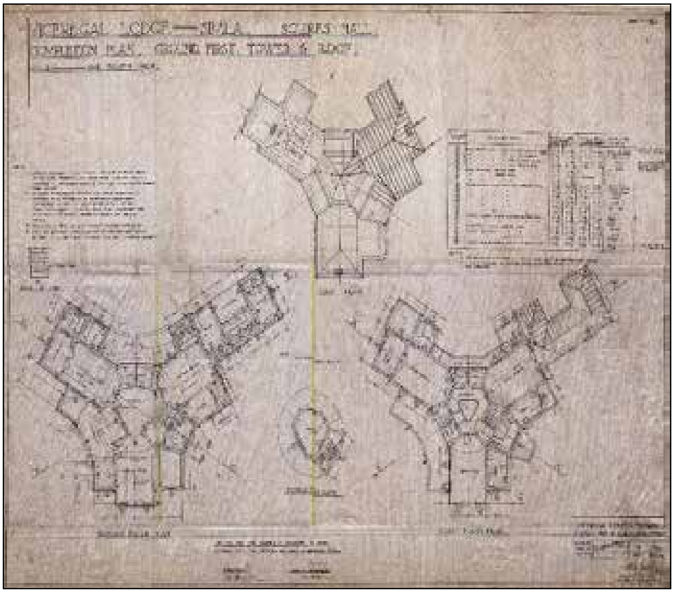
The Viceregal Lodge was built on the top of a flattened hill, with verdant lawns in the foreground and a terraced garden to the back. Originally, the estate covered an area of 331 acres of land, including the whole of Observatory Hill, Bentinck Hill, Prospect Hill and a portion of the hill on which Peterhoff stood. Now it is spread over an area of more than 110 acres and lawns and gardens around the building cover around 25 acres. Its gardens are among the best laid out gardens and have not been altered. It was Lord Landsdowne, who succeeded Lord Dufferin within a few months of the completion of the Viceregal Lodge (1888-1894) and had initiated the landscaping with a view to host garden parties and social gatherings by creating suitable green front lawns with mod borders and terrace. As per records, there were 40 gardeners with 10men employed solely for the purpose of chasing away monkeys during the time of Curzon. The Rose Garden was designed by him. Lord and Lady Minto (1905-1910) added the Terrace Garden to the north and the rear garden at the top terrace was planted with Chinar trees with a sundial placed in the northern lawn. In order to grow plants in the harsh winter, the Green House was built in 1912 during Lord Hardinge's time. The front lawn was culled out of a wooded hill side and provision for rain harvest tanks was made at the very inception of the garden's landscaping.

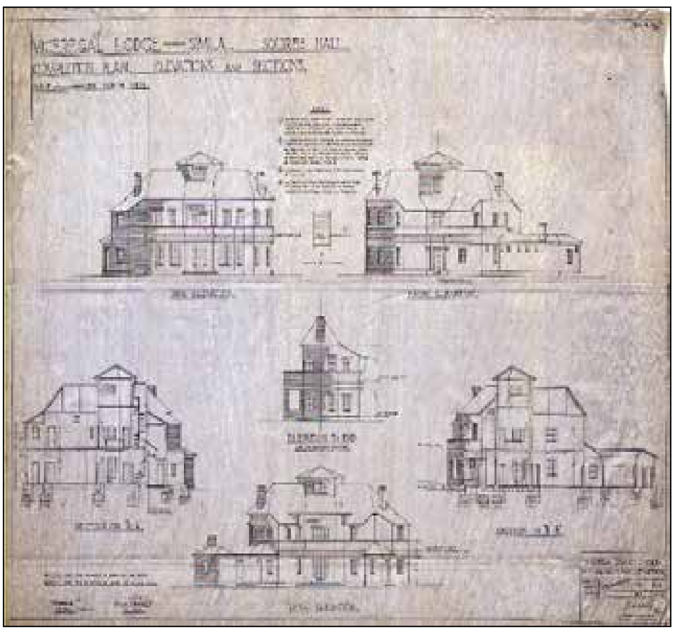
The entire garden is divided into three parts -- the main garden in the front of the main building stretches up to a rose garden which has more than 100 varieties of roses and also boasts of a rare 'tulip tree' and a bird-bath and flower beds are covered with colourful flowering plants. The garden remains in full bloom throughout the year. On the western side it is in terraced form with an oak tree which, in fact, is older than the building itself. Though Shimla faces acute water shortage during summer, but here the arrangements for rain water harvesting is still in working condition through five underground tanks with a capacity of 12-lakh gallons. Its nursery with its glasshouse, built in 1912, has more than 250 varieties of exotic and indigenous plants. Recently, two poly green houses have been added to preserve rare species of plants and efforts are on to conserve Himalayan flora and other endangered species by preserving their germ plasma. The garden was well planned with neat pathways in gravel and stone, lined with dry stone masonry garden walls, arched parapets and stone balustrades along the terraces. Stone benches, cast iron seats, bird-baths added interest.

H. Other buildings

To the east of the complex is the Swimming Pool Wing which is now being converted into an auditorium and the lower portions into a cafeteria, ticket and publication sales counter and on the north the postmaster's flat. Access to the Swimming Pool hall is from the terrace to the west which is to be enclosed to form lobby space. The date of construction of the postmaster's flat is unknown. It is perhaps contemporary to the main building. The date of addition of the swimming pool is unknown though it was probably constructed in the 1930's. Still further east is the Old Observatory House, now being used as Guest House. The original House was built by Col. J.T. Boileau sometimes in 1844. Behind this is the electric engine house and on the north western side are the lawns. The underground rainwater harvesting tanks are placed at a sufficient distance away from the main block.

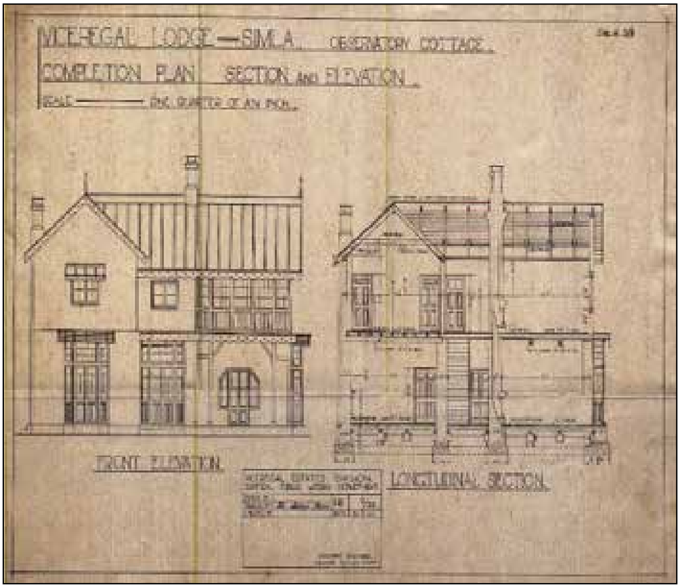
The other heritage buildings in the Viceregal Lodge estate are the Square hall complex comprising of the main building, the present residence of the Director, IIAS, Stable House, under the



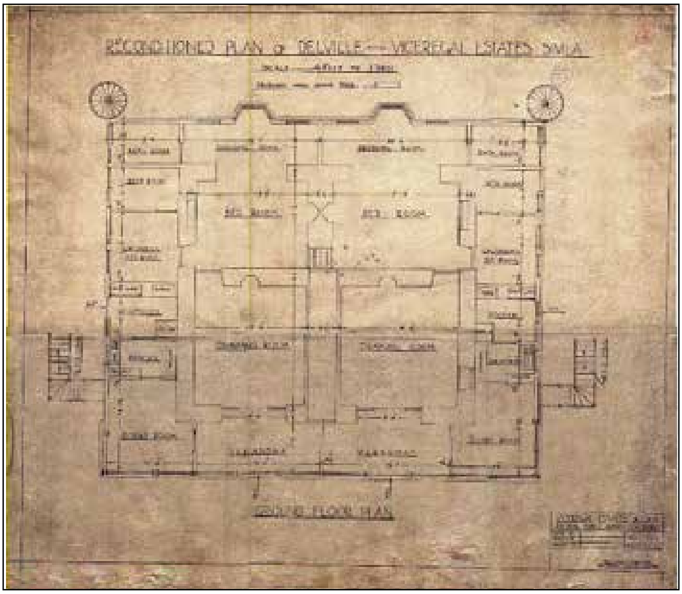


Square Hall

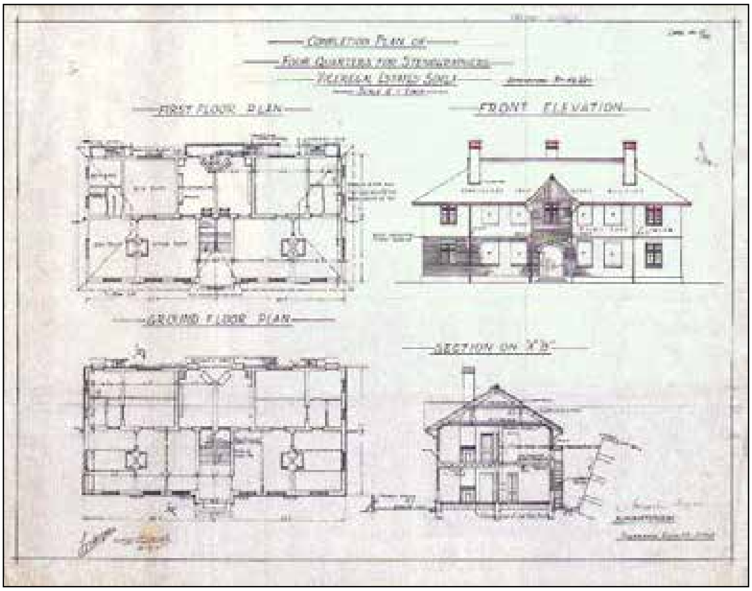
possession of the Academic Resource Officer, Out House of three sets and double storied Mali Line with four sets for the staff; Tennis Court Building and a Single storied structure as jail; Redstone House in two storied one set in each levels, presently occupied by the Librarian and Accounts Officer of the Institute; Bilaspur House with eight sets for fellows and three single storied out houses for the staff ; Clair Villa Cottage, the original residence of the Registrar with attached staff quarters, both the houses are under renovation; both the Delvilla Old and Delvilla New having four sets each for fellows with attached three staff quarters, one double storied with six sets of rooms; Zakir Hussain House with four sets for fellows; three storied staff Quarters- C-Block having 31 rooms, of which 18 with the IIAS and 13 with CPWD; Curzon Cottage (four sets), originally Stenographers Quarters and now is being used as fellows' residence; Curzon House, at present under the possessions of the Judicial Academy; Grass Shed Cottage, a single storied structure for use of the fellows; DSP Quarters, a double storied structure, now being earmarked for UNDP scholars: Fellows House having three sets and a double storied staff quarters ; Courteen Hall (three sets) with double storied annexe(one set each level) and out house; 28 Family Lined two storied building, 14 rooms with IIAS and 14 with CPWD; Military Barrack No. 1, a double storied building with 12 sets of rooms (10 with IIAS and 2 with CPWD); Military Barrack No. 2 with 6 sets and 2rooms; Military Barrack No.3 (3 rooms); Military Barrack No. 4 with four sets, (three with IIAS and 1set with CPWD); Observatory Cottage, present Secretary's residence and separate Servant Quarters; 12 Rooms Mali line staff quarters; Old Enquiry House, presently under the possessions of the ASI; Siddhartha Vihar Hostel for guests of the IIAS and 2 sets of staff quarters; Guard House having four sets with staff; Fire line A-Block with ten sets of rooms (5sets with IIAS and 5 sets with CPWD); Fire-line B-Block ,a double storied building with five sets of rooms and one room; Building known as Electrical Supervisors Quarters, now being used as residence by the Sr.PS to the Director of the IIAS; Observatory building, the present Guest House and Fellows mess and four rooms out house; Karanch-line building,



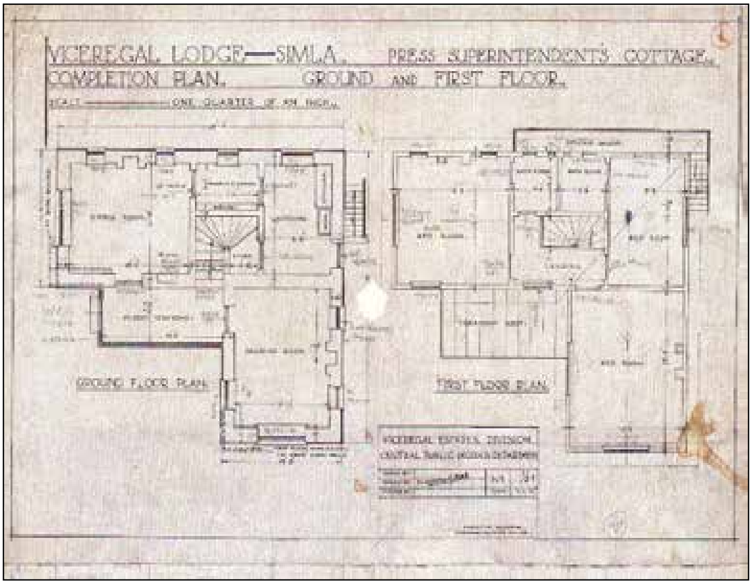
Observatory Cottage



Delvilla House



Curzon Cottage



Starry Cottage

now being used by the Associate Fellows of the IIAS; and Starry Cottage (2 sets), A-Block with 8 sets for fellows, B-Block staff Quarters with 8 sets, 18 Family Line Staff quarters, 12 Family Line Staff Quarters, all in Prospect Hill.

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V

Additions, Alterations and Modifications in the Building

The available records and documents revealed that this colonial building was modified and altered during the occupancy of the successive Viceroys for their functional reasons. Many additions and alterations were made during original constructional stage which include addition of extra windows in the dining room, arches between Ball Room and Dining Room and corridor and small dining room; alteration to the piers of the east wall of the Ball Room, Steward's Room, basement of Kitchen Wing, approaches and drains to the Kitchen Wing basement, glazing roof of the gallery, staircases, roof at east wing, etc. However, maximum changes to the external appearance and interior of the building have been carried out during the tenure of Lord Curzon. The south west tower was rebuilt and the central tower with the water tanks was raised two floors higher. Curzon is also said to have carried out major repairs to the building. A smaller octagonal turret placed at the west face of the building, as indicated in Irwin's drawing, was removed too, probably during Lord Curzon's time. He set out to make various modifications to the Viceregal Lodge, including changes in the interior furnishes and also improved the gardens and added a rose garden.

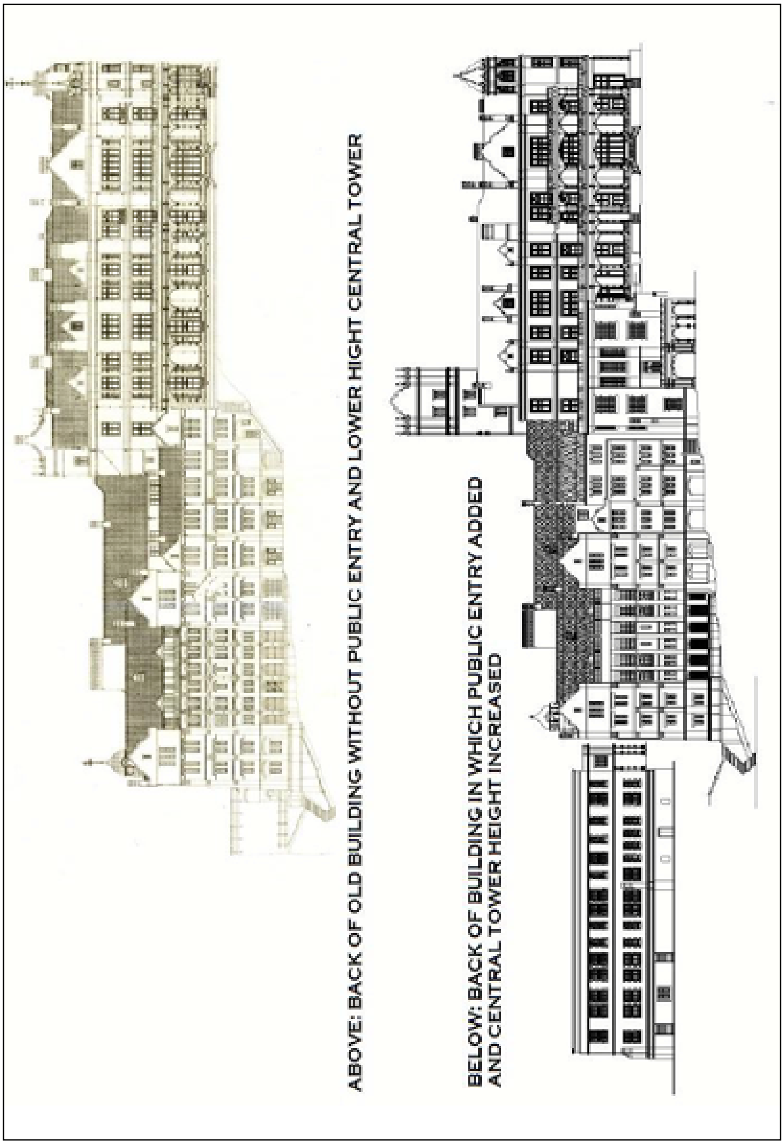
Some of the additions are not only incongruous but have proved detrimental to the condition of the building due to weathering and rainwater penetration through cracks and widened joints resulting in attempts at repair and prevention through replacement of damaged stone and provision of *chhajjas*, arcades, etc. The damage caused by the effects of the April 1905 earthquake, and later seismic disturbances, led to the dismantling or modification of certain sections of the building. The upper storey and dome of the south-west corner tower was rebuilt during Lord Curzon's tenure (1899-1905), resulting in a change in its height and external appearance. The Band Porch on the west face had suffered great damage. The original triple arcade of the Band Porch was dismantled and closed and the stairs modified, resulting in a change in the functions and appearance of the building. An entire line of arches in the upper veranda above this porch on the west elevation were added later.

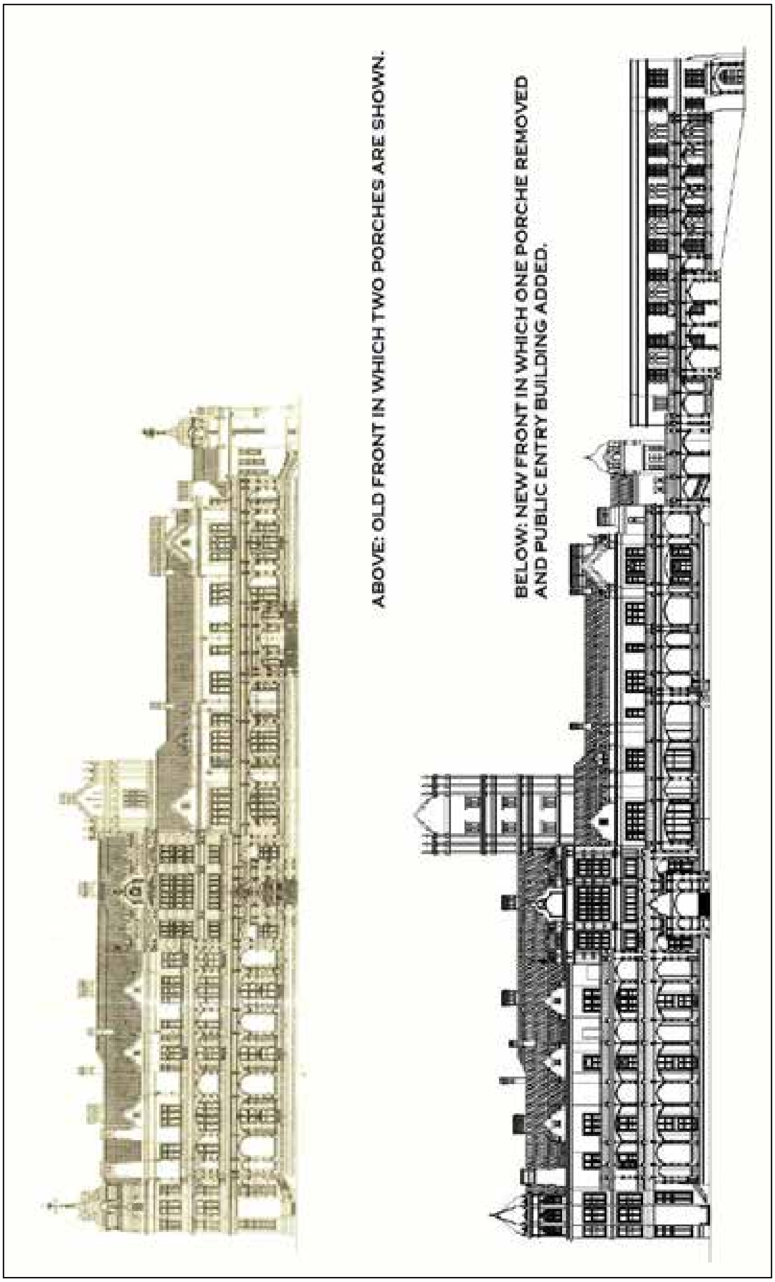
The central tower of the main block was modified with the addition of two storeys, window openings and alarm siren giving greater emphasis to the central section of the main building. The octagonal turret on the west of the building was removed after the earthquake, resulting in modification in west elevation and deflection in adjacent projected section of the west façade.

Addition of arcades in the first floor on the west of the main building was done with the purpose of accessing the terrace on second floor level, resulting in structural cracking on lower floor due to increased load. Changes were made to the west facade, the piers of the Ball Room. Cast iron spiral staircases were added at two locations, first floor arcade on south, north terrace in the first floor on the east wing, first floor and ground floor arcade on the north by puncturing the floor slabs for the purpose of connecting the upper floors.

The carved arcaded sandstone screen separating the entrance hall from the gallery at ground floor level has been removed and the direction of the staircase modified. The south-east portico was also removed and the dismantled components were stored for reassembling and the stairs modified. The building was extended by 16 feet towards the west (PWD Proceedings, Oct.1886, No. 29). Landscaping of the grounds was begun by Lord Lansdowne.

Originally, there were stone pillars creating a screen between the entrance and the long gallery. This was subsequently removed


ABOVE: BACK OF OLD BUILDING WITHOUT PUBLIC ENTRY AND LOWER HIGHT CENTRAL TOWER
BELOW: BACK OF BUILDING IN WHICH PUBLIC ENTRY ADDED
AND CENTRAL TOWER HEIGHT INCREASED


ABOVE: OLD FRONT IN WHICH TWO PORCHES ARE SHOWN.
BELOW: NEW FRONT IN WHICH ONE PORCHE REMOVED AND PUBLIC ENTRY BUILDING ADDED.

to allow the entrance gallery to be one grand seamless space. This has reference in Lady Dufferin's diary note of 15th July 1888:

"The house too, now that it approaches completion, looks so well, and perhaps this is a good opportunity to give you some idea of it. The Entrance hall is the great feature of it. The staircase goes up from it, and there are stone pillars dividing it from a wide corridor leading to the state rooms, and both hall and corridor are open to the top of the house, three storeys. This gives an appearance of space and height which is very grand."

Lord and Lady Minto added terraces and Lord Harding sanctioned the Council Hall designed and built between 1911 and 1913. There is a drawing signed by John Begg, Consulting Architect to the Government of India, dated 9 April 1913. The construction of the Council Chamber and Public Entry Buildings was added by using similar stone for external facing and decorative elements and minor changes in detailing. Both form a visually coherent complex of interconnected but separate buildings. The original drawings for this section of the building available with the CPWD are dated from 1911 to 1938. The design of the Council Chamber was approved by Lord Hardinge in I911 and construction was probably finished by 1913, as indicated in the Survey of India map of 1914-15, since the foundation and basement plan, elevations and sections are dated 1911. Subsequently, the internal lounge connecting the main building to the Dining Hall on the ground floor and the Council Chamber was roofed in 1936 and opened out to the gardens. Alterations to the internal layout and screen walls of the Council Chamber were carried out and completed in the year 1942.

Public Entry building was built to link the main block with small section of load-bearing wall and provides a thorough ADC's corridor at ground floor level of the east wing. There is no specific date of construction of the western section of the Public Entry building but the Survey of India map dated 1914-15 showing this section of the building indicates that it was built in 1914, probably at the same time as the Council Chamber. In 1927, during the tenure of Lord Irwin (1926-31), eastern portion of the Public Entry

Building was added (as indicated in the drawings of building alterations dated 1926).

The date of construction of the postmaster's flat is unknown. It is probably contemporary with the main building. The date of addition of the swimming pool is unknown though it was probably constructed in the 1930's.

Other additions include additional electrical installations, pipes, plumbing and sanitary fittings for the toilets. Unfortunately, a range of ad hoc additions such as conduits and electrical cables criss-crossing over the verandas; replacement of rectangular section cast-iron rain water pipes with round section pipes or mild steel pipes with thin gauge are some of the notable alterations in the exterior face. In one of the internal courtyards of the building, public toilets have been constructed. This intervention, is however not a negative impact on the exterior face of the building, nor does it affect the interior views, except the fact that this does alter the material integrity.

Most of the wall finishes such as wall papers and damask silks have not survived and have been stripped off over the years to expose bare walls. Wall finishes like wooden skirting and wainscoting does survive in most of the rooms on the upper floors, as well as the State rooms. Wherever these wainscoting and skirting survived, they are in need of careful restoration as these are mostly painted over in many layers and are damaged in sections. The entire services are routed through service corridors and / or service staircase areas. There are some areas where the electrical wires and cables require careful rethinking and wire management. This is also seen in verandas and even historic State Rooms where cables for electrical and data lines cut across the architectural elements, defacing the interiors.

The old brass top toggle type switches and the distribution panels are still functioning in many places. Each circuit contains rewirable fuses with toggle switches. The wiring is also done using wooden casing capping and is functioning in some section of the building and is generally routed along the wooden skirting in the rooms. However, over the years, other types of switches have incrementally been used. While this is almost unavoidable, it is imperative to take great care in the location of these fittings as also to ensure that the new fittings are as discreet as possible, preferably using the original fittings.

In so far as the interior is concerned, it is the elaborate woodwork that has stood the real test of time. Along with the panelling and pilasters, the staircase with its heavy newels and handrails is remarkable. A massive shipment of teak was procured from Burma (now Myanmar) for this purpose and supplemented, wherever required by local cedar wood (deodar) and walnut. During the time of Marquis Curzon, many parts of the building came in for major refurbishing. The carving in the dining room was completed, and a replica of the screen that stood behind the Emperor of China's throne was added. In the old Council Chamber, that later became the billiards room, portraits of Governors-General and Viceroys were hung. A collection of Indian arms was displayed on the walls of the main gallery where their impressions are still visible. As stated, the construction of the main building was completed in the year 1888 and other buildings were added subsequently.

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VI

Previous Technical and Scientific Studies

In view of the distressed structural conditions of the building, IIAS made efforts to keep this historic building in presentable condition and to save the heritage structure. Scientific and technical studies have also been made from time to time through different Governmental or non-governmental agencies.

1. *Conservation of Rashtrapati Niwas, Shimla, INTACH Project* by Romi Khosla and Mahendra Raj in two volumes in the year 1995;
2. *Report on Investigation of Distress in Rashtrapati Niwas at Shimla and Rehabilitation Measures* by Central Building Research Institute (CBRI), Roorkee and in the year 2009;
3. *Report on Conservation Master Plan on Viceregal Lodge/Rashtrapati Niwas, Shimla* by M/S Abha Narain Lambah Associates, Mumbai in 4 Volumes in the year 2010; and
4. *Report on Causes of Observed Defects and Recommendations for Remedial Measures* by Poul Beckmann, Structure Engineer from London engaged by the INTACH in the year 1997.

Apart from the above and to deliberate the technical issues and for selection of best suited methods for repairs and conservation materials, IIAS, Shimla also organized a technical workshop in the campus on 16-17 September 2013 which was attended by experts from Central Building Research Institute (CBRI), Roorkee, Archaeological Survey of India (ASI), Central Public Works

Department (CPWD), School of Planning and Architecture (SPA), New Delhi and Eminent Architect and Conservationist Sh. Ved Segan, Mumbai and other technical experts. After the workshop a broad consensus was arrived at regarding best suited method and materials to be used in repair, retrofitting and restoration of this monumental icon. Based on the outcome of the deliberations, CPWD prepared a Detailed Project Report (DPR) incorporating all the components including the additional details furnished by the Archaeological Survey of India (ASI) and got it approved from the Director General of the Archaeological Survey of India for implementation in a phased manner.

Of the scientific and technical reports, only two reports in original submitted by CBRI and M/S Abha Narain Lambhah Associates and photo copy of first volume of the report submitted by INTACH in 1995 are available with the IIAS while the second volume is not in their records. On examination of the available copies of the reports it is found that the reports submitted by them have addressed the problems quite correctly. In the reports of the CBRI and Poul Backmman, emphasis has been given to the structural ailments of the building and proposed possible remedial measures, including the techniques or methodology to be adopted to tackle them. Not only that, CBRI carried out investigations to find out the causes of distress in the lime concrete vaulted floors and stone masonry walls, covering visual observations, material characterizations, finite element analysis, load transfer mechanism, identificating possible causes of distress and repair and rehabilitation measures for the masonry structures. In the report of the INTACH, more stress had been given to the detailed documentation of the condition assessment of the building, while the report submitted by M/s. Abha Lambah Narain Associate is general in nature and has stressed only on the heritage and architectural value including its furnishing, finishing and furniture, etc. of the building. The scientific and technical studies made earlier are described briefly in the following pages for ready reference:

A. Conservation of Rashtrapati Niwas, Shimla, INTACH Project proposal by Romi Khosla and Mahendra Raj, 1995

The report should be in two parts, of which only the photocopy of the first part containing five sub-heads/chapters with eleven annexure is presently available with the Estate Office of the IIAS. The first chapter highlights the historical significance, architecture, constructions and services of the Lodge. The second chapter deals with the project justifications while chapter three describes in brief the conservation objectives. In the fourth chapter, proposed activities have been dealt and the project risk has been briefly described in the last chapter. The status and the conditions of each and every part of the building, as well as the objectives and restoration in the long term and short term, have been highlighted in the report. The long term objectives are the restoration of the buildings and surroundings of the historic main complex to a condition which would enable optimal adaptive reuse in keeping with its historic and architectural significance. The conservation strategy followed and measures adopted would be in accordance with the internationally accepted norms and procedures regarding authenticity of materials, techniques and processes. For this it is essential to ensure the structural stability of all sections of the main complex identified as having severe structural defects, through judicious structural interventions based on accurate monitoring over a period of time and stress analysis. This will help to eliminate the sources of associated decay of the built fabric due to which large area of the building has become unusable, and to prevent the recurrence of decay mechanisms whose cumulative action over a period of time could again result in structural instability.

While the short term conservation objectives highlighted include: emergency stabilization of the areas in danger of imminent structural failure; elimination of damp intrusion from all sources; rectification of localized structural defects; conservation of external fabric including poulticing, repair, resetting, replacement, and cleaning of deteriorated stone masonry; restoration of interiors; upgrading of service networks not likely to be affected by subsequent conservation interventions and adaptive reuse of spaces according to the requirements of the IIAS. Phasing of different conservation operation has been done so that areas with the same type of problems can be tackled simultaneously keeping in view the time frame and need for urgent action. The areas with localized structural defects which require minor stabilization are proposed to be taken up in the first phase.

1. Removal of Damp Intrusion from clerestory area, roofs over projected windows, courtyards, flat roof terrace at Mezzanine level, flat slabs over arcades, external walls and arcades, retaining walls in the main building: Type of defects observed are localized structural defects due to expended movement, failure /lack of waterproofing system, material deterioration, poor detailing. The recommended remedial action proposed include: providing concealed concrete or stone ties across diagonal or vertical cracks in the wall masonry joints at specified vertical intervals as required; Gravity grouting and raking out and repointing for horizontal cracks along joints; providing continuous horizontal ties at below floor slab level in arcades and external walls; consolidation of cracks in the slabs by grouting; prevention of rising damp by placing footing drains, or providing impervious barriers to moisture passage by inserting a double damp course layer through the entire thickness of the wall in alternate work widths of 3' or inserting flashing into cut out mortar joints. Possible use of chemically injected damp courses (polyester resin, silicone mixed with mortar) by low pressure or gravity feed into holes drilled in mortar joints. Voids in the walls should be grouted. Walls subjected to hydrostatic water pressure such as the south walls of the lower levels of the Kitchen wing to be treated.

2. Re-flooring of the courtyards with impervious materials laid to proper slopes (stone flags) to prevent water logging and damp foundation; removal of planters and renewal of plinth protection around the building; removal of decayed waterproofing treatment from flat slabs, provision of adequate slope away from external wall, edge drains with concealed spouts and down take pipes; detailing and sealing horizontal skylight openings in flat slab of

Kitchen Wing mezzanine level; replacement of a few broken glass blocks and sealing joints; detailing of lead flashing in area around the clerestory windows and replacement of decayed windows; sealing of junctions between flat roofs over projected windows and wall with properly detailed cove fillets and provision of adequate slopes towards rainwater down pipes; repointing of joints in external walls and masonry of arcades; replacement of decayed stone units which have become porous, leading to damp intrusion through the masonry unit instead of through the joints and checking of efficacy of existing rainwater sub-surface drainage system, repair and augments.

3. Central Tower (Cracks due to local stresses, decay of parapet elements, defective parapet wall/floor slab junction): The recommended remedial action proposed include: strengthening of masonry and provision of ties at the points where tie rods have been inserted and cracking has occurred; insertion of concealed stitch beams across the vertical and diagonal cracks in the corners; consolidation of cracked roof slab; renewal of roof terrace slab by waterproofing treatment and provision of adequate cove fillet at the parapet wall/flat slab junction; repair of parapet stone coping with watertight joints; recarving and resetting of damaged decorative stone elements and replacement of decayed stones; repointing of cracks along external window frames and broken panes; replastering and painting of the interior.

4. Stabilization of Chimney Stacks of Main building and Kitchen Wing: Cracks along the joints and broken stone slabs. The recommended remedial action proposed include: dismantling and rebuilding of upper sections of stacks which are determined to be an unstable condition; grouting of wall masonry of lower levels of the stacks in the Kitchen Wing; repointing of open joints in the external masonry; repair and replacement of stones in the chimney caps; and removal of organic growth.

5. Restoration of South East Bell Tower: Severe active structural cracks in walls and ceilings at all levels due to structural cracks in walls and ceilings at all level due to structural movement and material deterioration and damage due to damp intrusion. The

recommended remedial action proposed include: stabilization of soil and differential settlements of foundations; consolidation of wall masonry by grouting and providing concealed stitch beams across cracks; sections of the damp wooden roof support structure which may be affected by wet rot; restoration of masonry spiral staircase at lower level; repointing open joints in the external walls; replacement of lead sheets roof over pitched wooden board roofs of pediments with watertight detailing of junction with main domical roof; replacing lead flashing on ledges of pediment openings and sealing off sources of rainwater entry; providing waterproofing treatment on roof of projected oriel window on the south; detailing for weather protection of the windows in the external walls; replacement of decayed doors and windows; and filling of internal cracks after stabilization and plastering and painting of internal walls; replacement of decayed sections of the rainwater downpipes; and arrest leakages from sub-surface rainwater drains to the north and east of this area.

6. Arresting Stone Deterioration, Restoration of Original Façade, external walls and outer arcades: Stone decay, cracking, powdering associated with efflorescence, roughened surfaces and preferential weathering, spalling, splitting, map cracking, contouring scaling due to thermal stresses, open joints and lime runs, organic growth, acid etching due to lichen, staining and discoloration. The recommended remedial action proposed includes: All active cracks and sources of localized stresses are to be stabilized. Moisture from gutters, drains, rainwater outlets, rising damp is to be stopped. Removal of vegetation and control of organic growths; Cleaning of discoloured and stained surfaces; poulticing to draw out soluble salts; open joints in copings, string courses, *chhajjas* to be filled and defective stones replaced; re-carving of damaged or broken decorative stones; resetting of lifted or displaced stones; replacement of defective stones or those with better weathering features; and decayed open joints and defective mortar to be raked out and repointed using a mix which is not stronger than the stone.

7. Stabilization of East Porch: Localized active structural cracks

and crushing of stone units due to differential settlement. The recommended remedial action as suggested are as under: Soil stabilization, foundation strengthening; dismantling and rebuilding of west bay; replacement of damaged stones; waterproofing of flat slab; removal of decayed plaster and replastering; and ensuring underground water tank has no leak.

8. Vaults on the west of the main building: Severe active structural cracks in the walls and ceilings are due to structural movement and material deterioration. The recommended remedial action suggested are: consolidation of deteriorated vaulted roof structure and wall masonry by grouting after renewal of waterproofing layer on roof below the lawns; stabilization of active cracks in the vaulted area below the Band Porch and west annexes of the main block; soil stabilization; provision of damp exclusion layer on east retaining walls; grouting of stabilized cracks and plastering of interior; and provision of toilet facilities.

9. Band Porch and North Portico: The recommended remedial action suggested for repairing the deflection of corners portico and deteriorated roof structure include: any continuing foundation settlement in vault area; rectification of deflected corner walls and corner triple columns by reconstruction if considered necessary and concealed horizontal ties between ceiling and lintel/arch level; consolidation of cracks in roof slab and replacement of cove fillet with appropriate detailing to prevent water penetration; consolidation of deteriorated material of vaulted roof slab of north portico; waterproofing treatment; repointing the separated joints in the masonry; repairing of eroded surface of vaults; replacement of decayed stones and removal of salt encrustation by poulticing; cleaning of discoloured stone masonry; repairing and refixing of cornice sheets and wall panelling; repair of decorative cast iron staircase; and painting of interior.

10. Conservation of Woodwork (Fungal attack, cracking, building up of layers of varnish and paint, damaged carved surfaces, weathering of wood frames): The recommended remedial action as suggested are replacement of few decayed sections of roof support structure after removal of source of damp; cleaning, removal

of built up layers of varnish and paint, filling of cracks and provision of protective coating.

11. Usage of space: The level of facilities and amount of usable space is found to be inadequate even at the present time, especially so at the time of conferences, symposia, etc., which are a regular feature of the academic life at the IIAS. In view of the IIAS's plans for expansion and intensification of activities, the present functions and efficiency of space utilization in the main building complex have been analysed and future potential assessed. The present space usage reveals that in the main building itself, about 20% of the area which could be turned to active use is underutilized and also proposed for removal of the boiler equipment, laundry pipes and ice making equipment and repair of punctured walls and floor slabs; upgrading and providing toilet facilities as reuse plan; modifying sewage and drainage to the structure; and installation of heating system in some areas to be reused as the Library.

Further research and investigation on Monitoring of structural cracks and wall deflections; Material analysis of deteriorated lime concrete vaults, salts efflorescing; and Structural stress analysis and modelling of the area to determine design of appropriate structural interventions had also been proposed.

B. Report on Causes of Observed Defects and Recommendations for Remedial Measures submitted by Poul Beckmann, London, 1997

The Report was prepared in the year 1997 on behalf of the INTACH with the objective to diagnose the causes of material and structural damage and distress to the building, and to recommend a suitable programme of remedial measures to restore the building in short and long term to make the greatest use of the building. The details of the problems that were identified during the desk study and / or observed during the site visit and his recommendations for proposed remedial action or further investigations:

1. Wide spread defects in the masonry were seen. Their distri-

bution over the height of the building is such as to indicate that they are caused by a combination of the nature and quality of the stones and the way that they have been built in, i.e. window jambs of sandstone, with bedding planes vertical, abutting rubble masonry panels. It is recommended that the old cement repairs be replaced by lime pozzolan re-pointing and that a similar mortar/grout be used to fill the cracks.

2. Some badly bonded junctions in the masonry were seen. Further searches for these should be carried out and where they are considered serious, they should be secured with anchor bolts to fill the gaps.

3. Some poor roofing and roof drainage details were observed; it is recommended that they are rectified as a matter of urgency, to prevent further damage from water penetration.

4. One wrought iron beam over a veranda was found badly corroded and in need of replacement; there was some rust visible on some of the beams carrying the water tanks in the Central Tower. One end of one of the steel beams, carrying the roof of the Council Chamber was, however, found to show no corrosion. Further investigation of this potential problem should be carried out.

5. The Council Chamber itself appeared structurally sound; some cracking at the northernmost end may be due to past deflection. Extensive damp staining indicated locally defective roof waterproofing and poor roof drainage. Remedial techniques are suggested.

6. Severe cracking was seen in some of the vaults and on some of the walls in the Kitchen Wing. The directions of the past relative movements indicate that there has been in settlement of some of the internal walls, relative to the external ones. Study of the original construction drawings indicates that the settlement may have been caused by the founding, on fill, of the affected internal walls. Precise levelling and crack monitoring over 18-24 months will be necessary to ascertain if the settlement is complete or still ongoing; the material properties of lime concrete in the vaults should also be investigated. The choice of remedial measures will depend on these two factors. Severe cracking in a wall on the 2nd floor was

found due to local overloading from a beam carrying a wall of a recent attic above; this should be propped or removed as a matter of urgency.

7. The South-East corner of the three-stored block was found to be pushed out by the untied foot of the hip rafter of the roof; internally, evidence of severe water penetration was seen. The roof defects should be rectified, the rafter should be tied back and the stonework anchor bolted back to sound masonry, prior to making good end of the cracks.

8. The Public Entry Building was seen to suffer from poor roofing and roof drainage. The western vaults were seen to have some cracking that was not considered structurally serious. Finally, recommendations are made on instrumentation to be used for monitoring of settlements and crack movements. The methodology and the techniques as proposed in the detailed report has been fully utilized and incorporated in subsequent chapters.

C. Investigation of Distress in Rashtrapati Nivas at Shimla and Rehabilitation Measures by the Central Building Research Institute, Roorkee, 2009

CBRI, Roorkee had submitted a report during September 2009 on the investigation of causes of distress particularly on Kitchen Wing of this majestic building of the Viceregal Lodge, Shimla. CBRI team carried out detailed study, collected samples and done geophysical analysis along with other tests to find the causes of distress in lime concrete vaulted floor and stone masonry walls. The investigation covers visual observations, material characterization, finite element analysis, and load transfer mechanism, identification of possible causes of distress, repair and rehabilitation measures for the masonry structure and recommendations for initiating remedial measures. From the distress survey, material investigation, structural analysis, moisture movement and crack monitoring, it is concluded that the causes of distress may be because of localized settlement of the buttresses. Keeping in view the above facts, repair and rehabilitation scheme has been suggested. The objectives of repair and rehabilitation work are mainly to (i) reinstate the structural integrity and safety of the member by restoring or increasing its strength and stiffness (ii) to prevent the ingress of distress promoting agents such as moisture to improve durability; (iii) cleaning and replacing distressed drains/ roof tiles/sanitary pipes to arrest further localized settlement; (iv) to maintain the architectural heritage/ aesthetic/ appearance of the structure and proposed to transfer partially the dead load of basement floor-2, ground floor and first floor to ground from the structure through steel trusses and then to repair and strengthen the damaged components especially in distressed kitchen block using various techniques including grouting of stone masonry walls and (v) repair and strengthening of lime concrete vaulted floors with hydraulic grouts, etc.

1. Treatment of Dampness in the walls: The dampness in the stone masonry has developed due to water leaked through damaged plasters, damaged water proofing in bath room floors, defective plumbing and plugged drains, improper designed / damaged sunshades, broken Mangalore tiles etc. The procedure for repair of wet patches on wall by way of arresting leakage, removing damaged plaster, cleaning the surface, applying a coat of mortar and curing was suggested.

2. Repair of Cracked Walls: Masonry walls with concentration of multiple cracks in the same portion and weak wall regions recommended for repair by micro-concreting along with reinforced GI wire fabric. Minor and medium cracks to be repaired by pressure injection of epoxy. For cracks wider than about 5 mm or for regions in which the concrete or masonry has crushed, a treatment other than injection is indicated. In such cases, bolting, stitching and micro concreting was suggested.

3. Provision of MS tie plates around the outer walls of distressed portion: It is suggested to provide mild steel tie plates (width 125, thickness 10 mm) on the outer walls at three levels between the floors. Use of 20 mm diameter bolts at a spacing of 1m is recommended. Proper steel packing plates and washers should be used for proper packing.

4. Water proofing: The existing water proofing treatment with lime concrete on the flat roof in the library block has deteriorated and needs replacement. For lime concrete treatment, the structural roof surface shall be finished rough to provide adequate bond. Roof drain outlets shall be cleaned to prevent accumulation of water. Masonry drain mouths shall be widened 2.5 times the diameter of the drain, and rounded with cement mortar (I: 4). Special attention and strict supervision has to be paid to proper overlapping of joints, particularly treatment around drainage openings in the roof and treatment of parapets. Procedure for water proofing of such terraces using bituminous compounds has been explained in the report.

5. Lime Concrete Waterproof Finish: Procedure for water proofing of such terraces using lime mortar has been explained in the report.

6. Junctions of Parapet Wall and Roof: To carry out the waterproofing of this area, felt shall be laid as a flashing with minimum overlaps of 100 mm. The lower edge of the flashing shall overlap the felt laid on the flat portion of the roof and the upper edge of the flashing shall be tucked into the groove made in the parapet on the vertical face of the wall. Each layer shall be so arranged that the joints are staggered with those of the layer beneath it. After the layers of felt are laid and bonded, the grooves shall be filled with lime mortar (1:3) which, when set, will satisfactorily secure the treatment to the wall.

6. Overhead Glazing / Skylight Glass: The glass used in the skylight of the building has broken and needs replacement. Shimla falls under wind zone II having a wind speed of 39 m/s. Therefore, for overhead glazing used to cover roofs/ skylights, tempered glass of 4mm thickness or laminated glass of minimum 5.38mm shall be used.

7. Remedial measures for slope stabilization: Stabilization of back slope and front slope of building was suggested by way of construction of some additional retaining walls, reconstruction and channelizing of outer main drain, proper linking and ensur-

ing proper functioning of drain network, backside of kitchen area should be properly paved and to minimize the infiltration of rain water near the foundation of building.

The techniques and the methodology along with the drawings/ sketches as suggested/recommended in the report by the CBRI have also been included in the relevant Chapter.

D. The Viceregal Lodge: A Conservation Master Plan prepared by M/S Abha Narain Lambah Associates, Mumbai, 2010

The report contains 4 volumes and focuses mainly on the restoration of the heritage value of the building. This report also contains structural stabilization methods ranging from splice repair of damaged sections of timber trusses and rafters using like well-seasoned wood and steel plates to repair of structurally weakened girders and structural framing members, bracing and strengthening of damaged masonry vaults, arches and domes. Roof repairs and waterproofing including relaying timber boarding and lead sheeting below the tiles, correction of all terrace slopes, gutters and drainage runs are to be undertaken. These are categorised in the following sub heads: Roof & Terrace Consolidation; Water Discharge & Drainage; Structural Framing Members; Masonry Walls, Vaults, Arches and Lintels; Basements; Geotechnical, Geological & Geophysical Issues. Report also suggested Dutchman repairs for missing or broken details; restoration of lime pointing for the stone joints in some cases, to nonabrasive cleaning to remove salts and encrustations in others; restoration of the Historic interiors spaces; conservation of Historic services electrical fittings and sanitation and plumbing services equipment and Victorian Kitchen complete with an Aga Oven, coal ovens, etc. The report also suggested modernization and upgradation of the Institute's facilities; Interpretation& Visitor Amenities & Circulation; addressing the restoration of the historic landscape; restoration of other buildings in the complex, etc.

The recommendations highlighted in the above referred reports have not been examined and no serious thought was given by the respective responsible implementing agencies. The fire station and the swimming pool complex were converted into an auditorium and ticket and publication sales counter and café. The traces of water penetration or seepage from flat roof are visible and the roof top should be watertightened by filling the gaps in the stone tiles and the water outlets are to be made functional.

VII

International Charters on Conservation and National Conservation Policy

The archaeological heritage including monumental or built-heritage and living traditions constitute the basic record of past human activities. Its protection and management is therefore essential to enable archaeologists and other scholars to study and interpret it for the benefit of present and future generations. The protection of the archaeological heritage must be based upon effective collaboration between professionals from many disciplines and it also requires the co-operation of government authorities, academic researchers, private or public enterprise and the general public. People are becoming more and more conscious of the unity of human values and regard ancient monuments as a common heritage and recognize their common responsibility to safeguard them for future generations.

The International Community under the auspicious of the UNESCO and various organizations laid down guiding principles on the conservation and restoration of ancient monuments and sites in the Athens Charter of 1931 and agreed upon the responsibility for applying such guidelines within the framework of its own culture and traditions. This charter was reviewed and updated in 1964 in the Venice Charter, which deals with the conservation of historic buildings, the Burra Charter for the conservation of places of cultural significance (1979) and the Washington charter of 1987 which deals with historic towns and districts; these charters were published by ICOMOS.

So far as conservation of monuments in India is concerned, it draws its formal inspiration from the Indian Archaeological Policy, 1915 that mandates the safeguarding and protection of monuments as an important activity of the organisation. Conservation guidelines and principles were further elaborated in John Marshall's *Conservation Manual: Handbook for the Use of Archaeological Officers and others Entrusted with the Care of Ancient Monuments,* 1923, and it is these guidelines that have largely been adhered to by the ASI ever since. Apart from these internal guidelines, the Archaeological Survey of India has taken cognizance of the various international charters and guidelines in defining conservation approaches for protected monuments. It is a well known fact that the functions of the Archaeological Survey of India (ASI) has changed manifold since its inception and, therefore, duties and responsibilities of ASI's archaeological officers, in-charge of conservation and management of a protected monument, have gone beyond their earlier mandate. Functions of an archaeological officer are no longer limited to the safeguarding of a monument but now also include maintaining and sustaining its setting and environment as well as to continuously engage with communities that either resides within the proximity of a monument or those that are inextricably associated with the monument itself. As such, the National Policy for Conservation of the Ancient Monuments, Archaeological Sites and Remains (NPC–AMASR), protected by the Archaeological Survey of India, has been launched in February 2014.The proposed Policy primarily focuses on all Ancient Monuments and Archaeological Sites and Remains, declared as monuments of national importance under the AMASR (Amendment and Validation) Act, 2010 and does not, for the time being, include unprotected built heritage.

The proposed policy aims to, not only draw lessons and inspirations from the ASI's rich legacy for conservation but also acknowledges the adoption of contemporary approaches to conservation, management and protection of monuments and archaeological sites, and proposes various principles of interventions within and around them. The Policy also acclaims available traditional craftsmanship in the country and the use of traditional building materials and skills as an integral part of the conservation process. The Policy, for the first time, deals with topical aspects like the management of tourism and development (within and around a monument), as well as issues of capacity building and building of partnerships with multi-disciplinary organisations and institutions. The Policy attempts to put a monument in perspective (as a ubiquitous part of its setting) and underpins the role of local communities.

The Policy may be read in conjunction with the provisions of the AMASR (Amendment and Validation) Act, 2010. The Policy is envisaged as a dynamic document and, as it is put into operation by the ASI's Archaeological officers and field staff, it is subject to periodical reviews as may be decided by the Archaeological Survey of India. It is also hoped that the proposed Policy is applicable to a vast number of state protected monuments spread all over the country. The details of the International Charters and National policy for Conservation of Ancient Monuments and Archaeological Sites and Remains are given below:

I. The Venice Charter, 1964

Accordingly, the IInd International Congress of Architects and Technicians of Historic Monuments, which met in Venice from 25 to 31May 1964, approved and adopted by ICOMOS in 1965.

Conservation

Article 4: It is essential to the conservation of monuments that they be maintained on a permanent basis.

Article 5: The conservation of monuments is always facilitated by utilising making them for some socially useful purpose. Such use is therefore desirable but it must not change the lay-out or decoration of the building. It is within these limits only that modifications demanded by a change of function should be envisaged and may be permitted.

Article 6: The conservation of a monument implies preserving a setting which is not out of scale. Wherever the traditional setting exists, it must be kept. No new construction, demolition or modification which would alter the relations of mass and colour, should be allowed.

Article 7: A monument is inseparable from the history to which it bears witness and from the setting in which it occurs. The moving of all or part of a monument cannot be allowed except where the safeguarding of that monument demands it or where it is justified by national or international interest of paramount importance.

Article 8: Items of sculpture, painting or decoration which form an integral part of a monument may only be removed from it if this is the sole means of ensuring their preservation.

Restoration

Article 9: The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. The restoration in any case must be preceded and followed by an archaeological and historical study of the monument.

Article 10: There traditional techniques prove inadequate, the consolidation of a monument can be achieved by the use of any modern technique for conservation and construction, the efficacy of which has been shown by scientific data and proved by experience.

Article 11: The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration. When a building includes the superimposed work of different periods, the revealing of the underlying state can only be justified in exceptional circumstances; when what is removed is of little interest; the material which is brought to light is of great historical, archaeological or aesthetic value and its state of preservation good enough to justify the action. Evaluation of the importance of the elements involved and the decision as to what may be destroyed cannot rest solely on the individual in charge of the work.

Article 12: Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.

Article 13: Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings.

II. The Burra Charter, 2013

The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members. Conservation is an integral part of the management of places of cultural significance and is an ongoing responsibility. The Charter sets a standard of practice for those who provide advice, make decisions about, or undertake works at places of cultural significance, including owners, managers and custodians.

Conservation Principles

Article 2. Conservation and management:

2.1 Places of cultural significance should be conserved.

2.2 The aim of conservation is to retain the cultural significance of a place.

2.3 Conservation is an integral part of good management of places of cultural significance.

2.4 Places of cultural significance should be safeguarded and not put at risk or left in a vulnerable state.

Article 3. Cautious approach: 3.1 Conservation is based on a respect for the existing fabric, use, associations and meanings. It requires a cautious approach of changing as much as necessary but as little as possible.

3.2 Changes to a place should not distort the physical or other evidence it provides, nor be based on conjecture.

Article 4. Knowledge, skills and techniques: 4.1 Conservation should make use of all the knowledge, skills and disciplines which can contribute to the study and care of the place.

4.2 Traditional techniques and materials are preferred for the conservation of significant fabric. In some circumstances, modern techniques and materials which offer substantial conservation benefits may be appropriate.

Article 5. Values: 5.1 Conservation of a place should identify and take into consideration all aspects of cultural and natural significance without unwarranted emphasis on any one value at the expense of others.

5.2 Relative degrees of cultural significance may lead to different conservation actions at a place.

Article 8. Setting: Conservation requires the retention of an appropriate setting. This includes retention of the visual and sensory setting, as well as the retention of spiritual and other cultural relationships that contribute to the cultural significance of the place. New construction, demolition, intrusions or other changes which would adversely affect the setting or relationships are not appropriate.

Article 14. Conservation processes: Conservation may, according to circumstance, include the processes of: retention or reintroduction of a use; retention of associations and meanings; maintenance, preservation, restoration, reconstruction, adaptation and interpretation; and will commonly include a combination of more than one of these. Conservation may also include retention of the contribution that related places and related objects make to the cultural significance of a place.

Article 16. Maintenance: Maintenance is fundamental to conservation. Maintenance should be undertaken where fabric is of cultural significance and its maintenance is necessary to retain that cultural significance.

Article 17. Preservation: Preservation is appropriate where the existing fabric or its condition constitutes evidence of cultural significance, or where insufficient evidence is available to allow other conservation processes to be carried out.

Article 18. Restoration and reconstruction: Restoration and reconstruction should reveal culturally significant aspects of the place.

Article 19. Restoration: Restoration is appropriate only if there is sufficient evidence of an earlier state of the fabric.

Article 20. Reconstruction:20.1 Reconstruction is appropriate only where a place is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the fabric. In some cases, reconstruction may also be appropriate as part of a use or practice that retains the cultural significance of the place.

20.2 Reconstruction should be identifiable on close inspection or through additional interpretation.

Article 21. Adaptation: 21.1 Adaptation is acceptable only where the adaptation has minimal impact on the cultural significance of the place.

21.2 Adaptation should involve minimal change to significant fabric, achieved only after considering alternatives.

Conservation practice

Article 32.1 Records associated with the conservation of a place should be placed in a permanent archive and made publicly available, subject to requirements of security and privacy, and where this is culturally appropriate.

32.2 Records about the history of a place should be protected and made publicly available, subject to requirements of security and privacy, and where this is culturally appropriate.

Article 33. Removed fabric: Significant fabric which has been removed from a place including contents, fixtures and objects should be catalogued and protected in accordance with its cultural significance. Where possible and culturally appropriate, removed significant fabric including contents, fixtures and objects, should be kept at the place.

III. ICOMOS Historic Gardens (the Florence Charter, 1981)

The Florence Charter sets forth principles and guidelines for the preservation of historic gardens. The ICOMOS-IFLA International Committee for Historic Gardens, meeting in Florence on 21 May 1981, decided to draw up a charter on the preservation of historic gardens which would bear the name of that town. The present Florence Charter was drafted by the Committee and registered by ICOMOS on 15 December 1982 as an addendum to the Venice Charter covering the specific field concerned.

Definitions and objectives

Article 1. "A historic garden is an architectural and horticultural composition of interest to the public from the historical or artistic point of view". As such, it is to be considered as a monument.

Article 2. "The historic garden is an architectural composition whose constituents are primarily vegetal and therefore living, which means that they are perishable and renewable." Thus its appearance reflects the perpetual balance between the cycle of the seasons, the growth and decay of nature and the desire of the artist and craftsman to keep it permanently unchanged.

Article 3. As a monument, the historic garden must be preserved in accordance with the spirit of the Venice Charter. However, since it is a living monument, its preservation must be governed by specific rules which are the subject of the Present charter.

Article 4. The architectural composition of the historic garden includes: • Its plan and its topography; • Its vegetation, including its species, proportions, colour schemes, spacing and respective heights; • Its structural and decorative features; • Its water, running or still, reflecting the sky.

Article 5. As the expression of the direct affinity between civilization and nature, and as a place of enjoyment suited to meditation or repose, the garden thus acquires the cosmic significance of an idealized image of the world, a "paradise" in the etymological sense of the term, and yet a testimony to a culture, a style, an age, and often to the originality of a creative artist.

Article 6. The term "historic garden" is equally applicable to small gardens and to large parks, whether formal or "landscape".

Article 7. Whether or not it is associated with a building in which case it is an inseparable complement, the historic garden cannot be isolated from its own particular environment, whether urban or rural, artificial or natural.

Article 8. A historic site is a specific landscape associated with a memorable act, as, for example, a major historic event; a well-known myth; an epic combat; or the subject of a famous picture.

Article 9. The preservation of historic gardens depends on their identification and listing. They require several kinds of action, namely maintenance, conservation and restoration. In certain cases, reconstruction may be recommended. The authenticity of a historic garden depends as much on the design and scale of its various parts as on its decorative features and on the choice of plant or inorganic materials adopted for each of its parts.

Maintenance, conservation, restoration, reconstruction

Article 10. In any work of maintenance, conservation, restoration or reconstruction of a historic garden, or of any part of it, all its constituent features must be dealt with simultaneously. To isolate the various operations would damage the unity of the whole.

Article 11. Continuous maintenance of historic gardens is of paramount importance. Since the principal material is vegetal, the preservation of the garden in an unchanged condition requires both prompt replacements when required and a long-term programme of periodic renewal (clear felling and replanting with mature specimens).

Article 12. Those species of trees, shrubs, plants and flowers to be replaced periodically must be selected with regard to established and recognized practice in each botanical and horticultural region, and with the aim to determine the species initially grown and to preserve them.

Article 13. The permanent or movable architectural, sculptural or decorative features which form an integral part of the historic garden, must be removed or displaced only insofar as this is essential for their conservation or restoration. The replacement or restoration of any such jeopardized features must be effected in accordance with the principles of the Venice Charter, and the date of any complete replacement must be indicated.

Article 14. The historic garden must be preserved in appropriate surroundings. Any alteration to the physical environment which will endanger the ecological equilibrium must be prohibited. These applications are applicable to all aspects of the infrastructure, whether internal or external (drainage works, irrigation systems, roads, car parks, fences, caretaking facilities, visitors' amenities, etc.).

Article 15. No restoration work and, above all, no reconstruction work on a historic garden shall be undertaken without thorough prior research to ensure that such work is scientifically executed and which will involve everything from excavation to the assembling of records relating to the garden in question and to similar gardens. Before any practical work starts, a project must be prepared on the basis of said research and must be submitted to a group of experts for joint examination and approval.

Article 16. Restoration work must respect the successive stages of evolution of the garden concerned. In principle, no one period should be given precedence over any other, except in exceptional cases where the degree of damage or destruction affecting certain parts of a garden may be such that it is decided to reconstruct it on the basis of the traces that survive or of unimpeachable documentary evidence. Such reconstruction work might be undertaken more particularly on the parts of the garden nearest to the building it contains in order to bring out their significance in the design.

Article 17. Where a garden has completely disappeared or there exists no more than conjectural evidence of its successive stages, a reconstruction could not be considered a historic garden.

IV. Charter for the Conservation of Historic Towns and Urban Areas (Washington Charter 1987)

This charter for the Conservation of Historic Towns and Urban Areas, which was adopted by the ICOMOS General Assembly in 1987, establishes principles and guidelines for the protection and conservation of historic towns. The charter seeks to complement the Venice Charter, whose emphasis is on the individual monument. It addresses such issues as the integration of preservation objectives into planning policies; the qualities of historic towns that should be preserved; the participation of residents in the preservation process and the social and economic aspects of historic town preservation.

Principles and objectives

1. In order to be most effective, the conservation of historic towns and other historic urban areas should be an integral part of coherent policies of economic and social development and of urban and regional planning at every level.

2. Qualities to be preserved include the historic character of the town or urban area and all those material and spiritual elements that express this character, especially: a) Urban patterns as defined by lots and streets; b) Relationships between buildings and green and open spaces; c) The formal appearance, interior and exterior, of buildings as defined by scale, size, style, construction, materials, colour and decoration; d) The relationship between the town or urban area and its surrounding setting, both natural and man-made and e) The various functions that the town or urban area has acquired over time. Any threat to these qualities would compromise the authenticity of the historic town or urban area.

3. Participation and involvement of residents are essential for the success of the conservation programme and should be encour-

aged. The conservation of historic towns and urban areas concerns their residents first of all.

4. Conservation in a historic town or urban area demands prudence, a systematic approach and discipline. Rigidity should be avoided since individual cases may present specific problems.

Methods and instruments

5. Planning for the conservation of historic towns and urban areas should be preceded by multidisciplinary studies. Conservation plans must address all relevant factors including archaeology, history, architecture, techniques, sociology and economics. The principal objectives of the conservation plan should be clearly stated as should the legal, administrative and financial measures necessary to attain them. The conservation plan should aim at ensuring a harmonious relationship between the historic urban areas and the town as a whole. The conservation plan should determine which buildings must be preserved, which should be preserved under certain circumstances and which, under quite exceptional circumstances, might be expendable. Before any intervention, existing conditions in the area should be thoroughly documented. The conservation plan should be supported by the residents of the historic area.

6. Until a conservation plan has been adopted, any necessary conservation activity should be carried out in accordance with the principles and the aims of this Charter and the Venice Charter.

7. Continuing maintenance is crucial to the effective conservation of a historic town or urban area.

8. New functions and activities should be compatible with the character of the historic town or urban area. Adaptation of these areas to contemporary life requires the careful installation or improvement of public service facilities.

9. The improvement of housing should be one of the basic objectives of conservation.

10. When it is necessary to construct new buildings or adapt existing ones, the existing spatial layout should be respected,

especially in terms of scale and lot size. The introduction of contemporary elements in harmony with the surroundings should not be discouraged since such features can contribute to the enrichment of an area.

11. Knowledge of the history of a historic town or urban area should be expanded through archaeological investigation and appropriate preservation of archaeological findings.

12. Traffic inside a historic town or urban area must be controlled and parking areas must be planned so that they do not damage the historic fabric or its environment.

13. When urban or regional planning provides for the construction of major motorways, they must not penetrate a historic town or urban area, but they should improve access to them.

14. Historic towns should be protected against natural disasters and nuisances such as pollution and vibrations in order to safeguard the heritage and for the security and wellbeing of the residents. Whatever the nature of a disaster affecting a historic town or urban area, preventative and repair measures must be adapted to the specific character of the properties concerned.

15. In order to encourage their participation and involvement, a general information programme should be set up for all residents, beginning with children of school age.

16. Specialized training should be provided for all those professions concerned with conservation.

V. Charter for the Protection and Management of the Archaeological Heritage (1990)

This charter lays down principles relating to the different aspects of archaeological heritage management. These include the responsibilities of public authorities and legislators, principles relating to the professional performance of the processes of inventorization, survey, excavation, documentation, research, maintenance, conservation, preservation, reconstruction, information, presentation, public access and use of the heritage, and the qualification of professionals involved in the protection of the archaeological heritage. The charter has been inspired by the success of the Venice Charter as guidelines and source of ideas for policies and practice of governments as well as scholars and professionals. The charter has to reflect very basic principles and guidelines with global validity. For this reason it cannot take into account the specific problems and possibilities of regions or countries. The charter should therefore be supplemented at regional and national levels by further principles and guidelines for these needs.

Article 1. Definition: The "archaeological heritage" is that part of the material heritage in respect of which archaeological methods provide primary information. It comprises all vestiges of human existence and consists of places relating to all manifestations of human activity, abandoned structures, and remains of all kinds (including subterranean and underwater sites), together with all the portable cultural material associated with them.

Article 2. Integrated protection policies: The archaeological heritage is a fragile and non-renewable cultural resource. Land use must therefore be controlled and developed in order to minimize the destruction of the archaeological heritage. Policies for the protection of the archaeological heritage should constitute an integral component of policies relating to land use, development, and planning as well as of cultural, environmental and educational policies. The policies for the protection of the archaeological heritage should be kept under continual review, so that they stay up to date. The creation of archaeological reserves should form part of such policies. The protection of the archaeological heritage should be integrated into planning policies at international, national, regional and local levels. Active participation by the general public must form part of policies for the protection of the archaeological heritage. This is essential where the heritage of indigenous peoples is involved. Participation must be based upon access to the knowledge necessary for decision-making. The provision of information to the general public is therefore an important element in integrated protection.

Article 6. Maintenance and conservation: The overall objective of archaeological heritage management should be the preservation of monuments and sites in situ, including proper long-term conservation and curation of all related records and collections etc. Any transfer of elements of the heritage to new locations represents a violation of the principle of preserving the heritage in its original context. This principle stresses the need for proper maintenance, conservation and management. It also asserts the principle that the archaeological heritage should not be exposed by excavation or left exposed after excavation if provision for its proper maintenance and management after excavation cannot be guaranteed. Local commitment and participation should be actively sought and encouraged as a means of promoting maintenance of the archaeological heritage. This principle is especially important when dealing with the heritage of indigenous peoples or local cultural groups. In some cases it may be appropriate to entrust responsibility for the protection and management of sites and monuments to indigenous peoples. Owing to the inevitable limitations of available resources, active maintenance will have to be carried out on a selective basis. It should therefore be applied to a sample of the diversity of sites and monuments, based upon a scientific assessment of their significance and representative character, and not confined to the more notable and visually attractive monuments. The relevant principles of the 1956 UNESCO Recommendations should be applied in respect of the maintenance and conservation of the archaeological heritage.

Article 7. Presentation, information, reconstruction: Presentation of the archaeological heritage to the general public is an essential method of promoting an understanding of the origins and development of modern societies. At the same time it is the most important means of promoting an understanding of the need for its protection. Presentation and information should be conceived as a popular interpretation of the current state of knowledge, and it must therefore be revised frequently. It should take account of the multifaceted approaches to an understanding of the past. Reconstructions serve two important functions: experimental research and interpretation. They should, however, be carried out with great caution, so as to avoid disturbing any surviving archaeological evidence, and they should take account of evidence from all sources in order to achieve authenticity. Where possible and appropriate, reconstructions should not be built immediately on the archaeological remains, and should be identifiable as such.

Article 9. International co-operation: The archaeological heritage is the common heritage of all humanity. International cooperation is therefore essential in developing and maintaining standards in its management. There is an urgent need to create international mechanisms for the exchange of information and experience among professionals dealing with archaeological heritage management. This requires organizing seminars, conferences, workshops, etc. at global as well as regional levels, and the establishment of regional centres for postgraduate studies. ICOMOS, through its specialized groups, should promote this aspect in its medium- and long-term planning. International exchanges of professional staff should also be developed as a means of raising standards of archaeological heritage management. Technical assistance programs in the field of archaeological heritage management should be developed under the auspices of ICOMOS.

VI. National Policy for Conservation of the Ancient Monuments, Archaeological Sites and Remains (NPC–AMASR) protected by the Archaeological Survey of India, February, 2014

National Policy for the Conservation of the Ancient Monuments, Archaeological Sites and Remains (NPC-AMASR) continues, on the one hand, to further the already laid-out objectives of safeguarding monuments and sites of national importance and, on the other, envisions bringing in renewed impetus for contemporising and indigenising the conservation approach. The process of conservation [of monuments] is being aimed to manifest itself as a dynamic enterprise intertwining concerns for the sustenance of their physical fabric with their overall effective management. As we have moved into the second decade of the twenty first century, the duty of the Archaeological Survey of India (ASI) will be to conserve these monuments [along with their setting] with utmost care, to be cherished upon by the nation as "national treasures".

The proposed Policy primarily focuses on all Ancient Monuments and Archaeological Sites and Remains, declared as monuments of national importance under the AMASR (Amendment and Validation) Act, 2010 and does not, for the time being, include unprotected built heritage. The Policy may be read in conjunction with the provisions of the AMASR (Amendment and Validation) Act, 2010. The Policy is envisaged as a dynamic document and, as it is put into operation by the ASI's archaeological officers and field staff, it is subject to periodical reviews as may be decided by the Archaeological Survey of India. It is also hoped that the proposed Policy is applicable to a vast number of state protected monuments spread all over the country. The details of the National Conservation Policy are as under:

1. Monument and its Context

1.01 "Ancient Monument" means any structure, erection or monument, or any tumulus or place of interment, or any cave, rock-sculpture, inscription or monolith which is of historical, archaeological or artistic interest and which has been in existence for not less than one hundred years and includes:

i. the remains of an ancient monument,
ii. the site of an ancient monument,
iii. such portion of land adjoining the site of an ancient monument as may be required for fencing or covering in or otherwise preserving such monument,
iv. the means of access to, and convenient inspection of an ancient monument.

"Archaeological Site and Remains" means any area which contains, or is reasonably believed to contain, ruins or relics of historical or archaeological importance which have been in existence for not less than one hundred years, and includes such portion of

land adjoining the area as may be required for fencing or covering in or otherwise preserving it, and the means of access to and convenient inspection of the area.

1.02 The term *"Monument"* mentioned in the Policy shall connote "The Ancient Monuments and Archaeological Sites and Remains" as defined in Section 2 (a) and 2 (d) of the Ancient Monuments, Archaeological Sites and Remains (Amendment and Validation) Act, 2010 unless specified otherwise.

1.03 *"Monuments"* comprise a vast array of human-built edifices, either standing or underground or still buried, and these reflect tangible manifestation of India's rich past. Monuments include archaeological sites and mounds, cave shelters, rock-cut temples, monoliths, sculptures and bas-relief panels, underground structures and architectural heritage representing various categories, e.g., religious, palatial, residential, defensive, funerary, civic, institutional, landscapes, etc. The monuments may be 'functional' or 'non-functional' depending upon whether or not these are functioning as per their original intended use.

1.04. "*Monuments*" were often built as part of a wider urban or natural context / setting and not built in isolation. Thus, monuments should be conceived as inseparable part of their immediate context or setting.

1.05 Monuments reflect myriad applications of building materials, such as, mud, wood, stone, brick, lime, metal, glass, etc., or composite material application, used under different construction techniques, often representing different architectural styles and styles of ornamentation (structural and applied), reflecting influences from other regions and diverse cultures due to cultural interactions in the past millennia. There are considerable regional and local variations in monuments in terms of materials, styles and techniques also due to influence of vernacular (indigenous) architecture.

1.06. All Monuments, once declared nationally important, irrespective of their living or non-living status, transcend their original function and should be valued and conserved in a spirit of being exemplars of past cultures and represent exemplary human creativity, building crafts tradition, patronization, and architectural and/or artistic and/or engineering accomplishments. These monuments also serve as tangible manifestation of historical and cultural events and developments of our past that spreads over several millennia.

1.07. All monuments that are declared nationally important are deemed to have high value / significance -- archaeological (including architectural, artistic and engineering), historical (including events and association), cultural (including religious and intangible) and ecological. Monuments can have either a single or a combination of these values which contribute to their importance at the national level.

1.08. All monuments are irreplaceable and non-renewable cultural resource of the country, a by-product of a multi-ethnic and diverse culture. Irrespective of their scale, location and type, monuments, once declared so, should be regarded as National Treasures or National Icons. Utmost care must be taken to protect and preserve them for posterity.

1.09. The understanding and interpretation of a "Monument" has changed with time, over the past 100 years, world-wide. Many more categories of historic buildings and sites are considered heritage and are being conserved by countries across the world. The process of identifying monuments of national importance also representing under-represented and / or including types, such as, but not limiting to, for instance, historic gardens, historic cities (settlements and precincts), industrial heritage, vernacular heritage, cultural landscapes, cultural routes, etc., should be regularly undertaken.

2. Terms and Definitions

2.01 *Conservation* means the processes through which material, design and integrity of the monument is safeguarded in terms of its archaeological and architectural value, its historic significance and its cultural or intangible associations.

2.02. *Structure* means any building, equipment, device or other facility which is fixed to the land and is a part of the monument, site and/or archaeological remains.

2.03. *Intervention* means the action undertaken with the objective of conservation, as outlined in the sub-articles 2.04 to 2.17, for the safeguarding of a monument and its integrity.

2.04. *Fabric* means all movable and immovable contents of or within a Monument including its setting.

2.05. *Maintenance or preventive conservation* means the such care of a monument as is exercised in order to prevent damages and deterioration and to avoid an intervention as long as possible. All monuments should be duly maintained in order to retain their significance regularly monitored to and thwart any major unnecessary intervention.

2.06. *Preservation* means maintaining the *status quo* of a monument including its setting, there by not allowing any changes, either through deliberate human interventions or due to action of natural agents of decay, to its fabric or its immediate environment.

2.07. *Repair* means removing or replacing decayed or damaged material or portion of a monument in order to impart stability and to prevent loss of original material.

2.08. *Restoration* means bringing back the monument or any part thereof, as nearly as possible, to an earlier known state or condition.

2.09. *Reassembly or Reinstatement* (*Anastylosis*) means putting existing but dismembered parts back together.

2.10. *Reinstatement* means putting components of earlier material back in position.

2.11. *Adaptation or Adaptive Reuse* means modifying a lesser significance part of the monument, or a place inside or outside it, to suit it to a compatible use, involving , as little as possible, loss of value (as outlined in Sub-article 1.05).

2.12. *Reconstruction* means to rebuild in the original form.

2.13. *Retrofitting* means to consolidate a monument's structure by inserting new parts or new material / technology in order to improve their safety and to make them functional.

2.14. *Scientific clearance* means systematic removal of historic building material -- debris buried within or outside the monument, not necessarily at that location -- to retrieve any buried architectural members or sculptures, etc., for purpose of their study, investigation and possible reinstatement.

2.15. *Stabilization* or *Consolidation* means action to arrest processes of decay using external agents that are "time tested and proven scientifically".

2.16. *Transplantation or Translocation* means to remove the monument from its existing location and to relocate it at an alternate location.

2.17. *Cleaning* means periodic removal of any harmful encrustations or non-original surface deposits and bio-deteriorating agent from the surface of a monument.

2.18. *Authenticity* is a value / significance imparted to a monument through a truthful and accurate depiction of one or more of the following elements: location and setting; form and design; materials, construction techniques and building craftsmanship and function and traditional management systems

2.19. *Integrity* is the quality/ extent of the completeness / intactness of the monument demonstrated through its attributes such as structural, functional (in case of a living monument) and visual.

3. Conservation Principles

3.01. Conservation of monuments, archaeological sites and remains constitutes all necessary actions or interventions within and around a monument which are undertaken, as and when deemed necessary, in order to: (a) prolong its life and existence; (b) prevent its damage and deterioration; (c) minimise the impact of external agents of decay (natural and human induced) on its setting, structure and material and (d) prepare it for natural or human induced disasters.

3.02. A monument or an archaeological site should be subjected to minimum -- whilst only necessary -- interventions so as to maintain its authenticity and integrity. Original / historical material and an architectural / ornamental detail (structural or non-structural) must be valued and retained for as long as possible and should not be replaced without the conduct of a proper investigation or simply because these have lost their original form and appearance as a result of slight erosion or natural processes of deterioration.

3.0. All efforts to conserve a monument should be made to retain its value and significance, its authenticity and integrity, its visual connections to and from the monument, and to sustain a truthful representation of its original / historic appearance. The purpose of such an effort should be to ensure that the monument is kept in its original state or, in certain cases, restored to an earlier known state or to a state as it was discovered at the time of its identification and notification.

3.04. The conservation of a monument is a continuous process. Adequate resources (human and financial) should be made available to conserve it for posterity.

3.05. The conservation of a monument should, under no circumstance, be based on any conjecture or artistic imagination and should be based on reliable documentary evidences (past conservation records, documents, paintings sketches, drawings, photographs, travelogues, etc.) and/or *in-situ* archaeological evidences.

3.06. Conservation should be treated as a multi-disciplinary enterprise that focuses on developing holistic solutions against various agencies of decay and deterioration that are acting on the monument. Comprehensive and careful study of all relevant aspects should be undertaken to develop an over-arching conservation philosophy and approach for each monument.

3.07. The conservation of the original / historical material should be aimed as an essential pre-requisite to sustain the time-dimension of a monument which confirms its antiquity and faithfully maintains its authenticity.

3.08. Interventions such as restoration, consolidation, reproduction and retrofitting carried out within a monument should, as far as possible, be clearly discernible as a later alteration / repair / restoration, etc., to be able to clearly identify them from the original fabric of the structure. Nonetheless, in certain cases, where a monument is being restored with the intention of merging [a new intervention] with the original fabric, for the sake of maintaining architectural integrity, work must be done very carefully by matching the original material / details in terms of form, colour and specification, preferably through the use of the same material and employing traditional skills as used in the original fabric. Such interventions should, as far as possible, be reversible in nature. The decision for achieving such objectives should be carefully recorded and documented for posterity.

4. Conservation Approach

4.01. The conservation of a monument should employ appropriate scientific equipment and technology to facilitate research and the understanding of its physical nature, the analysis of its materials and construction technology, and that of its current condition. The use of appropriate technology should also be mandated for documentation purposes.

4.02. Conservation should not only limit itself to the intervention within the structure / fabric of a monument but shall also include the protection and maintenance of the setting or environment that is integral to it.

4.03. Conservation should include regular monitoring and continuous care of a monument and its setting. Short-term (up to 2 years), Mid-term (2 – 5 years) and Long-term (5 years and above) monitoring and maintenance plans should be developed and implemented to prevent any further deterioration of the structure that may warrant unnecessary comprehensive conservation work later.

4.04. Documentation should be an essential pre-requisite before conserving a monument. Documentation aids in understanding the nature of the fabric of a monument, its value as well as its current condition that should be used as basis by which the required Conservation Plan can be prepared.

4.05. Regular inspection must be undertaken by the archaeological officers to ensure routine visits to monuments, at least once a year, to examine the condition of a monument and to draw up inspection notes which will aid in the preparation of necessary conservation programme or plan.

4.06. Annual Conservation Plan (ACP) should carefully be drawn up by all Circles clearly prioritising conservation works for monuments based on available resources in a given financial year. Priority should be given to works of urgent nature required to preserve or consolidate a monument. Annual Conservation Plan can be revised, from time to time, in cases of emergency or in case of any unforeseen circumstance emerging during the execution of conservation works. Annual plans should also be drawn up for providing amenities or necessary infrastructure within monuments.

4.07. It is important to prepare a Conservation Plan for a monument preceding actual conservation work, in order to understand the proposed intervention[s] in the context of a monument's typology and function. The Conservation Plan should clearly define the value based approach to conservation and outline the extent of proposed conservation interventions. Conservation Plans should be reviewed regularly to evaluate previous measures and their effectiveness. Plans should be revised to incorporate modifications from time to time or if any new concern is observed that impacts the authenticity and integrity of the monument. The plan should be reviewed once every five years. Site Management Plans (SMPs) may also be prepared for monuments to address all relevant extrinsic and intrinsic issues. SMPs should be prepared by multidisciplinary team of professionals, in consultation with ASI's archaeological officers, to assist ASI in adopting a coordinated approach (by addressing the concerns of all relevant stakeholders) to conserve and manage a monument along with its setting.

4.08. Conservation works should be peer reviewed from time to time by a group of multidisciplinary experts who should examine the quality of on-going conservation works and whether conservation is being carried out according to the approved conservation plan.

4.09. The entire process of conservation should be documented prior to, during and after conservation in maps, drawings, photographs, as digital records and field notes so as to create records of interventions. The documentation should capture various stages of intervention and all relevant details. This will be useful from the point of view of understanding all past and current interventions in the future.

4.10. Critical attention should be paid in case where a monument is in use and continues to perform its originally intended function. In such cases, it is important to review existing conservation approaches / philosophies keeping in mind conservation concerns as well as functions that are being performed within the monument. Thus, conservation and functional / administrative issues pertaining to such a monument should be seen as a harmonious and complementary activity and should be balanced in a way that its authenticity and integrity is not compromised.

4.11. Original / historical material or details may or may not be replaced. Action in this regard will depend upon whether or not the archaeological or architectural integrity of the monument is to be retained. Replacement of parts of the material fabric or a detail may be considered only if it has completely lost its inherent material strength or structural integrity. Replacement may only be undertaken to prevent further deterioration, formation of faults or decay of other portions of the structure. This aspect may be borne in mind whilst replacing a structural or architectural member. Missing or damaged sculptures, idols, wall paintings, inscriptions etc., should not be replaced or attempted to be completed.

4.12. If the original material or detail is at all to be replaced, it must be the last option to be exercised and shall be undertaken only upon ensuring that no other conservation action can ensure its *in-situ* survival. The original material / detail, once it is decided for replacement, as far as possible, should be stored in a safe environment for the purpose of conducting further investigations / research, or it may even be put on display for the purpose of education or study.

4.13. Time-dimension (i.e., antiquity or age) should be maintained by preserving the patina (benign surface encrustation) of the material or its surfaces (exterior and interior). Hence, measures should be taken to clean the material in a way that even all bio-deterioration agents and harmful / non-original surface encrustations are removed, the patina, which is the protective layer, is maintained. Any intervention to clean surfaces should be undertaken after thorough research and documentation.

4.14. The use of inappropriate chemicals for cleaning monument surfaces and synthetically produced building materials for conservation should be avoided, keeping in view their incompatibility with the original fabric of a monument. The likely action of any synthetically produced material to be used in repair, restoration or renovation upon the surface or stability of the structure must be properly investigated before its actual use in conservation work.

4.15. Highest attention should be paid to the conservation of fragile ornamentation embellishing a monument. All efforts backed by scientific knowledge should be made to protect and preserve them *in-situ* for as long as possible. In case all efforts to preserve the fragile ornamentation *in-situ* fail to protect its material and visual integrity, an assessment should be made to remove and place them in a safe environment whilst replacing them with reproductions of the same profile and specifications to maintain architectural integrity. This, however, is to be done only in extremely rare cases.

4.16. It is important to respect various additions / alterations in time or "layers of history" that have contributed to the development or evolution of a monument. In cases where inappropriate modern or recent additions and/or alterations have been made to the monument in the recent past, after its protection, which have a direct impact on the authenticity / integrity of the monument, it may be desirable to remove or undo such interventions. The monument should then be restored to either its original or an earlier known state depending upon the available evidences. In no case, however, should any part, original or pre-modern, be removed on grounds of improving the appearance of the monument, or changing its complexion, or to achieve a better perceived conformity with its function.

4.17. In any attempt for consolidation that is carried out by inserting new material or by use of chemicals, the nature and specifications of the original / historical material should be kept in view. The new material to be used for the conservation should match in specification the original / historic material or should be complementary and compatible. Prior to any intervention, it is desirable that the original / historical material should be analysed for its composition and specifications and for the new material to be accordingly selected.

4.18. Landscaping and horticultural practices, including surface development, are necessary within and around a monument to provide a cleaner, dust free micro-environment, to create comfortable spaces, and to enhance visual perception. Introducing a new landscape within and / or around a monument should put greater emphasis on the use of local flora, and should, as far as possible, be least maintenance oriented and be self-sustainable.

4.19. Formal landscapes (for instance, historic gardens) that were intrinsically designed and laid out as a part of a monument, should be preserved, as far as possible, as per the original design and intent, yet respecting various historic layers of interventions. Any contemporary inappropriate alterations should be carefully removed so as to not to damage the historic landscape and its layout. In certain cases, it may also be necessary to undertake archaeo-botanical investigations in earlier records (paintings, photographs, descriptions, etc.) or scientific clearing to discover original landscape features that may have been buried over time. It is desirable to use appropriate technology to establish conformity with the original plantation and species of flora that were planted and laid out in a historic garden before proceeding with the restoration of its original/earlier layout.

4.20. Conservation of a monument should not limit itself to structural interventions but should also consider, wherever necessary, restoration of historic interiors which alleviates the visitor's experience and understanding of the function of a monument. Historic/original furniture and furnishings, including illumination, can be authentically restored in certain types of monuments, for instance, in mediaeval forts and palaces, to bring out their functional context. However, this should be done only on the basis of documentary or material evidence and no conjecture or artistic impressions should be allowed in restoring historic interiors. Under no circumstance historic interiors of the ancient monuments should be used as recreation spaces.

4.21. Special care should be taken at archaeological sites or mounds wherein architectural remains or artefacts found on its surface or sub-surface should also be carefully preserved at the site or scientifically cleared (after proper documentation) from the site to be kept in a safe custody. It should accordingly be decided whether the extracted architectural or structural remains can be used during the process of preservation of the archaeological site (*anastylosis*).

5. Conservation of Monuments (Value based Approach)

5.1. It is important to define the nature of conservation intervention for monuments that is based on their value / significance which is determined by the nature and extent of intervention required for its conservation. The imperative of such value based approach is derived from the nature / typology of a monument and from the interpretation of its value / significance.

5.2. Preservation should be the major objective in the case of monuments with high archaeological value. These are the archaeological sites or remains of a monument or portions of monuments with decorative features, including those with applied ornamentation, such as wall paintings, inscriptions and calligraphy, sculptures, etc.

5.3. Restoration may be undertaken on monuments with high architectural value and only in parts of a monument wherein there are missing geometric or floral patterns, or structural members of a monument which have been damaged recently. At no cost shall an attempt to restore an entire building be allowed as it will falsify history and will compromise its authenticity. Similarly, decorative features such as wall paintings, inscriptions, calligraphy and sculptures should also not be restored.

5.4. Reconstruction may be undertaken for such monuments wherein such an intervention is the only way by which to retain or retrieve their integrity / context and without which its survival is imminently impossible. Reconstruction should be attempted only in extreme cases, such as damage or destruction due to the impact of a disaster (natural or human induced) or structural failure, and should be undertaken only on the basis of evidence and not conjecture.

5.5. Reproduction of members of a monument may be undertaken for such a monument whose original members (structural and/or ornamental) have deteriorated and lost their structural and material integrity and removing these from their original location is the only way to safeguarding those members as well as the monument itself.

5.6. Sympathetic and Adaptive Reuse can be undertaken only for ancillary portions of a monument, should this be the way to maintain and/or sustain the monument or to incorporate complementary functions for instance, ASI's field offices, interpretation centres, inspection rooms, storage spaces, public amenities, etc. Such re-use should be strictly limited to the services necessary for the monument's preservation, and should not be extended to the construction of residential buildings or offices that are dedicated for other purposes. All such construction should also be subject to provisions of Articles 14.02 and 14.03.

5.7. Transplantation or Translocation of a monument is to be done only in the rarest of rare circumstances, and that it should only be undertaken as a means for safeguarding the integrity of the monument. Such removal deprives a monument of its original spatial context and should be considered only if the monument cannot be maintained or preserved in its original surrounding. Transplantation should precede comprehensive documentation, a thorough recording of all events and circumstances that necessitate such intervention. Translocation of the monument should be undertaken after careful analysis of the new site (to which the relocation is proposed), and aspects such as soil investigation and visual integrity.

6. Role of Building Craftsmanship in Conservation

6.1. India is privileged to benefit from the continuing existence of traditional masons, crafts persons, carvers etc., who pursue their traditional practices in different parts of the country. They practice pre-modern traditions of construction, detailing, sculpting, carving, painting and traditional knowledge systems developed and inherited by them which are replete with the understanding of ritualistic aspects and principles and with elements of design employed in the construction or carving of architectural or ornamental members embellishing a monument. In most cases these traditional knowledge have been transferred hereditarily for generations or following *Guru-Shishya-parampara* (teacher-disciple tradition) and is largely unrecorded.

6.2. Crafts-persons that comprise traditional builders and masons such as *Sthapatis*, stone carvers, carpenters, woodcarvers, ironsmiths, painters etc., to name a few, can play a great role in the conservation process as they are living repositories of building and artistic traditions which have been sustained through generations. Their role in conserving a monument is paramount.

6.3. As far as possible, traditional skills should be utilised in the maintenance, repair and conservation of monuments for which they are relevant. Efforts should be made to utilise genuinely traditional skills and not accept false or fraudulent claims.

6.4. Traditional and ritualistic knowledge in building construction and in the understanding of a material and its application should not only be respected but should also be widely applied after following the conduct of a proper trial or tests as to their acceptability in the conservation of a monument, for which it is appropriate.

6.5. Significantly, in the context of a monument, the employment of crafts- persons and the utilisation of their skills should be limited to the restoration and reproduction of geometric designs, patterns and carvings as well as in the implementation of restoration and reproduction of designs in historic interiors that based on documentary or *in situ* evidences and not for exercising his/her creativity. Thus, the replication of sculptures and inscriptions (including calligraphy) on ancient or mediaeval monuments should not be allowed as such an act will decisively compromise with their antiquity and integrity. Traditional craftsmanship should also be widely used for the reconstruction or the adaptive reuse of a monument.

6.6. Conservation should, therefore, be a medium to support and encourage these traditional masons and crafts persons as well as nurture their traditional systems of knowledge and schools. Not only should traditional knowledge systems be documented, but transmission of these to the younger persons should also be encouraged so as to advance their participation and learning in these building crafts techniques. Such persons can then be employed, as and when required, in the conservation of monuments.

6.7. Conservation should be seen not merely as a product-centric enterprise (i.e., conservation of a monument) but as a process-centric endeavour wherein promoting and sustaining building crafts, and communities practicing these, become an integral practice in safeguarding a monument.

7. Capacity Building

7.1. Conservation of a monument, being multi-disciplinary and scientific enterprise, demands regular training and the creation of professional expertise such as that of archaeologists, conservation architects, engineers, scientists, horticulturists, planner, surveyors etc., to name a few. Capacity building has to be undertaken not only for professionals within organisations, such as the ASI, but also with allied professionals, technicians, academicians, crafts-persons etc., so as to update and upgrade present conservation methods and to enable the adoption and adaptation of best conservation practices available anywhere nationally or internationally.

7.2.There is a strong need to develop, maintain and regularly update a pool of trained and skilled conservators, artisans and crafts-persons and they must be engaged in and exposed to a variety of conservation activities, nationally and internationally and from time to time, depending on the expertise and skills required for specific conservation projects.

7.3. Considering the fact that monuments are an irreplaceable and non-renewable heritage resource, responsibility for documenting and conserving these monuments should be entrusted to the ASI technical staff or professionals who have undergone proper training in the field of conservation. Anyone who is involved with the conservation of monuments should be well versed with the nature and behaviour of historic materials and their application including the impact of agents (natural and human-induced) that cause their decay and deterioration. Capacity building of such a person should be undertaken to enable him/her to develop a holistic understanding of the monument (including its setting) and the knowledge required for its safeguarding and maintenance.

7.4. More and more universities and educational institutions across the country should be encouraged to impart training to professionals and practitioners and offer specialisation in conservation and management of monuments. Specialised courses at graduate, post-graduate and doctoral levels, including short term courses, should be developed and conducted regularly so as to train young professionals and practitioners.

7.5. Collaborative programmes should be encouraged amongst institutions, organisations and laboratories working and researching on the different aspects of documentation and conservation in order to share information and expertise in these fields.

7.6**.** Central and state agencies, responsible for the conservation of state protected monuments or unprotected historical buildings, should also be encouraged, from time to time, to send their in-house staff for training so as to enhance their knowledge and skills in the various fields of conservation and management of monuments.

8. Promotional / Outreach Programmes

8.1. It is necessary to generate public awareness, to educate and involve people by instilling in them a sense of delight, appreciation and pride for monuments, to make them understand the importance of various legislations in protecting heritage and to join hands with various agencies working to protect this tangible cultural wealth for posterity. The aim is to make the local communities and visitors aware about their responsibilities towards the monuments of the country, so as to obtain their aid in the task of their preservation and maintenance.

8.2. All related agencies responsible for the conservation of monuments should therefore organise, from time to time, awareness campaigns and promotional/outreach programmes about the monuments of the country. The programmes should focus on various aspects related to their history and conservation, and to educate and sensitise local communities in preserving these monuments. Visitors should be encouraged to engage themselves in discoveries at the site at Site Museums attached to the monuments. Special pamphlets and brochures should be developed and distributed freely to a visitor whilst acquainting him/her with the history and context of the monument.

9. Tourism and Visitor Management

9.1. Undoubtedly, there has been an unprecedented interest amongst national and foreign visitors to visit monuments for a variety of reasons, such as for education, information, pilgrimage, recreation and entertainment. A visitor gains tremendous knowledge and insight not only about the history of a monument or an archaeological site but also about the social, cultural and economic aspects of its patron and/or the builder or contemporary society at large.

9.2. Tourism, as an industry, plays a very important role in promoting visitation to monuments and in providing all necessary infrastructures for its support. However, it has been experienced that, in some instances, due to over-visitation in some of the monuments, these are subjected to tremendous adverse pressures which catalyse their decay and deterioration.

9.3. It is, therefore, important to determine the carrying capacity of a monument, especially where visitation is in very high numbers. In order to better protect and preserve such monuments, the number of people visiting them as well as their access should be managed and, if situation demands, these may have to be limited temporarily, especially in such areas or parts that are highly vulnerable to decay an /or deterioration. Aspects like fragility, rarity as well as apprehensions of the permanent irreversible damage on the monument or its part should be looked into so as to determine how many visitors can be allowed to visit it within a day or at a given period in time.

9.4. Suitable facilities/infrastructure should be created within or near the monument for the convenience of visitors. Facilities like parking that allows for a sufficient number of vehicles, toilets, cloak room, potable water, audio-guide facilities, ticket booths, souvenir counter etc., should be located in a way that these are easily accessible prior to entering a monument. Similarly, guidebooks or pamphlets indicating a monument's history, its architecture and planning, and various do's and don'ts, should be provided to a visitor in order to enhance his/her understanding of the site.

9.5. Significantly contributing to the understanding and appraisal of a monument is the facility for interpretation. Interpretation Centres should be established at suitable locations to provide information and interpretation about the monument not only with regards to its history, architecture and events associated with the monument etc., but also about its setting, thereby aptly placing it in its appropriate regional, socio-cultural and socio-political context. Appropriate medium, technology and innovative methods of interpretation should be adopted for demonstration and presentation of information to a visitor. Depending upon the type of visitor, information can be provided in multiple languages.

9.6. Interpretation centres should be designed and located in a way that these do not disturb, in any way possible, the environment and setting of the monument. As far as possible, the use of vernacular (local) material and techniques or the use of materials complementary to the historic building material of the monument should be adopted for the construction of the interpretation centre.

9.7. Visitor access and circulation should be worked out to facilitate movement within the monument in order to achieve optimum visitation thereby causing least hindrance. However, care should be taken in controlling access to areas which are vulnerable to excessive influx of visitors (as provided for in Article 9.03).

9.8. Adequate signage (sign-boards) should be provided at appropriate locations to give necessary and unambiguous information such as access points, at points of entry, at appropriate locations at its various sections, and at facilities within and near the monument. Signage should also be provided at suitable locations within the monument in order to explain authentically its history and nature and/or its significance and values. Signage should be designed in a way that they are clearly legible, and materials used should be those that complement the nature of the monument.

10. Illumination of a Monument

10.1. Monuments often act as landmarks in urban areas or settings of which they are a part of. This aspect can be accentuated through the introduction of appropriate lighting that allows for interplay of light and shade which will highlight their presence and appearance within the setting.

10.2. Monuments maybe illuminated for the benefit of visitors and local communities who may either, as decided on a case to case basis, be allowed to visit and experience them during certain hours in the evening or to appreciate their constant presence. In most cases, monuments may be illuminated externally at night to invite attention to their form and silhouette as well as for their security.

10.3. Illumination should be done in a way that the monument is not subjected to bright lights that may attract insects, especially during monsoons, or result in fading the colour of its surfaces, especially when these are painted or carved. In cases where illumination is placed internally within a monument, care should be taken so that the illumination levels are appropriate and no distortion in the colours of the wall surfaces occurs or on its decorative features, such as, on wall paintings, etc.

10.4. Appropriate technology should be selected for illumination so that no intervention is made on the structure or fabric of a monument. Lighting, wiring, and related utilities should be designed and located in such a way that these are not visible during the day. The technology applied/used should, as far as possible, be self-sustainable and easy to maintain. The use of natural sources of energy, wherever possible, should be encouraged, provided that this technology that is adopted for the harnessing of natural sources of energy does not, in any way possible, impact on the visual integrity of the monument.

13. Access for the Differently-abled persons

13.1. The benefits of visiting a monument should be available to all the citizens of the country including those who are differently-abled and are unable to enjoy normal access or view of a monument.

13.2. Care should be taken to employ all means possible to facilitate access, provide specially designed visitor amenities, as well as provide information and interpretation of a monument to differently-abled individuals by employing appropriate means.

13.3.However, due care should be taken to provide facilities and access in a way that such provisions do not, in any way possible, compromise the authenticity and integrity of the monument or create visual disorder.

13.4. Whilst all due emphasis should be given to provide access to a monument for differently-abled persons, in cases where such an access for them leads to major physical interventions within the monument's structure that impacts its integrity, it may be necessary to resort to the alternate option to create special areas within or around the monument from where maximum view [of the monument] can be provided/enjoyed.

14. New Interventions within a monument

14.1. Monuments, contrary to the belief that they are frozen entities in space, actually have an inherent dynamism as they continue to 'evolve' over periods of time. The evolution may not always be in terms of changes in the fabric of the monument itself, but in terms of their existence in the continually changing environment surrounding it. It may be necessary at times to intervene within or around a monument from the point of view of providing amenities for the comfort of its visitors or for the convenience and function of the ASI staff or to address security concerns within and around the monument.

14.2.Any such new intervention within or around the monument should be done with great care and in a way that does not reduce its significance as well as values of its environment in terms of being an incompatible intervention in terms of design, material, colour or scale. For physical interventions to the environment within or around a monument, preference should be given to materials that are compatible with its historic building fabric or that are vernacular (local), which reflects the building characteristics of the region to which the monument belongs to.

14.3. Any new intervention should, as far as possible, blend with the historic character of the monument and its setting and should not offer contrast which distracts one's attention from the monument itself. New materials or construction techniques, if at all to be employed for the construction of new buildings within a monument's immediate environs, should be handled with great care and sensitivity, so that these do not become eye-sores with the passage of time or spoil in any way the appearance of the monument.

14.4. Designs and details of any intervention should be such that these are easy to maintain, are self-sustainable and are of the least energy intensive.

14.5. Priority should be given to interventions that employ the reuse of ancillary or secondary portions of a monument or complex. Whilst the main monument should not be subjected to any reuse, ancillary or secondary structures within these monuments or complexes may be considered for "sympathetic and compatible" re-use, subject to restrictions as prescribed in Articles 3.06, 14.02 and 14.03.

14.6. While interventions within the protected area of the monument are governed by the policies that the Archaeological Survey of India follows or adopts, in the surrounding areas, particularly the prohibited and regulated zone existing 300 meters beyond the protected limit of the monuments, it is the National Monument Authority (NMA) which has been mandated to consider matters of construction related activities and interventions. This process also involves the framing of heritage bye-laws with respect to each protected monument/site and such bye-laws cover aspects of heritage control to interventions such as those related to building elevations, façades, drainage systems, civic infrastructure etc., that are to be placed within the defined zone.

15. Disaster Management

15.1. Monuments and archaeological sites are increasingly being subjected to a variety of hazards (natural and human induced) thus exposing their vulnerability to threats and risks. It is, therefore, important for all agencies concerned to be sufficiently prepared to mitigate a disaster, should it strike, and to develop mechanisms for quick Response and Recovery.

15.2.Adequate training should be provided to the monument in-charge to a) identify disasters that can have deleterious impact on a monument on the basis of the past history of disasters in the region, b) to undertake impact assessment for anticipating and visualising disaster scenarios, c) to assess current levels of preparedness in mitigating disasters, and d) to be able to coordinate with various agencies (central, state and local) for developing a quick response post-disaster programme and actions.

15.3. Disaster Management Plan should be made as an important pre-requisite of the Conservation Plan for a monument. It would be useful if vulnerability assessment of each monument also becomes a part of the ASI database.

15.4. All adequate facilities should be provided within the monument, which are to be located at appropriate locations, so as to give emergency treatment to the possible victim[s] of a disaster so that initial proper medical attention can be provided to him/her. Access and evacuation routes and evacuation spaces should be clearly demarcated and indicated through appropriate signage for visitors so as to improve their response mechanisms during a disaster. All efforts should be put in place to a) safeguard the lives of people within the monument or living in its vicinity and b) to safeguard the monument.

15.5. Monuments and their structural members (material, construction technique, jointing etc.) should be ably assessed to determine their behaviour during and against disasters. Should there be a need for necessary minimum retrofitting of a monument, this may have to be carried out so as to provide sufficient consolidation to the monument which will mitigate its possible impact during disasters.

VIII

Preservation of Monumental Heritage and Conservation Initiatives

Cultural heritage is a wide concept. It can be distinguished by built environment (buildings, townscapes, archaeological remains) and natural environment (rural landscapes, coasts and shorelines, agricultural heritage) and artefacts (books & documents, objects, pictures). Today, we find that heritage is not only manifested through tangible forms such as artefacts, buildings or landscapes but also through intangible forms. Cultural heritage includes tangible culture such as buildings, monuments, landscapes, books, works of art, and artefacts, intangible culture such as folklore, traditions, language and knowledge, voices, values, traditions, oral history and natural heritage including culturally significant landscapes, and biodiversity. Tangible heritage is generally split into two groups of movable and immovable heritage. Immovable heritage includes buildings (which themselves may include installed art such as organs, stained glass windows, and frescos), large industrial installations or other historic places and monuments. Moveable heritage includes books, documents, moveable artworks, machines, clothing, and other artefacts, that are considered worthy of preservation for the future include objects significant to the archaeology, architecture, science or technology of a specified culture. Intangible cultural heritage consists of non-physical aspects of a particular culture, more often maintained by social customs during a specific period in history. These include social values and spiritual beliefs, artistic expression, language and other aspects of human activity. Natural heritage is also an important part of a society's heritage, encompassing the countryside and natural environment, including flora and fauna, scientifically known as bio-diversity, as well as geological elements (including mineralogical, geo-morphological, paleontological etc.), scientifically known as geo-diversity. These kinds of heritage sites often serve as an important component in a country's tourist industry, attracting many visitors from abroad as well as locally. Heritage can also include cultural landscapes.

India has a rich cultural heritage inherited from the past generations in the form of living traditions, folklore, legends, popular beliefs and rituals and performing and visual arts, etc. on the one hand and the archaeological or monumental heritage on the other. Preservation of these heritage is a complex issue, particularly in view of the rapid changes due to globalization, uncontrolled growth of tourism and over exposure in the name of tourism, indifferent attitude of people towards our fragile environment and heritage due to lack of awareness. Sometimes questions are raised about the need and necessity of the preservation of and benefits from heritage. Heritage is the reflection of the identity of the people and the nation identifies him or herself with one's heritage, which gives a sense of pride. By preserving our traditional arts and crafts and patronizing them, their continuity becomes possible. It is our heritage, which draws tourists to our country and also motivates people from one part of the country to visit the other part and brings economic benefit to the people of the area.

So far as the archaeological or monumental heritage are concerned, it is vast and varied and distributed throughout the country reflecting tangible manifestation of India's rich past and represents variety in terms of medium, materials and techniques. These comprise a vast array of human-built edifices, either standing or underground or still buried, including ancient habitation remains in the form of mounds and burial sites, cave-shelters, rock-cut caves, temples, monoliths, inscriptions, sculptures and bas-relief panels and architectural heritage representing various categories, e.g., religious, palatial, residential, defensive, funerary, civic, institutional, landscapes etc., both functional or non-functional, depending upon whether or not these are functioning as per their original intended use. Each one of them is significant on its own and reflects and is conditioned or influenced by religion, society, economy, environment etc., and is a part of our history and tradition. They are valuable link between the past and the present. Another important point is that conservation of a monument is not a one-time affair. Time, diverse climate, vandalism, deliberates and natural destructions have contributed to their masonry decay. Since the building is old and is in a state of decay, its condition is regularly monitored and remedial measures taken.

Preservation of heritage, however, does not end by declaring a particular monument or archaeological site as protected. These have to be preserved in a manner so that these do not get damaged any further. Each monument or site has its own specific problems for the preservation. Even though different agencies are responsible for its preservation, involvement of community is essential. Individuals as well as the community have an important role to play by identifying hitherto unknown monuments, sites and antiquities, take up the work of listing and documenting them and maintain vigil so that the monuments are not damaged or destroyed and antiquities are not removed or stolen from their location. Awareness about this rich heritage will help in preserving it for posterity. In recent years, as a result of awareness about the need and importance to preserve our cultural heritage, as a first step, some of the organizations have started listing and documenting the cultural heritage. There is also a shift from individual monuments to heritage areas including streets, towns and even cities.

Conservation of Monumental Heritage Initiatives in India

Conservation of historic monuments in India as a matter of policy was taken up only in the nineteenth century. However, the practice of restoration/ *jirnoddhara* of the structures were prevalent in the country since ancient times. Whenever a new temple is constructed, provisions were also made for its maintenance and repairs as revealed from inscriptions. Terminology such as *Khandajirnoddhara, Sphutita, Khandasphutitanavakarma*, *Navakarma, Nava sudha karma* etc., have been used for repair, renovation, restoration of fallen parts or those which are damaged, mutilated and decayed, removal of soot due to application of oil and growth of moss and various types of accretions, additions or alterations to the existing structure or complete renovation of an edifice, and for colour or lime washing, etc. The steatite relic casket found from Shinkot in Bajour in Pakistan refers to the conservation of corporeal relics of Buddha in the reign of Menander. Restoration of a bund of Sudershana Lake in Junagadh was carried out by Saka Satrap Rudradaman in the middle of second century CE. There is specific reference of repairs of Pashupatinatha temple at Kathmandu by replacing the old wood works. The Chinese pilgrim Hieun Tsang, who visited in 629CE, also mentioned the practice of repairs by using old materials of earlier structures built in the first century BCE. Mandsor stone inscription of Kumargupta records the restoration of Sun temple in 473-74 CE; Khoh copper-plate inscription records the maintenance of Pushtapurikadevi, etc. The Somnath Temple in Gujarat is an outstanding example. The copper-plate charter of Pallava king, Parmeswaravarmana I (675CE), revealed that even at the time of construction of temple, provisions had been made for regular income for the periodical maintenance and renovations. There is a record from Ayyampalaiyam in Palani taluk of District Madhurai belonging to Pandaya King Varaguna II (870CE), referring to the repairs carried out to the images. Besides the above, there are a number of epigraphical references regarding repairs, restoration and maintenance of the temples, and also mentions of the names of the artisans, the nature of materials used, etc. It is therefore clear that the preservation and conservation of monuments is not a new technique being followed but it was prevalent even in ancient times.

It was in the year 1774 that Dr. Samuel Johnson took the first initiative for studying the cultural remains of the country and wrote to Warren Hastings, the first Governor- General of Fort William, Calcutta, 'to examine nicely the tradition and histories of the

East, survey of the remains of ancient edifices and trace the vestiges of its ruined cities'. After a decade, this appeal took a concrete shape when the Asiatic Society was founded for enquiring, among other things, into the History, the Antiquities, Arts, Sciences and Literature of Asia. The first attempt in this direction was taken in the year 1800 when Francis Buchanan was officially deputed to conduct topographical survey of the erstwhile Mysore State and later in 1807, of the territories under the immediate authority of the Presidency of Fort William and adjacent regions. The report of these initiatives viz., detailed plans, exact measurements of ancient buildings and historical sites proved a very valuable document. Thereafter, for sometimes this survey work was discontinued. In 1808, the Governor-General, Lord Earl of Minto (1807-13) appointed a Taj Committee and a sum of one lakh of rupees was sanctioned for repairs; in the following years repairs were undertaken at the Taj, FatehpurSikri and other monuments in or near Agra including Sikandra the Fort and tomb of Itmad-ud-Daulah.

Realizing the importance of preservation of our heritage, the Bengal Regulation XIX of 1810 and Madras Regulation VII of 1817 authorized the government with the power to intervene whenever the public buildings are under threat of misuse. Earl Moira or Marquis of Hastings (1813-23) ordered for conservation works at Sikandara, FatehpurSikri, Rambagh, etc. in Agra and surprisingly, under the same Moira, steps were taken to dismantle the marble bath in Shahjahan's palace for a gift to King George IV. Lord Amherst (1813-28) caused special repairs to the Qutb. During the tenure of William Bentinck (1828-35), a move was made to demolish the Taj for the value of its marble.

In 1848, Cunningham, a Lieutenant of the Royal Engineers had formulated a plan for an Indian Archaeological Survey. In the year 1861, the Governor General, Lord Canning felt the necessity of investigation and collection of the remains of which the country was full and confirmed the plan formulated by Cunningham. This task was naturally entrusted to him and he was made the first Archaeological Surveyor of India. The aim of the survey being – 'an accurate description-illustrated plan, measurements, drawings or photographs and by copies of inscriptions -- of such remains as deserve notice, with the history of them so far as it may be traceable, and a record of the tradition that are...regarding them.' But the conservation of the monuments was left outside the scope of his programme.

With the setting up of the Archaeological Department in the year 1861, the then Government passed an Act XX of 1863 which invested the Government with authority to 'prevent injury to and preserve buildings for their remarkable for their antiquity, or for their historical and architectural value.' In February, 1873, the then Supreme Government entrusted the work of preservation of buildings of historical and architectural interest to the Local Provincial Governments.

The other aspect of heritage preservation relates to antiquities or moveable objects, the Indian Treasure Trove Act, 1878 was passed by making it obligatory for persons to inform the concerned authorities in case any art objects found accidentally and restraining people from indulging in clandestine digging for treasure or antiquities.

In January 1878, Lord Lytton, the Governor General (1876-80) realized that the preservation of monuments should be the responsibility of the Supreme Government, for he 'could not conceive of any claim upon the administrative and financial resources of the supreme government more essentially imperial then this'. This was perhaps the first admission on the part of the then Government of India in respect of their responsibility for the preservation of the cultural heritage of India and in 1881, during the tenure of Lord Ripon, the Governor General, H.H. Cole was appointed as the Curator of Ancient Monuments with the duties to prepare classified lists of ancient monuments of each province and advise the Governments on the restorations and conservation of ancient monuments. Cole also formulated a programme of conservation works for the future and produced the Preservation of national monuments in India, ten folio volumes with illustrations of some famous monuments in India. However, after only three years, the Curator's post was abolished and the entire responsibility for listing and conserving the monuments was handed back to the Local Governments.

With the arrival of Lord Curzon as the Viceroy of India (1889-1905), archaeological conservation got a new impetus and his bold and imaginative approach produced a profound change in the Government conservation policy. He noticed that hardly any local governments were interested in archaeology. In his famous address to the Asiatic Society of Bengal on 6 February 1900, he stressed that 'Epigraphy should not be set behind research any more than research should be set behind conservation. Both are parts of any scientific scheme of any antiquarian work. I am not one of those who think that Government can afford to patronize the one and ignore the other. It is, in my judgment, equally our duty to dig and discover, to classify, reproduce and describe, to copy and decipher and to cherish and conserve'. Again on 23 September 1900, he said: 'I cannot conceive of any obligation more strictly appertaining to a Supreme Government than the conservation of the most beautiful and perfect collection of monuments in the world, ignored by a delegation of all authority to provincial administration...... Thus it has come about that owing to the absence of any central and duly qualified advising authority, not merely are beautiful and famous buildings crumbling to decay but there is neither principle nor unity in conservation or repair. While from time to time horrors are still committed that makes the student shudder and turn grey.'

He proposed to the British Government for the revival of the post of the Director General for supervision and co-ordination of the works of the Surveyors, which was accepted by the Government and John Marshall came to India in 1902 at the age of twenty-six as the first Director General of the reconstituted Archaeological Survey of India in February 1902.

In the year 1904, preservation of ancient monuments and remains was made statutory with the enactment of the *Ancient Monuments Preservation Act, 1904* 'for preservation of ancient monuments, for the exercise of control over traffic in antiquities and over excavation in certain places and for the protection and acquisition of certain cases of ancient monuments and of objects of archaeological, historical or artistic interest.'

In April 1906, Archaeological Survey was placed on a permanent basis. The erstwhile Indian States were also brought within the preview of the Archaeological Surveyors. Importance was given to the historicity of a monument by treating it as an archaeological document reflecting the constructional trends and techniques of the past and its technicalities in relation to a historical structure for the purpose of conservation. It was the archaeological officer trained in archaeology that guided and advised the engineers of the Public Works Department of the Local Governments how to carry out repairs to monuments. In John Marshall's view, a trained archaeologist and a student of history could be a better conservationist than an expert in Civil Engineering, since deeper understanding of history of the structures is essential for the preservation of an old building. A regular scheme of conservation was framed by training bright and qualified students with background of history or classical languages after recruiting them in the Department and by selecting all kinds of buildings in various parts of the country for conservation.

Based on his practical experience of conservation, John Marshall evolved norms and techniques and also defined principles and methods for the preservation of Indian monuments in his *Conservation Manual-Hand book for the use of Archaeological officers entrusted with the Care of Ancient Monuments, 1923.* Even the smallest of the small problems of conservation has not escaped from his purview. An extract of the *Conservation Manual* which is relevant even today is that, 'Officers charged with execution of conservation work should never forget that the reparation of any remnant of ancient architecture, however humble, is a work to be entered upon with totally different feelings from a new work of form the repairs of a modern building. Although there are many ancient buildings whose state disrepair suggests at first sight a renewal, it should never be forgotten that their historical value is gone when their authenticity is destroyed and that our duty is not to renew them but to preserve them. When therefore, repairs are carried out, effort should be spared to save as many parts of the original as possible since it is to the authenticity of the old parts that practically all the interest attaching to the new will owe itself. Broken or half decayed original work is of infinitely more value than the smartest and most perfect new work.'

In the wake of the Montague Chelmsford Reforms of 1919, archaeology for the first time became a central subject. Sixteen years later, the Government of India Act, 1935, included ancient and historical monuments, archaeological sites and remains in the Federal List, assuming all powers vested in the Provincial Governments under the Act of 1904 without any corresponding entry in the Provincial List. The Government of India assumed all powers vested in the Provincial Governments under the Act of 1904, relieving them of the surviving functions of administrative control. Many of the major monuments of India are to this day in a state of good repairs is largely to the credit of this Act of 1904 and to the way in which it has been administered.

In 1945, the Department of Archaeology was reorganized and conservation which was being mostly executed through the Local Public Works Department of the then Provincial Governments was centralized throughout India. Monuments continued to be properly maintained and conserved by the successors of Marshall in the same tradition. To this date it is the same techniques and norms that have largely been adhered to by the ASI while undertaking conservation works on monuments in the country.

On 26 January 1950, the Constitution of free India came into force. Under its provisions (Article 246, Seventh Schedule) the allocation of functions relating to archaeology has been divided between Union and State Governments in regard to the protection of ancient monuments, sites and their remains. The framers of our Constitution of India made it mandatory that it shall be the duty of every citizen of India 'to value and preserve the rich heritage of our composite culture' and 'to protect and improve the natural environment, including forests, lakes, rivers and wildlife, and to have compassion for living creatures'. In support of the above, Part

IV of the Constitution dealing with the Directive Principles of the State Policy (Article 49) stipulates that 'it shall be the obligation of the state to protect every monument or place or object of artistic or historic interest to be of national importance from spoliation, disfigurement, destruction, removal, disposal or export, as the case may be.'

In fulfilment of the provisions of the Constitution, the Parliament passed the *Ancient and Historical Monuments and Archaeological Sites and Remains (Declaration of National Importance) Act, 1951* by which all monuments previously protected under the Ancient Monuments Preservation Act 1904 were re-designated as monuments and sites of national importance. In addition, over 450 monuments and sites located in the former Princely States were included in the list. Subsequently, through Section 126 of *The States Reorganization Act, 1956,* some more monuments and archaeological sites were added to the list of centrally protected monuments.

In order to further safeguard our archaeological heritage, a comprehensive new statute entitled *Ancient Monuments and Archaeological Sites and Remain Act, 1958,*was enacted 'to provide for the preservation of ancient and historical monuments and archaeological sites and remains of national importance for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects'. The Act defines ancient monuments and antiquities as those which have been in existence for not less than one hundred years. The new Act further empowered the Government to assume some powers in regard to monuments whose owners refused to enter into agreement with the Government, and to prohibit the constructions of buildings within the protected areas or on or near sites. Since the passing of these acts, certain new developments have taken place which was not foreseen by their framers with the result that the Act of 1958 remains ineffective in certain matters. From the Preamble of the Act it would be seen that the principal objectives of the Act are three fold: preservation of monuments and sites of national importance; regulation archaeological excavations; and protection of sculptures, etc. At that point of time there is no mention about the registration of development activities around the monuments and sites, or about the usage of monuments as publicity medium. In pursuance of these Constitutional obligations, most of the federating States have enacted similar legislations patterned on the Central Act. However, in the year 2010, the Act of 1958 was suitably amended, *Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation), Act, 2010* for effective safeguarding against such threats.

Likewise, the growing illicit traffic in antiquities demanded an amendment or revision of the *Antiquities (Export Control) Act, 1947* by a new Act called *The Antiquities and Art Treasures Act, 1972* which was enacted to regulate the export trade in antiquities and art treasures; to provide for the prevention of, and fraudulent dealings in, antiquities; to provide for the compulsory acquisition of antiquities and art treasures for preservation in public places, etc. Under this act, antiquity has been defined to include objects of human craftsmanship which have been in existence for not less than one hundred years and manuscripts, records etc., which have been in existence for not less than seventy five years.

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IX

Present Structural Condition of the Monument

The entire building is badly affected by leakage and seepage from poorly executed drainage system due to which water accumulates over the flat roof and water travels through the joints and gets locked in the form of entrapped damp in the walls, adversely affecting the sandstone. There is widespread defect in the stone masonry such as delamination, powdering and spalling of stone; excessive weathering caused by combined effect of weather; inherent properties and qualities of stones, particularly separation of sandstone window jambs from adjacent limestone rubble masonry; erosion of stone masonry unit surfaces and joints; efflorescence and salt encrustation, discolouration, organic growth; development of horizontal and vertical cracks in the walls, joints and concrete roofs; rusting and corrosion of steel works and deterioration and rotting of wooden architectural members, etc.

The most common problem of the building is vertical cracks in varying degree of width and depth in the walls, roofs, window mullion and transoms, separation of sandstone window jambs and limestone rubble masonry and large cracks in the vaulted ceilings. The Kitchen Wing is badly affected by diagonal and vertical cracks on the vaults, ceiling, inner and outer walls and sinking of flooring and seepage and dampness at different levels. The drainage defects of the flat-roof were seen to be many and widespread due to design defects. Narrow gutters and non-functioning of drains including drain-pipes due to clogging with debris, broken down pipes and leakage of rain or snow water from roof top due to defective and poorly-executed re-roofing and badly jointed galvanised sheets are the other defects.

In the service areas, rainwater drains are the source of water logging and dampness due to poor maintenance. Due to these multifarious factors, most portions of the Kitchen Wing are not in use. The underground rainwater harvesting tanks are placed at a sufficient distance away from the building, though the service areas and rainwater drains may be a source of water logging and dampness as they are not properly maintained and are also within or close to the building.

Many additions and alterations have been done over time affecting the use and services as originally planned and thus causing major behavioural changes in the structure. With the passage of time, the building has deteriorated to such an extent that some components of the building have developed major cracks and almost all the roofs and terraces are profusely leaking, causing severe damage to the entire structure of the monument. The situation to save the structure has become alarmingly bleak.

Present situation of the building has become alarming. The levels of distress due to structural failures, sinking, aging, weathering, dampness, seepage and ingress of water from all possible components such as roof, gutters, down pipes, wall facade, damaged pointing, damaged peripheral storm water drains etc., have reached a situation where, if these are not attended to immediately, it may not be possible in near future to have a practical solution for repairs and restoration of the building economically.

As a result, the Viceregal Lodge building is under threat of a spectrum of structural and architectural issues. The architectural integrity of the building is affected on many counts such as deterioration and delamination of the building stone, water ingress, inconsistent finish and incongruous additions over time. Service issues such as the condition of plumbing and water drainage is also causing a major threat of water penetration into the building fabric, often manifesting itself as later structural or architectural problems.

Due to poor maintenance and passage of time, the building is deteriorating day by day. It has developed structural cracks on external walls and lime concrete vaults near kitchen area. Most of the roof and terraces have become major cause of ingress of rain-water inside the building line. The structural system comprised mainly of load bearing walls in stone masonry with lime mortar and hard core infill with mud mortar finished in courses on the outer sides with lime mortar. The building was founded on weathered rock. There are visible cracks in masonry walls at most of the locations. The crack width is ranging from some microns to even 8-10mm.The conditions of the defects and distress located during frequent visits are indicated in detail below:

1. Condition of the Main Portico and North, South-east and East Porticoes: The condition of the main entrance portico of the Main Block is poor with horizontal structural cracks in the roof slab along construction joints connected with open joints between the keystones and voussoirs of the arches. These cracks have led to extensive water penetration, salt efflorescence and decay of masonry due to damp conditions.

The south-east portico was originally located in front of the widest section of the south arcade of the east wing and dismantled in the early part of this century and replaced by a two feet wide small external staircase. The east portico has suffered considerable damage to the stone elements of the columns in the first bay with structural cracks due to seepage from top open terrace and also from movement and settlement which is probably still active. The north portico is not in use. The structural condition is dilapidated due to deflection of architectural members. The north-east corner of the portico is strapped to prevent outward deflection. The north-west corner is yet to be attended.

2. Condition of the arcades and flat roof terraces of the building: The condition of the south arcade is poor due to decay of flat roof slab, cracks in the slab connected with separated joints between the voussoirs of the arches and some water penetration. On the first floor, the slope given to the terrace slab above is towards the gutter running along the external wall instead of towards the external edge of the terrace, which is a design fault. Combined with repair and waterproofing attempts over the years this has resulted in an uneven surface of the terrace and insufficient slope causing pooling of rainwater at certain points, which seeps through the slab, resulting in rusting of iron girders at different locations. Damage to the stone masonry and decorative cut stone elements of the windows has also been observed due to moisture resulting in salt encrustation and efflorescence on the external wall and discolouration and deterioration of the masonry of external arches and balustrades. The slab on the eastern section of the arcade has been punctured to install a cast iron staircase leading to the second floor.

As in the west section, the cracks in the roof slab are often continuation of the cracks and widened joints between the voussoirs of the external arches as a result of the load of the support beams at some points and structural movement in the external arcade. There is considerable water penetration in this area through the cracks in the roof slabs, at the junction of the wall and slabs because of decay of the protective *gola*, fillet, and through decayed areas of the part roofed with glass prisms. In front of the east wing, the design and construction is virtually the same but there is no arcade at the first floor level. This portion is badly affected due to water penetration through the cracks in the roof slab and from the wall roof junction leading to extensive leakage from top and deterioration of saturated stone elements. The material used for the slab itself has also deteriorated and there is considerable rainwater percolation from the line of the wall junction with the slab where the *gola* fillet provided has decayed. There is also an accumulation of rainwater along this line due to the gutter being located along the exterior wall instead of along the outer edge, near the balustrade, and incorrect slope due to repair works over the years. The roof slabs have not been sealed during later repair works and proper slope has not been maintained, resulting in accumulation of water.

The vaulted ceiling of the north-west portion of the north arcade is in distressed condition, while the north-east corner is found strapped with steel flat sections at four points to prevent outward deflection. There is extensive water penetration on the eastern side of the north arcade through roof top and down-take pipe junctions. The masonry of the spandrels has also decayed, leading to coverage with thick plaster incised to resemble coursed stone in certain areas.

The space above the Band Porch on the west arcade on the first floor is retained as open terrace and there is deflection in the porch below. This arcade continues in front of the projected north-west section. The roof is a combination of glass blocks, Hayward's glass prism lights and the flat slab in panels are supported by plastered iron girders. There is extensive water penetration at the external wall junction with the roof, and at the outer arcade junction with the roof leading to dampness, salt efflorescence discolouration and decay of the upper levels of stone masonry. There is also separation and cracking along masonry joints.

3. Condition of the roof structures, covering and chimney stacks: The overall support structure of the pitched roof appears to be in a fair condition, with some decay of the wood components where there has been considerable leakage in the past. At many places the roofing pan-tiles have been loosely placed without proper laps and found broken and cracked. At junctions of the masonry wall and tiled roof, such as at the chimney stacks, GI sheets have been loosely provided as flashing. At certain places, the timber boarding has been replaced by corrugated GI sheets with terracotta tiles on top. At places, the timber truss resting directly on external walls is without any bed block or wall plates, leading to weakening of the structure and steel bedding plates.

The Central Tower which contains the water tanks has been provided with tie rods at the upper two levels to prevent outward movement of the walls. It has flat accessible concrete slab roof supported on iron girders with a decorative parapet wall having stone finials on either side of the central gable section. The parapet wall of the Central Tower is in a poor condition with the finial not secured properly by rusted iron dowels and there is extensive seepage at the wall/slab junction due to decay of the *gola* cove fillet and improper slope of the roof terracing.

Flat roofs and terrace slabs in the main block are of concrete cast in panels and supported on iron girders which are covered with plaster. The flat roof slabs of the arcades are also provided with sections of Hayward's glass prisms and glass blocks inset in iron framing. There is extensive leakage from the missing and broken prism and glass ceilings and at places glass prisms and tiles are not bonded properly with the frames.

A major problem arises from the detailing for rainwater disposal due to which rain water, instead of being directed away from the external wall of the building, is taken towards the drains which run along the face of the external wall with gratings at the points where hoppers for the rainwater pipes are located. Instead, the slope of all the terraces and roof slabs of the arcades being towards the edge, is towards the gutter along the external wall of the building which, combined with cracking in the slab itself, and decay of the original *gola* cove fillet provided to seal, the slab/wall junction results in extensive water penetration and damage to the external wall masonry and interiors. There are a number of structural cracks through these flat slabs, and the points where they have been punctured for the cast iron stairs are also significant points of water ingress.

The south, west and north terraces on the second floor have typical stone balustrades with joints, and the floor slab has been treated with a number of waterproofing materials in order to stop water ingress into the floors below. These waterproofing treatments have decayed. The open joints of the stone tiles have not been filled up, due to which there is ingress of water below. The slope on these terraces is again towards the external wall of the building instead of being towards the outer edge of the building.

The L-shaped flat slab over the mezzanine level of the Kitchen Wing has been provided with stone tiles. The joints have not been properly sealed; as such there is extensive water seepage. The steel joists and CGI sheet arch supporting the roof slabs on first and second floor levels on the north-west and north-east sides and in the verandas with jack arch type roofing placed over I-sections are corroded.

The main building roof is a pitched roof of large spans comprising of wooden trusses as their support structure, on which corrugated G.I. sheets with battens are laid, over which interlocking type of terracotta tiles are placed. At some places it is observed that timber plank boarding has been retained. The roofs are intersected with masonry chimney stacks and decorative gable walls. The entire roof of the main building has a GI sheet drain with sides clad in wooden planks around the periphery of the centre atrium. The entire pitched roof system appears to be disturbed in which gutters and valleys are badly damaged. Tiles on the roof are missing. Base sheets are also damaged. Trusses need repairing by repainting. The central atrium has an opaque glass false ceiling. The roof over the central atrium area rests on a series of king post trusses which are resting on the inner walls/members around the atrium. The area around the central atrium comprises of roof supported on queen post wooden trusses. The trusses not only support the roofing system but also the wooden false ceiling. Frames to ceiling are damaged and need repairs and replacement. Glasses have broken. Outside door-windows joinery has outlived its life and is badly damaged. False ceiling has been badly damaged due to continuous ingress of rain water.

Of the chimney stacks, two stacks are in dilapidated conditions due to weathering of stone surfaces as well as development of structural cracks along the horizontal joints of the stone masonry, water ingress through broken caps and damaged chimney stacks and growth of vegetation.

4. Condition of the facade and openings: The typical defects associated with the external walls are structural cracks through the masonry units or through the mortar joints, separation of joints due to structural movement, erosion of stone masonry unit surfaces and joints, efflorescence and salt encrustation, discoloration, organic growth, powdering and spalling of stone, superficial cracks through the plaster, plaster flaking, persistent dampness due to moisture penetration through roof, wall masonry or cracks at various places.

One of the most important reasons for the extensive structural cracking observed on the exterior walls, particularly related with the door and window opening stone surrounds moulded mullions and transoms. This results in concentration of the floor load and other stresses in certain sections, and cracking of the intermediate stone mullions which are effectively serving supports to the lintels above the large span openings. There is also a lack of horizontal ties at all levels of the building, which results in the opening and separation of masonry joints. However, this south-west tower is an area which has been observed to have maximum deflection and extensive cracking in the exterior masonry and is being monitored by glass tell-tales.

Originally, the building was not provided with any weather protection elements on the exterior and reinforced concrete brackets supporting the stone *chhajjas* have been introduced in the building. These are prone to corrosion and spalling of the concrete, resulting in exposing the reinforcement and deteriorating *chhajjas*. The effect of this design fault is particularly evident in areas such as the entrance hall section of the main block where the complex profile of the stone elements retains rainwater in the stone masonry as there are no *chhajjas* to throw the rainwater away from the external face of the building. This has resulted in the deterioration of large areas of masonry in the upper section of this facade. The wider joints between deteriorated stones have been repointed and the deteriorated stones of different properties were replaced in the past. The deteriorated stones in inconspicuous areas such as the courtyards and parts of the Kitchen Wing have been plastered over and incised to resemble coursed stones.

Structural problems are evident in the south-east corner rooms where there are a number of cracks in the area above the east door and the keystone has dropped, together with separation of joints between the voussoirs. The exterior walls to the south are saturated from floor to ceiling with the masonry above lintel height in the projected window section being damp due to the same reasons as the preceding rooms. The sill stone of the window on the east is cracked. The east external wall of the corridor is damp due to a damaged roof slab which has blocked rainwater downpipes, incorrect and damaged slope of the terrace above. The masonry joints between the ashlar doorframe elements and the adjacent masonry have widened and there is some organic growth due to persistent damp.

The south-east and south-west corner rooms on the ground floor are badly affected by the saturated and damaged roof terrace due to blocked rainwater downpipes, incorrect masonry slope at two points and damaged *gola*, fillets at the slab/wall junction above.

The exterior wall of room No. 11on the first floor level is in a fair condition. However, there is water penetration from the damaged *gola* fillet at the external wall / roof junction, causing damage to the external wall masonry, and staining and efflorescence above the lintel level of the south windows. In the adjacent room (No.12), there are diagonal cracks visible on the south wall from the ceiling level. Water penetration from the top roof has damaged wooden false ceiling as well as wooden casing of the crossbeam. The exterior stone masonry is eroded, lintel and sill stones have cracked vertically and the projected stone course above the lintel level is stained with salt encrustation and the protective plaster provided in some sections has eroded. The joints between the stone elements of the openings have separated and show extensive staining and salt deposits due to persistent dampness. The exterior walls of the south-west tower are badly affected by vertical cracks, separation of stone masonry joints, delamination and flaking of layers of stone members of the windows and door openings. The flat arch above the door in the west wall of room (No.14) is cracked and upper sections of the external wall are in a poor condition.

The Room No. 111 has a large projected window in the centre of the south wall. There are cracks from lintel to ceiling level of the east window and leakage at the junction of the flat roof over the projected window with the tiled roof causing dampness. The *chhajja* over the east window is cracked; there is a horizontal crack in the lintel above the bathroom window, and dampness at the corner above dado levels. Cracks have been noticed in the south-west corner of the projected window of room 114 and lobby and damp patches in sections of the east wall. There is leakage and cracking on the exterior wall in the projected window area of room 115A, leading to dampness and plaster flaking. There are diagonal cracks in the service area through masonry units as well as the joints in section of the east wall related to the window opening. Due to damp conditions, there is considerable organic growth especially on the south wall. The ashlar stone elements of the windows in the service area are eroded and there is separation of joints in the upper triple bay window on the north.

The external walls of the rooms on second floor of the main blocks at this level have a number of cracks both on the exterior and the interior due to which there is water ingress and stone decay. Joints in the stone *chhajja* have separated.

5. **Condition of the drainage system, down-pipes, gutters, funnels, spouts, etc.:** The original roof drain system is connected through a network of roof drains diverted to the rear side of the building. Only those which have no access to the rear side are taken from the front. The roof water is taken to the rain harvesting pit, and is used for gardening. At many places the gutters are choked or damaged and much rain water down-takes is either rusted or broken leading to water ingress into the adjoining wall or have sections missing altogether. The cast iron water spouts, gutters and down- take pipes need to be checked and wherever there are missing sections, these need to be replaced in pipes of the same size, material and gauge as the original rectangular section pipes. Joints need to be properly caulked in lead to prevent leakage. Discharge outlets and manholes too need to be thoroughly cleaned to remove blockages and debris that chokes the outlets. The conservation exercise needs to trace the original water drainage system for the entire building, from roof to outer discharge pipes and manholes, as well as from toilets and wet areas such as kitchens and washrooms. The original plumbing schemes were fitted for bathtubs

without floor traps; in subsequent toilet renovations, the bathtubs had been removed and floor traps introduced. New plumbing runs into the building as visible along the verandas and exterior walls resulting in leakages from the toilet pipes and water eventually seeping into the building fabric. The west wall of Corridor (Fireman's Room and Records store) which abuts onto the toilets and courtyard is suffering from extensive moisture penetration from above as well as through the masonry, leading to dampness and flaking of the interior plaster. The toilet blocks in courtyard on the south are probably one of the main sources for water logging of the soil under the building due to disruption and choking of the original drainage system. While most of the sanitary fittings have unfortunately already been changed over the years with renovations of the toilets, there are still some original bathtubs surviving in the building, lying around on verandas, stacked in basements and found in other buildings in the estate.

6. Condition of the entrance hall and gallery: The main entrance doorway is in a fair condition with some damage to the stone elements and separation of joints. There is crack through the joints between the voussoirs of the flat arched opening above the entrance doorway. A crack between the pilasters to the west of the doorway is being monitored with glass tell-tales. The south-east corner of the Entrance Hall and the main staircase is a major area of concern in the main block, exhibiting active structural cracks due to continuing deflection on the interior of the east wall as well as on the exterior of the east and south walls. In addition, due to extensive moisture penetration, there is considerable efflorescence and deterioration of the exterior stone elements and the possibility of wet rot in the internal wooden panelling in this area. The main staircase has also been altered, probably at the same time the arcaded screen was removed. A small room has been provided under the stairs at the ground level which is used by the watchmen.

At the ground level a lift shaft and lobby have been carved out from the Seminar Room, the access of which is through a door from the entrance hall. The original lift, probably installed in the early 20th century was auctioned in 1977 and replaced by the present one. The window on the exterior wall of the lift shaft at the first floor level has a cracked lintel and a section of the cornice to the east is damaged for rainwater downpipe. The internal panelling of the gallery is in a fair condition with some damage caused by the modifications to the staircase. The carved teak brackets have been removed, though some old light fittings are still in place in the arches. At the second floor level there is water seepage from the clerestory/gutter on the south, resulting in decay of the wooden arcade elements and the ceiling at that point. Some of the intermediate balusters of the gallery corridor are missing at the upper levels.

7. Condition of the rooms in the ground floor of the main block: The State Drawing Room and wooden staircase (Library and Photocopy Room) is in a fair condition, but some diagonal cracks have recently appeared in the upper section of the north wall at the west corner, which may be the result of localized structural movement due to the deterioration of the west vault. The interior of this room is in a good condition with no damage to the interior panelling or staircase woodwork. The State Dining Room (Library) is in a good condition with localized water penetration at the north-east corner, leading to discoloration and damage of the panelling below. The false ceiling above the projected window on the south-east corner of the Seminar Room has been found damaged due to water penetration from the top flat terrace.

8. Condition of the rooms in the first and second floor of main block: The wooden ceiling above the projected south window as well as the wooden casing of the crossbeams of rooms have been partly damaged and damp due to water seepage from top flat terrace as well as from the parapet walls and gutters. Decorated moulded ceiling on the west side of the octagonal room of the south-west tower has been discoloured due to water seepage from the exterior wall cracks. Room 111 has a large projected window in the centre of the south wall. There are cracks from lintel to ceiling level at the north corner of the east window with some rainwater percolation, and at the west corner of the projected window. There is leakage at the junction of the flat roof over the projected window with the tiled roof, causing dampness. The *chhajja* over the east window is cracked; there is a horizontal crack in the lintel above the bathroom window, and dampness at the corner above dado levels. The plaster in the upper section of the south wall of room 113 is damp and flaking with minor cracks. Room 114 has cracks in the south-west corner of the projected window and damp patches in sections of the east wall. Most of the windows are found damaged and over the years these windows and doors have not been repaired.

9. Condition of the West Vaulted chambers and extension: These West Vaulted Chambers and extension, partly being used as carpenter's workshop, are in a very poor condition with deterioration of wall and flooring, corrosion of steel girders, cracks and erosion in vault masonry, dampness due to leakage from top and side walls and differential foundation settlement. The original vaulted chambers had been extended with flat roofs.

10. Condition of corridors, staircases & galleries: The public corridors, galleries and staircases are essential means of circulation and also important for the overall perception of visitors and users of the historic interiors. The condition of the service staircases and passages is in a poor state. The wooden steps of the stairways are decayed and have become slippery. The side walls are in poor condition due to deterioration of plaster, horizontal and vertical cracks, rusting of electric conduit pipes, excess/over-paint layers on wooden railings and balusters.

The galleries and corridors at different levels in the building are also in need of repairs by way of re-plastering the side walls, re-polishing the wooden panelling, etc. The main staircase provides access to the upper floors and the gallery arcades. It has been altered probably at the same time when the arcaded screen was removed. A small room has been created under the stairs at the ground level which is used by the guards. The south-east corner is exhibiting active structural cracks due to continuing deflection on the interior of the east wall as well as the exterior of the east and south walls. The stone masonry internal staircase 5 is located roughly in the centre of the internal kitchen wing corridor, to the north of service area 3 and connects the mezzanine level of this wing with the laundry level. The wooden framed Internal Staircase 6 with turned balusters leads from the internal corridor at the ground level to the set of rooms located on the mezzanine level of the east section of the Kitchen Wing and is in a good condition. However, the walls of the stairwell are damaged with considerable diagonal cracking and weakening of the material due to extensive water penetration**.** The masonry walls which enclose the stairwell of this wooden framed staircase to the south and west are in very poor condition. There are parallel vertical cracks above the lintel level in the east corner and diagonal and vertical cracks in the west corner of the south wall. These are connected with diagonal cracks in the chamfered south-west wall, which are in turn connected with diagonal and horizontal cracks in the west wall at the landing level. Extensive seepage through the cracks and water percolation from above has resulted in saturated walls leading to material deterioration and cracking of plaster.

The internal staircase located in the lower section of the bell tower has problems of moisture penetration in the walls at three corners and irregular diagonal cracks on the south wall from the intermediate balcony level to the ceiling. The levels of the bell tower below this have a spiral masonry staircase which has been closed by wooden boarding at the ground level.

The masonry walls of the internal staircase to the east and north are in a poor condition due to water penetration both from above and through the wall which is on the courtyard side. Some structural cracks in a diagonal pattern are evident in areas of the persistently damp wall and are located at weak points near the openings. This irregular staircase lobby leads to the Council Chamber lounge and is in poor condition with moisture penetration from the damaged roof slab leading to saturated walls with flaking plaster and discoloration. The internal spiral staircase connects the Princes corridor level, the west passage of the Kitchen Wing with the service area to the north and was a part of the old sewage system. The masonry of the wall is saturated. The source of moisture is from the courtyard side due to insufficient projection of the tiled roof and faulty eaves gutters, resulting in rainwater running down the exterior wall. The support masonry post has crushed and seriously cracked and concrete supporting the stone treads has decayed and fallen. Apart from the main external stone masonry staircases, those provided at the west end of the south arcade, there is an angular stone masonry staircase. The stone balustrade is found damaged and balusters broken into pieces.

11. Condition of windows and doors: The doors and windows in the building are made of high quality Burma teak wood but most of the door and window openings have deteriorated due to fungal attacks, cracking, damaged carved surfaces, weathering of wood frames and building up of layers of varnish and paints, especially along the outer faces and the verandas. The frames have deteriorated and window and door shutters are swollen due to water ingress and most of them do not shut properly, often leading to windows being left open to shake in the wind and causing further damage and shattering of glass panes. With poor past maintenance, a lot of the exterior windows have sagged, or the wooden members have deteriorated over time. Much of the original hardware has been replaced with inconsistent new hardware.

12. Condition of historic furniture and fixtures: Rashtrapati Niwas is a repository of a variety of historic furniture though in a rather poor condition and in need of restoration. What is rather unfortunate is that though the historic furniture is surviving in the m of many good pieces in the building, a lot of it is used purely for a utilitarian purpose, with no concern for its historic or aesthetic value. Thus, beautiful neoclassical period tables are stacked with piles of boxes, historic bun-footed sofas that were originally placed in the Entrance Hall and State Ball Room are now in the Canteen at Observatory Hall, the church pew from the Chapel is lying in the chowkidar's room and fragile neo-Elizabethan chairs with leather seats are used indiscriminately by administrative staff as regular office chairs. The furniture from the main building is scattered in disjointed sequences over various buildings in the campus. Much of the historic furniture survives. An inventory of the historic furniture kept at different rooms in the building and dumped in the basement and swimming pool areas is urgently required so as to create a document and record of the surviving historic furniture. This furniture needs careful restoration that would not only include careful restoration of the woodwork, but also restoration of the upholstery material and filling as close to original as possible. While some pieces of furniture had horse hair for filling, others in the campus also have later coconut fibre filling. Many leather upholstered chairs and Council Chamber furniture require re-upholstering and restoration in genuine leather while some high back chairs of the Elizabethan style require reweaving of wicker backs and seats. Brass castors found on many original sofas and chairs are in need of restoration and the upholstery fabric needs to be carefully studied from extant pieces and matched as closely as possible. In some chairs found in the building, there was originally gold leaf gilding. This has been painted over in oil paint. It is important to restore these furniture elements using gold leaf gilding.

13. Condition of electrical services: Being the first Indian building to be provided with electricity, the Viceregal Lodge is a seminal example of historic electrical services. Original distribution boards, electric fittings such as brass toggles, switchboards and electroliers survive and these are to be preserved. Each circuit contains rewirable fuses with toggle switches. The wiring is also done using wooden casing capping, which is functioning in some sections of the building and is generally routed along the wooden skirting in the rooms. The electrical distribution is done from the basement through two 250 KVA transforming substations located about 300 metres away from the main building. There is a range of historic electrical light fittings ranging from cast brass to bronze, crystal and glass. Historic chandeliers and fittings need to be restored by specialist conservators and all care should be taken to restore them with minimum replacement of historic material. Similarly, it is important to restore and preserve the historic brass toggle switches, distribution boards and electrical fixtures.

It is important to address the issue of a comprehensive up-gradation of the present electrical services, to ensure the efficacy and safety of the system as also to uphold the visual integrity of the historic structure. The electrical routing of wires and conduits should be in a manner that is discreet and sympathetic to the historic fabric, taking care to avoid defacing architectural mouldings and details and made to route along skirting and wood panelling. The ad hoc placement of electric switchboards, wiring and fittings needs to be removed and relocated using discreet fittings and fixtures preferably concealed in the dado and wooden panelling or those replicating the historic designs. The coves in the plaster can also be intelligently used to place slim tubes and optic fibre lights to create an elegant and discreet lighting scheme for the rooms. The fluorescent tube lights fitted across historic ceilings that deface the interiors are to be removed and wiring should not criss-cross over architectural details. Lighting too plays an important role in the architectural ambience of any space and design of lighting to highlight important architectural features and elements is critical. There are clues to be taken from surviving chandeliers and fittings that are original to the building's period of construction as also archival images and any restoration effort should aim to restore the historic light fittings. External illumination should be elegant and discreet, highlighting the architectural features; ensuring that the routing of wiring is discreet and does not in any way detract from the historic ambience of the building.

14. Condition of Fire-fighting and mitigation systems: The building is equipped with an original Victorian fire-fighting system and fire sprinkler system in the attic and has fire stations at each level containing water pressure meter, hose reels, alarm and glass break tools placed in corridors and public access areas and fitted with chain pulley mechanisms in all verandas enveloping the building for escape in case of fire. It is to be noted that the fireproof paint that used to be applied regularly during the colonial period was last renewed in 1956.

This historic Victorian system of fire-fighting and escape is invaluable and perhaps the best preserved system in India. The Lodge has an extensive wet riser system of fire hoses as well as sprinklers for fire-fighting which are to be revived and made serviceable as far as possible. The sand buckets which were originally installed in neat rows on hooks at periodic intervals in the attic space are now found empty and the original number of buckets intended are placed again in the attic level and filled with sand. Similarly, fire-fighting stations at each floor level and fire-fighting cylinders should be checked to ensure that these are serviceable. The rusty and broken fire escape pulley systems installed in the verandas should be restored.

15. **Condition of the different levels of Kitchen Wing:** Most of the flat terraces are badly leaking, causing damage to all other components of the building. In the kitchen, laundry and wine cellar area, lime concrete vaults have failed at springing levels. Wide cracks have developed. The buttresses behind such vaults were not able to take the horizontal reaction of vaults, arches and have failed at many locations. Visible cracks in buttresses are there in back side of the building separating out from the building lines. There are six external buttresses on the northern wall; three of these have cracked at the foundation level in the bottom portion. It is also observed that lime mortar has degraded and lime is leaching from the joints. On the western side is a water drain running from south towards north at a depth of 2 metre and is now functional. Some drainage pipes are broken and water is directly falling on walls, which is causing degradation of materials and hence cracks in walls. The floor above the rear side gallery is wet and degradation has taken place; however no major crack along the wall in the vaulted roof is seen. The northern wall of the Wine Cellar room on the first floor or basement level is in

extremely poor condition, with vertical structural cracks in both the corner buttresses on the exterior as well as the interior, and the north-east corner of the floor having settled substantially. Extreme north side of the basement floor has been retrofitted using steel built up columns and beams, it appears that partial load of floors has been transferred through these columns to the ground. No fresh distress is visible after repair. The southern section of the ceiling is damp with superficial cracks and erosion of the vaulted ceiling surface. Two rooms meant for wood stores are not in use and are in a poor condition, with damp in the wall masonry due to moisture through the retaining wall on the north and damp ceilings with erosion of the vaulted roof surface in sections. The Boiler Room has been sub-divided and is in a very poor condition with structural cracks in the north-west corner buttress, and a crack in the ceiling which is linked with that running through the ceiling of the coal store. Dampness is observed in the walls and part of the ceiling with erosion of the vaulted ceiling and the plaster on the walls is flaking. The adjoining coal store rooms are in an extremely poor condition with major structural crack in the ceiling of the northern bay, damp wall masonry and ceilings with large areas of the vaulted ceiling surface eroded due to the constant damp condition.

The condition of the rooms at the Laundry level in the second floor level of the kitchen wing is in a very poor state and these rooms have not been utilized either due to the poor structural condition or utilized as store. Northern side room has been repaired and retrofitted using columns and beams with steel built up sections. A portion named Dhobi Ghat has cracks in the vault that was repaired two years before as informed; no other visible cracks are observed in this portion. Adjacent to the Dhobi Ghat there is a boiler room where wet surfaces and cracking has been observed. Third floor level of the Kitchen Wing is having a large pantry (kitchen) in the middle portion; the height of this portion is equivalent to two floors. In the northern side of the kitchen there is a room, where cracks first appeared during 1995. The rooms at this level are in a very poor condition with structural cracking and damp intrusion. The kitchen is used as a canteen, while other spaces are vacant due to poor structural condition. These rooms located above the Serving Room are in fair condition. The archway which opens onto the godown level of the Council Chamber is blocked.

There is degradation of material in the eastern gallery by the side of the kitchen due to excessive water leakage and pounding. Presently the dampness has dried but the marks of dampness show that this area has been affected by profuse water leakage and pounding. The source of water could be rain water percolated from the roof through masonry voids. On the north side room along the pantry, there is excessive damage and degradation in lime concrete in the floor and wall. A number of tell-tale glass has been fixed on 18-05-2007 to see that crack is active or inactive. It is found that many glass plates have broken revealing that crack was active. Some visible marks of dampness in the ceiling of the pantry are observed from below. There is a longitudinal crack along the length in the middle of the vaulted roof.

In the western gallery along the pantry**, c**racks in the crown of the vault along the length have been observed in the floor. There is dampness in the vaults and some portions have dried out. There is spalling of concrete in the vaulted floor. The internal kitchen corridor is roofed with lime concrete unreinforced vaults of varying sizes, supported on plastered walls of brick masonry. It is in a poor condition with damage to the plaster and damp walls and ceiling due to moisture penetration from above in three main areas.

On this fourth floor level or upper part of the Kitchen Wing on the northern side, leakage from the connecting bathroom of a room has been verified during field investigations. As the bathroom is not being used, there is possibility of leakage from defective plumbing. Wooden pieces and other materials have been dumped in this area. There are cracks and dampness in the walls and vaults of the floor of the gallery on the western side. The southern side of the pantry (height is two floors), there is a book store and a large number of books have been stacked in this area resulting in excessive load on walls, vaults and buttresses of the kitchen block.

Moisture marks are seen at many places in the gallery and there is spalling in the vaulted floor as seen from bottom.

The wooden gallery connecting the internal corridor with the butter corridor on the north is in a fair condition with painted balustrades and wooden flooring. Butter corridor area is in a very poor condition, and is one of the major problem areas the main building with serious structural defects resulting in extensive deterioration. Deep structural cracks in the ceiling follow an irregular, roughly linear pattern and are connected with cracks between the voussoirs of the arched openings in the south wall of the corridor. The section of the vaults near the springing point has dropped by almost an inch in two areas -- the south-east corner of the third bay from the east and the west section of the fourth bay. Vertical cracks are evident in the east wall and the brick piers. There is extensive discolouration and flaking of plaster due to moisture penetration through cracks in the arched openings.

Major moisture penetration has been observed from the roof slab at the north-west corner and the northern section of the east wall of the Service Room and at the north-east corner of the west window on the north wall of Abdar. To the north of the internal kitchen corridor is the China and Glass Room. There is vertical crack from the east corner of the window sill to floor level, connected with a major crack in the floor at the north-west corner. The room is in a poor condition with the entire wall on the north-west and north damp, with plaster flaking and discoloured. The south wall on the east of the doorway is also damp with plaster flaking. Part of the false ceiling at the north-west corner and along the east wall has been damaged due to moisture penetration. A section of the east wall also shows signs of water penetration from above. There is vertical crack from the east corner of the window sill to floor level, connected with a major crack in the floor at the north-west corner. The rectangular plate room is located to the north of the internal corridor. It is in a fair condition. The upper section of the south wall and the north-east corner are damp due to moisture penetration from above and through interconnected irregular cracks in the north-east corner. There are minor vertical cracks above the lintel level of the windows on the west.

From the mezzanine level, a wooden flight of stairs connects the Kitchen Wing with the Prince's Corridor level of the east wing. The walls of this stairwell are saturated with deterioration of plaster and crushing of mortar joints resulting in an irregular pattern of cracking in the west wall and roughly parallel horizontal cracks in the north wall of the upper section. The original Dispensing (Binding Room) and Table Linen Rooms are located to the south of the internal corridor of the Kitchen Wing and are in a fair condition with some moisture damage on the south wall.

Mezzanine level at fifth floor is not in much degradation/ distress. Localized seepage of water is seen in the wall at the south room. There are few cracks in the floor; however the roof is terracotta tiles on wooden truss. These tiles supported on wooden trusses have been used as roofing unit for the kitchen block. Some of the tiles are displaced from their position and broken, resulting in ingress of water at various locations from flashing and valley sheets. Periodic maintenance is required to improve the roofing tiles. The broken tiles and debris are resulting in choking of drains. The vaulted area of the lower lobby is in a very poor condition with damp walls and ceiling with flaking plaster on all surfaces and structural cracks through the masonry units and joints in the west wall. The walls of the passage at the south-west and north-west corners are damp and the false ceiling boards are bulging due to water penetration from above. Active vertical cracks have also been found at the north-east and north-west corners and another vertical crack at the south-west corner in the passage and veranda. The walls and ceiling in the projected window section as well as the upper part of the central section of the east wall are discoloured with algae growth due to persistent damp. Structural cracks are also present on the exterior of the east wall. Some of the ceiling panels are bulged out due to damage caused by water. Structural cracks have been found from floor to ceiling at the south-west corner and from lintel to ceiling level in the south and east walls;

vertical and diagonal cracks in the area above the fireplace related to the bearing point of the roof truss above and major moisture penetration through the cracks in this wall and also the west wall is damp at the upper levels of the rooms and the veranda.

16. Condition of the Council Chamber: The Council Chamber is a three-storey structure. All four sides of the Council Hall have large span masonry arches. The terrace of the Council Hall is covered with grey stone slabs as wearing course, with wide joints filled with reddish mortar (lime *surkhi*), some of which have opened up. Flat terrace waterproofing treatment given during recent years is visible to be not effective. Below all the roofs, serious stains of leakage are visible at the springing of the arch on the south-east, where there is no false ceiling, and de-lamination cracks too. The main defects here were stains from water penetration. It was observed that on the roof, terracing had reverse falls in some areas and showed (largely linear) cracks that may extend through the waterproofing layer below, and the outlets from the perimeter gutter appeared quite inadequate. These were considered to be the two causes of water penetration that has caused damage to the walls and dome of the Chamber. The reverse falls may be capable of rectification by carefully removing the top of the screed by first grooving with an abrasive wheel / diamond saw, so as to create a slightly undercut edge of minimum depth of 40 mm around the "shaved-off" area and then relaying that area with the proper falls.

The cracks may perhaps be treated by widening them with a diamond saw, so as to create a dovetail groove with the crack in the bottom and then seal the recess with a polysulfide or similar sealant, de-bonded from the bottom of the groove. If this proves practicable, some of this work could probably, with advantage, be put in hand without delay. If the cracks, on closer examination, prove unsuited to the treatment, suggested above, the more drastic remedy of removal of the screed, re-waterproofing and re-screeding will have to be considered. The provision of a superimposed, lightweight, pitched roof might overcome the leaks through the cracks. It would, however, not deal with the inadequate outlets and it would grossly detract from the architectural character of the building, as well as destroy the view and the access from the main block. The discharge of water from the perimeter gutter would be improved if the present narrow-bore pipes were replaced by gargoyles with their inverts sloping away from the level of the bottom of the perimeter gutter.

17. Condition of the Public Entry Building: Structural conditions of the building, as on date are in good state of preservation. There are traces of staining due to seepage from roof top at few locations. The open joints of the parapet walls are to be taken up for filling up the joints and top water tightened. The GI Sheet *chhajjas* are found rusted and damaged and broken at many places. These are to be replaced. The open terrace on the south side has been repaired by using stone tiles. The joints of the stone tiles/slabs are opened due to decay of the lime mortar. The open joints should be pointed after proper raking out the dead and decayed mortar. The top terrace of the main porch of the building is to be set right by resetting the stone slabs and repointing the open joints. The windows and doors need to be restored to the original design using well-seasoned Burma teak. Also, the altered windows and doors need to be restored to the original design in the same way. In addition to the restoration of the timber shutters and frames of the external windows and doors, there needs to be put into place a provision for the careful restoration of the historic hardware. The damaged timber elements should be suitably repaired or replicated, as the case merits, and all other timber should be smoothened with sandpaper and re-painted or re-polished as decided. Missing hardware of the original brass fittings also needs to be taken into account in any restoration exercise since the replacements should ideally conform to the original design, size and material.

18. Conditions of the Heritage Buildings within the estate: The overall conditions of the heritage structures within the Viceregal Lodge complex are in good conditions and the CPWD, to whom the maintenance works have been assigned, are looking after the day to day upkeep of these structures. However, it is found that new interventions have been made by introducing modern materials in place of the original, without taking the ASI's views. The original set up of the B-Block in the Prospect Hill has been completely changed. The original wooden members have been removed by replacing with new materials. The flat roof of the Observatory House, the present Guest House and Fellows' Mess is profusely leaking during rains. One of the double storied barrack just below the Siddhartha Vihar is in precarious conditions and is partly collapsed. The varged boards of most of the pitched roof structures are found decayed and need replacement. The Church within this complex is in urgent need of intervention. Most of the wooden members of the superstructure are found decayed and need immediate replacement.

19. Conditions of the garden landscaping: The Horticulture wing of the Viceregal Lodge is responsible for maintaining the gardens. As on date it is one of the best in the region for its well maintained terraced garden by retaining its original character. A magnificent view of the distant mountains can be seen from the rear terraces and any new planting proposed should ensure that these views and vistas are retained as was originally intended. The planting beds at many places are above the level of the plinth -- as such plinth protection needs to be laid all around the base of the walls to prevent accumulation of water.

The greenhouse structure which is an important feature of the nursery is in urgent need of restoration. Other structures like the guard houses on the terraces and the water pump shelter on the main front terrace, all contribute in keeping the spirit of the gardens alive. They all are in need of conservation.

The retaining walls and the arched parapets are an important part of the heritage. With the addition of mulch and soil over the years, the level of the planting beds has been raised and the original drains are not functioning. Therefore, the original level of the drains at the base of the parapet wall needs to be brought back to ensure water drains off through a drain at the edge of the bed and thus not damage the vertical face of the retaining wall.

All the drains should be made functional by repairing these drains and clearing the choked portions and connect to the larger drainage system away from the site or towards the water harvesting tanks within the site.

To prevent ingress and further damage to the parapet walls of the lowest rear terrace garden, the broken steps should be restored in stone as per the original design. Wild vegetation growing in the joints of the paving and retaining walls are to be re-pointed with lime mortar. The IIAS has also initiated the work of paving interconnected pathways by replacing with local stones, following the original paving patterns.

The sundial and the plate indicating the plans of the hills around in the rear terraced garden are to be preserved. The stone bird bath and the stone bench in the front main terrace should be retained. The wrought iron benches and bins in the garden have been introduced and these should be placed along the pathways, towards the periphery of the terraced gardens, so that planting within is not damaged. The heritage garden premises should not be used for the purpose of picnicking or any other activities.

The two floral tanks and water fountain in the rear lower terrace of the late colonial period should be restored and made functional. Water hydrants, electrical boxes and all other services need to be appropriately sited and camouflaged to improve the aesthetics of the site. Service pipes need to be appropriately concealed in the ground.

The level of the gravel surface also needs to be lowered at the front porch of the main building and on slopes; intermediate stone staggers are to be provided to check the washing away of the gravel after every spell of rain. The level of the road at the entrance has been raised due to successive bitumen layering. As such the level of the road is higher than the entrance porch, thus causing water accumulation close to the buildings. The level of the road needs to be brought back to its original level by removing the raised portion and by replacing with flagstone flooring. The IIAS has assigned this work to the ASI. It has been found that at many locations, retaining walls bulge out and in damaged condition; these should be stabilized to prevent further collapse. Repair of the retaining wall in front of the Public Entry Building has been partly taken up by the ASI and the remaining portions should be completed shortly.

a

b

c

Leakage and water penetration from top roofs of the Entrance Portico

a

b

c

d

e

f

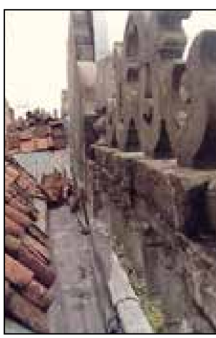
g

View showing present conditions of pitched roof.

a

b

c



d

e

Central Tower: Conditions of interior junctions between gable and parapet walls

a

b

c

South-east corner of the Main building, showing vertical cracks in masonry joints


a b


c d

Jack arch roof deterioration due to corrosion, damp and seepage from top roof

a

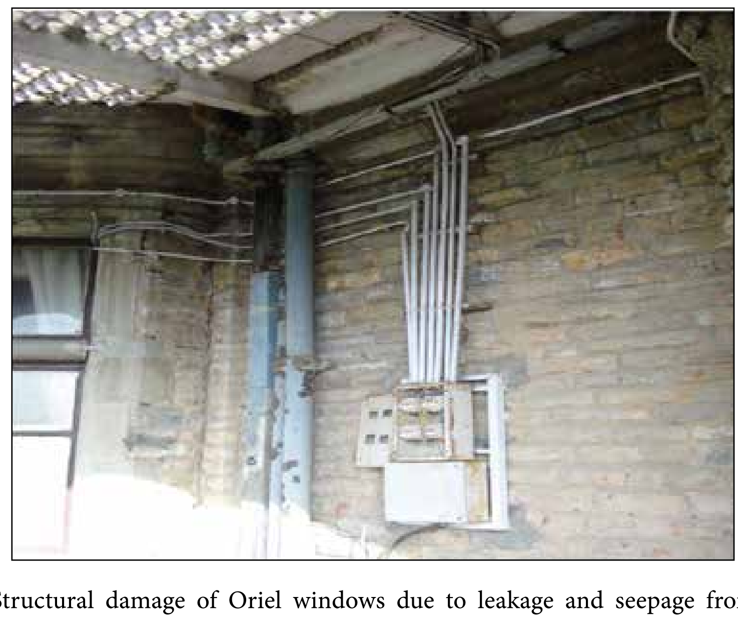
b c

Interior view of the attic and dormer west facing


a b


c d

Wooden ceiling damaged due to seepage from top roof



Structural damage of Oriel windows due to leakage and seepage from prism glass ceiling and new interventions

a b

c d

Cracks, blistering and flaking of architectural members due to weathering and seepage from top


a b


c d

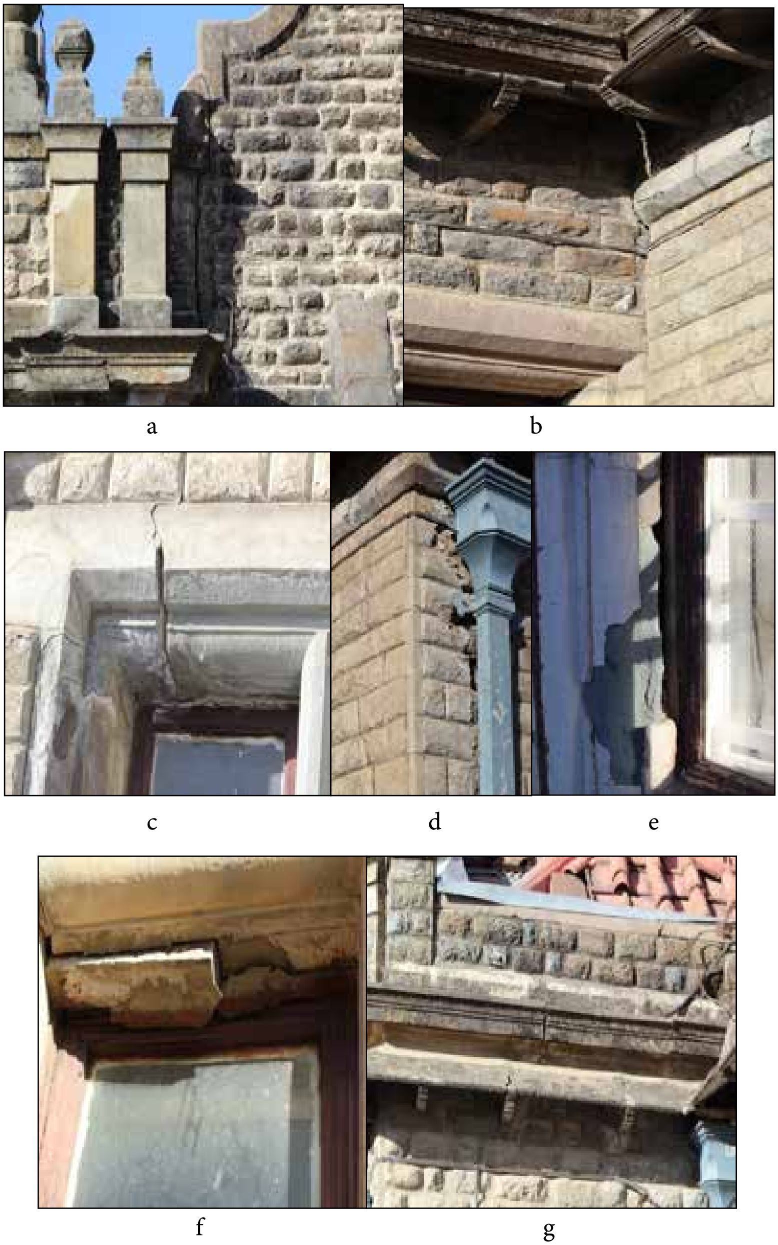

e f

Masonry cracks at various locations of the main building

a b

c d

Development of cracks at different levels, Main Block



Main block showing masonry cracks at various locations


a


b


c


d


e


f

Main block showing masonry cracks at various locations


a


b


c


d


e


f

Present conditions of the stone masonry stairs

Conditions of the stone and cast iron spiral stairs at different locations

a b

c

Condition of timber stairs

Exterior north view of the Kitchen Wing showing damaged downpipes and chhajas, etc.

c d

Damaged and distressed condition of rubble masonry retaining walls.
Source: IIAS.


a


b


c


d


e


f


g


h

Deteriorated and distressed condition of the vaulted ceilings of corridors and rooms of Kitchen Wing

a b c d e f g

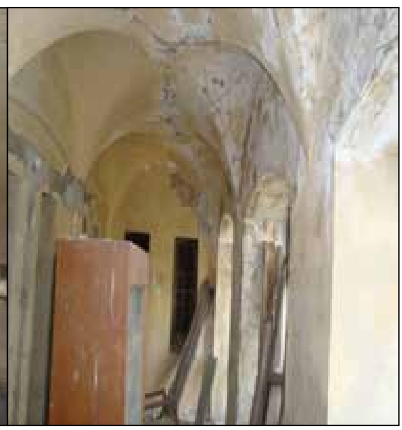
Ceiling and wall damages at various locations due to dampness and seepage from roof top

Kitchen Wing: deteriorated structural conditions of the rooms at laundry level

a

b

c



d

Kitchen Wing: Deteriorated vaulted chambers of the Kitchen due to cracks in the ceiling and damp.

a b c d e f

Deteriorated structural conditions of the top floor corridor and linen room of Kitchen Wing.

a b

c d

e f

Kitchen Wing: deteriorated structural conditions of the top floor corridor and side rooms.


a b


c d


e f

Kitchen Wing: deteriorated structural conditions of the top floor side rooms.

a b c d e f g h

Kitchen Wing: deteriorated structural conditions of the corridor sub-basement and north main entrance.

a

b

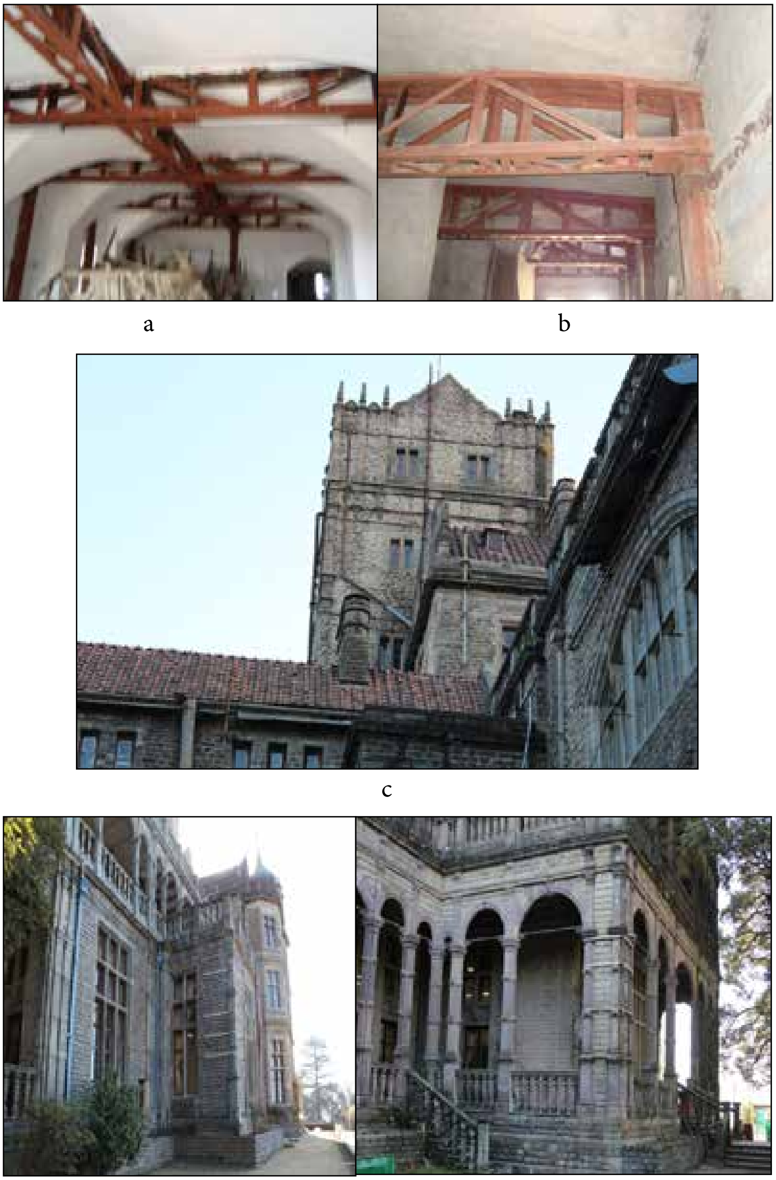
c

d

e

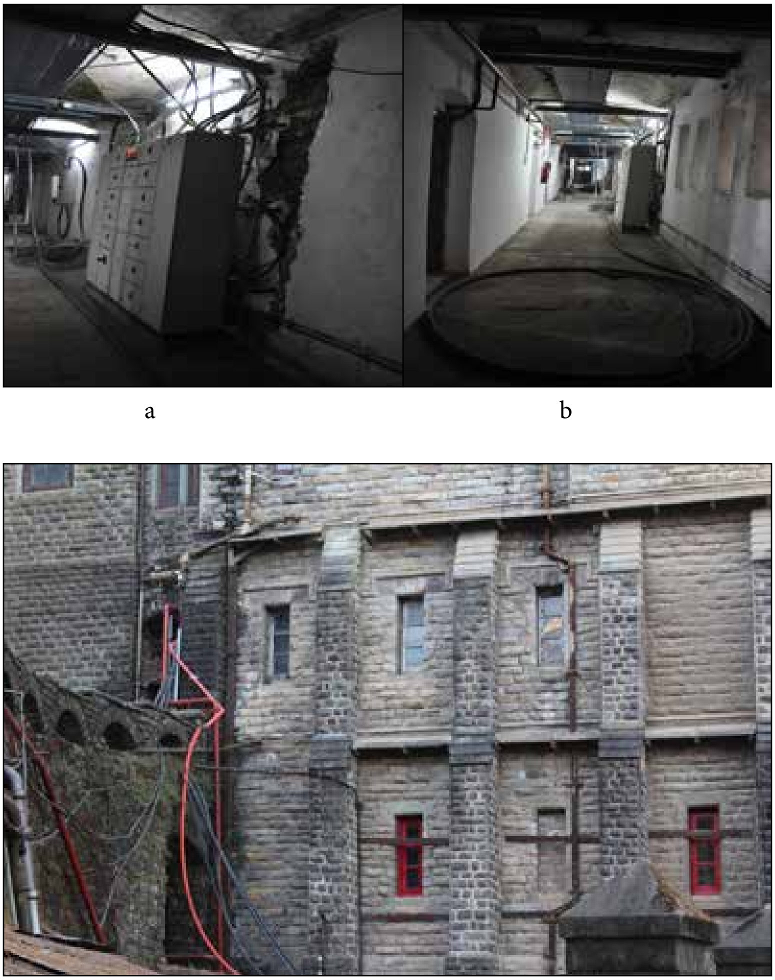
f

Kitchen Wing showing structural cracks in the vaulted ceilings due to dampness.



a b c d e

Retrofitting techniques by strapping or bracing with horizontal tie plates on bulged out and cracked portions.



a b

c

Structural damages due to new interventions on account of electric wirings.

a

b

Water seepage from top flat roof of the Council Chamber due to failure of past measures

Removal of dead and decayed mortar on the joints of the stone tiles paving on flat roof for repointing

Interior distressed conditions of the Central Tower.

a b c d

Structural damage due to water prentration from broken and missing Hayward Glass ceilings

X

Conservation Methods and Techniques

A fine specimen of colonial architecture, Rashtrapati Niwas/ Viceregal Lodge is a centrally protected monument of National Importance. Architectural integrity of the building is badly affected due to structural distress on account of water ingress and to some extent damage from1905 earthquake. Large-scale repairs and restoration, additions and alterations to the building had been carried out during the tenure of the successive Viceroys before India's independence. Subsequent to this and over the decades, due to poor maintenance, structural condition of the building has deteriorated. The levels of distress are structural failure, sinking, aging, weathering, dampness, crumbling and badly-bonded junctions in the stone masonry; cracks in the ceiling, walls and vaults, poor roofing and roof drainage failure resulting in leakage from the roofs and seepage from gutters, down pipes; wall facade, damaged pointing; damaged peripheral storm water drains, etc.; badly corroded wrought iron beams over verandas; visible rusted beams carrying the water tanks in the Central Tower; severe cracking in the vaults and walls of the Kitchen Wing and the Carpenter workshop in the West Vaulted chambers; untied foot of the hip rafter of the roof of the South-east corner of the three storied main block, etc.

The entire pitched roof system is appearing to be disturbed in which gutters and valleys are badly damaged. Tiles on the roof are missing and at places broken and displaced. Base sheets are also damaged. The trusses need repairs and repainting. The roof over the central atrium area rests on a series of king post wooden trusses which are resting on the inner walls / members around the atrium and not only support the roofing system but also the wooden false ceiling. Frames to ceiling are damaged and need repairs and replacement. At places the glasses have broken. Outside door-windows joinery has outlived its life and is badly damaged. False ceilings at various locations are found damaged due to continuous ingress of rain water. In the kitchen, laundry and wine cellar area, lime concrete vaults have failed at springing levels. There are visible cracks in the masonry walls at most of the locations. The crack width is ranging from some microns to even 8-10mm.The buttresses behind such vaults have visible cracks and are separating out from the building lines. Jack arch roofing is also damaged at many locations and glass prism terraces are profusely leaking.

The condition of the flat terraces is vulnerable with leakage, thus causing damage to all other components of the building. Flat terrace waterproofing treatments applied at later dates on the main block as well as on the Council Chamber and Public Entry Building are not effective. Underneath all the roofs, there are visible serious stains of leakage at the springing of the arch on the south-east, where there is no false ceiling, and also visible de-lamination cracks. The roof terrace of the three-storied Council Chamber is covered with grey stone slabs as wearing course with wide joints filled with lime *surkhi* mortar, and the joints have opened up.

The South-east corner of the three-storied block was found to be pushed out by the untied foot of the hip rafter of the roof; internally, evidence of severe water penetration are seen. The roof defects need to be rectified and the rafters are be tied back and the stonework anchor-bolted back to sound masonry, prior to making good end of the cracks.

In view of the distressed structural conditions of the building, the IIAS carried out scientific and technical studies from time to time through different Governmental or non-governmental agencies. On examination of the available copies of the reports it is found that the reports submitted by them have addressed the problems quite correctly. In the reports of the CBRI and Poul Backmann, emphasis has been given to the structural ailments of the building and proposed possible remedial measures including the techniques or methods to be adopted to tackle them. The CBRI also carried out investigations to find out the causes of distress in the lime concrete vaulted floors and stone masonry walls, material characterizations, finite element analysis, load transfer mechanism, identification of possible causes of distress and repair and rehabilitation measures for the masonry structures. It is also found that efforts have not been made to implement the recommendations and suggestions of the above referred reports by any agencies, thereby the building was allowed to decay in the absence of any remedial measures.

In view of the above and the results of these investigations carried out by different agencies and considering the analytical recording of the *in situ* present condition and locations of the causes of decay/deterioration of the building and following the established guidelines and conservation principles, an attempt has been made by the author for adopting a variety of remedial measures and repair techniques and methods to preserve and stabilize the structure from further deterioration.

1. Strengthening of stone masonry façade, external walls and arcades: The exterior walls of the building are perhaps most vulnerable as these are constantly exposed to climatic weathering and the external elements. As a large component of the exterior facade is of stonework, both as ashlar masonry as well as columns, arches, balusters, cresting and traceries, so stone consolidation becomes an important part of the conservation strategy. The building has an external stone facing of soft shale stone which is argillaceous sandstone. There is extensive water seepage from open masonry joints of the external masonry walls due to decayed pointing, cracks in the walls, broken stone surface, delamination, biological growth, leaking or missing sections of plumbing pipes, staining on the stone masonry, stone decay, powdering associated with efflorescence, roughened surfaces and preferential weathering, spalling, splitting, open joints and lime runs, organic growth, staining and discolouration, etc. In the course of periodical field visits, it was observed that there are various types of defects in stone work at various locations.

1.2. Delamination or spalling of the stone surfaces on the exterior façade of the building, particularly on pilasters and other vertical ornamental sandstone elements and splitting on the veranda balustrade uprights indicate that the defects are caused by the combined effect of excessive weathering and the inherent properties and quality of the particular stone. Delamination takes place along the natural bedding planes of the stones when they are laid vertically, instead of horizontally, and are exposed to weathering. Splitting of stones due to peeling off of layers is quite common. When sedimentary stones are used in building, this tendency of peeling off in layers can be exacerbated by improperly laid stones.

If the degree of delamination is only slight, the best way is to leave the stone as it is. If the stone block is thick enough, one method is to remove the delaminated layers up to sound stone. The other approach might be to remove the stones, then reverse and replace them on the façade. If these techniques are not feasible, the worst affected stones are to be replaced either with matching stone or a stone –like substitute, or by covering the stone façade.

1.3. The replacement of damaged or decaying stringer courses should be given high priority for its function of throwing away water from the building face than an ashlar stone in the veranda. Only non-corrosive stainless steel or phosphor bronze pins should be introduced by drilling through the detached layer in to solid stone behind. Any splits on upward facing ledges should be sealed with suitable mastic to prevent the ingress of water. Replacement of stone must be preceded by a thorough survey and assessment of the fabric and the accurate identification of matching stone. Efforts should be made to complete documentation including drawings of the relevant elevations, showing every individual stone beforehand so that the stones to be replaced can be clearly identified and the intended scope of work be clearly defined.

1.4. If spalling is present, and depending on the cause and the degree of its severity, the application of a water-repellent coating to a limited area, may--in some instances--serve to slow down the rate of deterioration. This treatment should only be employed when the masonry is completely dry in order to prevent further spalling. Yet it would be a temporary solution. A water-repellent or waterproof coating should never be applied to an already damp or wet building which may likely to have sub-florescence under its surface, thereby increasing the possibility of spalling.

1.5. Small pieces or larger fragments of masonry tend to separate from the masonry unit, often at corners or mortar joints caused by later alterations or repairs, such as use of too hard mortar. This type of partial replacement or "piecing-in" can be done either with natural stone or with a pre-cast imitation as a treatment for chipping stone. It involves replacing a small area of damaged stone with a new stone and the joint between new and old should be kept as narrow as possible to maintain the appearance of a continuous surface.

1.6. The crumbling stones are to be consolidated and strengthened, particularly with natural stones, to bring together deteriorating or disintegrating masonry. The broken or detached portion of the stone from the original construction joint should be treated by fastening together fractured masonry through drilling and reinforcement pinning and grouting methods.

1.7. The natural disintegration and erosion of stones are caused by wind and windblown particles and water, resulting in granular and rounded surfaces common to sandstones and limestone, and other non-homogeneous masonry materials. Weathering is particularly pronounced on sharp corners or highly carved or projecting architectural details and increasing the natural weathering rates resulting in noticeable softening or loss of masonry details. Individual masonry units badly damaged or disfigured by chipping, erosion or weathering should be replaced with matching stones depending on the cause and the degree of severity.

1.8. Separation of the sandstone window jambs from the adjacent limestone rubble masonry are found on the upper stories of the elevations. The use of two different kinds of stones in the window jambs and in the adjacent masonry, respond to a different degree to the diurnal and seasonal variations in temperature and air humidity. Some initial separation may be attributable to the 1905 earthquake. The cracking patterns in window transoms and mullions show the same pattern of occurrence as above and its underlying causes are likely to be the same. On the lower floor levels there may be an additional contributory cause, in so far as greater expansion of the sandstone window jambs compared to the adjacent masonry panels. The ongoing causes are such that a permanent cure cannot be affected. Once the separation cracks have formed, their causative stresses get relieved and the remaining residual movements will be seasonal. The remedial measure should be first to remove the past cement-based pointing. The joints and cracks should then be filled with lime-based mortars and grouts in the ratio of 1:1 and 1:2 mixtures of lime putty and dust from low-fired bricks, reasonably weatherproofed, having a lower strength than the stone, in order that any future cracking will be confined to the joints and not traverse the stones and have to be renewed in twenty-thirty years' time, but the relative weakness of the mortar will make this a much easier operation.

1.9. The narrow cracks should be filled by injecting through a hypodermic syringe with 1 or 2 mm needle. Fly ash with low sulphate content can be used in lieu of brick dust. Resin based grouts are likely to be stronger than the stone and would therefore not be suitable, as they would lead to new cracks forming through the stones. Where joints have opened so far that "key stones" in transoms have settled down, the transom and centre mullion should be dismantled carefully and reset them, possibly using small wet timber packs to maintain the new, larger joint width. Such packs can be left in, as they will dry and shrink, gradually transferring their load to the lime mortar which by then should have gained sufficient strength.

2. Treatment of wall masonry cracks: Cracks in the masonry walls occur for all sorts of reasons and are the visible symptom of possible problems. Fine hairline cracks running across the face of a wall indicate that a small degree of shrinkage has occurred in the fabric, depending upon the prevailing climatic conditions. The structure can readily accommodate such fine defects without undue concern. A diagonally stepped crack can indicate that structural settlement is happening, possibly due to upheaval at foundation level or some other form of slippage. If foundational settlement continues, the crack can consequently grow in width and individual stones or bricks can become loose and dislodged. If the cracks are wide at the top and tight at the bottom this can mean that one or both ends of the buildings' foundation are dropping or that the middle of the foundations is rising. If the cracks are wider at the bottom and tighter at the top then the opposite effects could be occurring. Vertical cracks usually mean that the stresses have been sufficiently severe to crack individual stones or bricks in the wall to such an extent that could make the broken pieces also unsafe. Continuous horizontal cracks which follow the masonry beds between the stones or brickwork indicate that walls are in an early stage of failure. Such crack patterns are found on parapet walls and parapet became loose and dislodged as a result of the structural failure and allowing rainwater to enter the building interior. Structural cracks can be caused by broken drains and water pipes, crushed or decayed internal structural timber, etc.

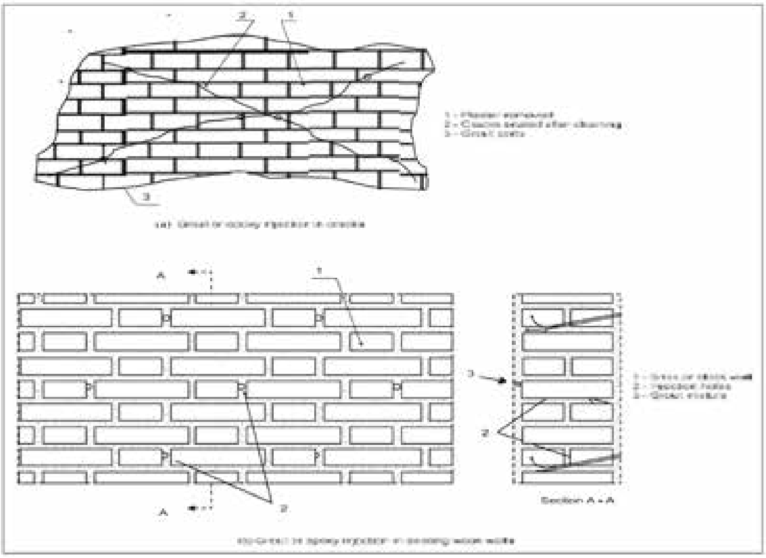
2.2. Crack movements should be measured or monitored only where they are likely to indicate the movements of the structural elements due to influence of climatic / environmental factors. Where a crack tapers, movement should be measured near either end of the crack; where substantial stretches of it change direction, movement should usually be monitored on each "leg". In order to get a measure of the seasonal fluctuations, due to variations of temperature and humidity, readings should initially be taken monthly. Whilst glass tell-tales will indicate that a crack has widened, but that will not measure crack movements. Monitoring is therefore best done with a Demountable Mechanical Strain Gauge (DEMEC). Alternatively, a calliper gauge, applied to two reference screws, could be used. Regardless of which method is used, any plaster should be removed so that the measurements are made of the movement of the structural masonry. Where there is risk of the reference discs or screws being disturbed, they should be duplicated.

2.3. Small cracks within a single block of masonry may not be serious, but longer and wider cracks extending over a larger area may be indicative of structural problems and should be monitored. The majority of cracks develop slowly and it should be monitored by installing tell-tales or setting up of three pins straddling of the cracks. The majority of cracks in building are of the hairline variety requiring only cosmetic redecoration treatments.

2.4. Hairline cracks, with a dimension of less than a millimetre in width, appeared in plaster of the walls and ceilings which go in definite horizontal or vertical straight lines or in stepped patterns. Over a period of time, if the structural movement has stopped, then the stabilized cracks that are between 1 and 5 mm in width, can normally be dealt with through filling the open voids and carrying out redecoration on the interior of buildings and repointing the affected area on the exterior. Such cracks in the plaster should first be widened so that the filler can be pushed right in. The corners of the scraper or filling knife are ideal for removing any loose plaster and for opening up and deepening the cracks. Remove the dust and dirt and mix the quality of filler before applying the same.

2.5. If the cracks are reasonably small (opening width = 0.075 cm), the technique to restore the original tensile strength of the cracked element is by pressure injection of epoxy. The external surfaces are cleaned of non-structural materials and plastic injections ports are placed along the surface of the cracks on both sides of the member with an epoxy sealant. The centre to centre spacing of these ports may be approximately equal to the thickness of the element. After the sealant has cured, a low viscosity epoxy resin is to be injected into one port at a time, beginning at the lowest part of the crack in case it is vertical, or at one end of the crack in case it is horizontal. The resin is injected till it is seen flowing from the opposite sides of the member at the corresponding port or from the next higher port on the same side of member.

2.6. Moderate wide vertical or zigzag cracks in coursed masonry

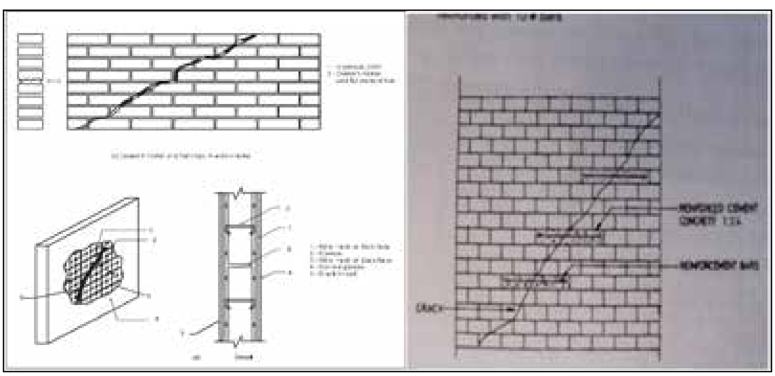


are observed at few locations due to movement, caused either by the response of the structure to seasonal fluctuations in environment or by slow residual foundation settlement. These are to be filled with a suitable mortar. The bed joints should then be raked out to a depth of about 40 mm. A thin (6 or 8 mm dia.) stainless steel reinforcing bar or a length of stainless steel wire rope about 6 mm diameter is then to be embedded in the raked out joints in a moderately strong mortar in the ratio of 1: 2: 9 cement: lime: sand, leaving the outer 20 mm of the joint empty. The steel should extend 0.50-0.75m on either side of the crack and the ends should be staggered in alternate joints. The outer 20 mm of the joints should then be pointed.

2.7. Cracks extending in width up to 25 mm indicate extensive structural repair works involving the possible replacement of affected sections of the building. Cracks of this dimension may also be accompanied by a variety of lesser dimensioned cracks. Cracks in excess of 25 mm in width will generally indicate very severe structural damage and require major repair works that could well involve the partial or complete rebuilding of the affected area.

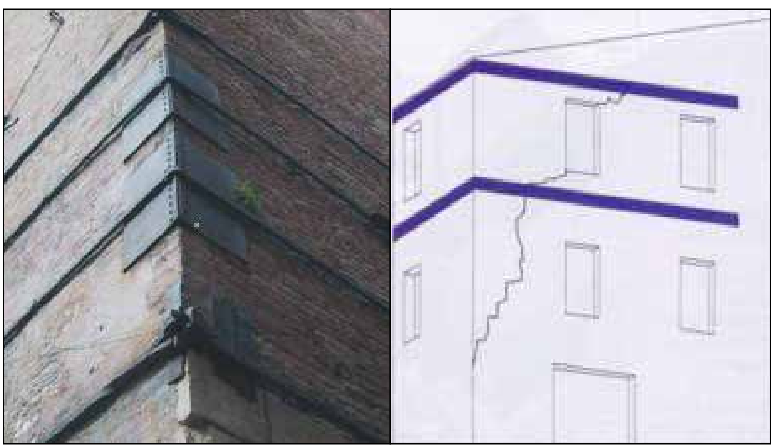
Structural underpinning may also be necessary due to the danger of associated collapse and instability.

2.8. Masonry walls with concentration of multiple cracks in the same portion and appearing on both sides on the wall or weak wall regions should be repaired with a layer of lime cement mortar or micro-concrete layer 20 to 40 mm thick on both sides, reinforced with galvanized steel wire fabric (25mm × 25mm size) forming a vertical plate bonded to the wall. The two plates on either side of the wall should be connected by galvanized steel rods at a spacing of about 300 to 400 mm. For large cracks wider than about 6 mm or for regions in which the concrete or masonry has crushed, a treatment other than injection is indicated. The loose material has to be removed and replaced with any of the materials mentioned earlier, i.e., expansive cement mortar, quick setting cement or gypsum cement mortar. In areas of very severe damage, replacement of the member or portion of member should be carried out. In the case of damage to walls and floor diaphragms, steel mesh could be provided on the outside of the surface and nailed or bolted to the wall and then covered with plaster or micro-concrete. The other option could be to repair the wall cracks by removing stones at both sides of the cracks up to 250 mm, and pre-cast reinforced concrete block of fit size should be placed to act as key stone. Lime cement mortar may be used to fix the pre-cast blocks in place. Precast block should be of size 200x200x500 and must be reinforced with 10 # bars.



3. Treatment and strengthening of existing walls: The exterior facades of the building are vulnerable due to constant exposure to climatic weathering and external elements. Where masonry is merely weathered, but still serving its function, it should not be replaced or repaired. The texture and patina of aged stone or brick-work are integral to the character of historic buildings, whilst the traditional materials can rarely be adequately reproduced. Repairs should be confined to the minimum that is essential, leaving the rest of the historic structure intact. As much historic fabric should be re-used as is possible. It may be appropriate to repair rather than replace individual stones.

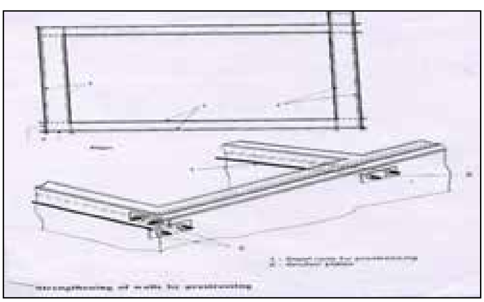
3.2. Any dismantling must be carried out with the utmost care so as not to cause unnecessary damage or loss of existing good masonry. The shortfall can be made up with either reclaimed materials, or new, provided it is an exact match in terms of materials, dimensions, colour, texture and method of finishing. Strapping with horizontal MS tie plates around the outer walls of distressed portion is another option for strengthening exterior disjointed, bulged out and cracked walls depending upon the intensity and gravity of the ailment from location to location at three levels between the floors and by drilling 20 mm diameter bolts at a spacing of 1m with steel packing plates and washers. The type and quality of the masonry material and the structural integrity of the



building are the main criteria to be considered when choosing the method of strengthening.

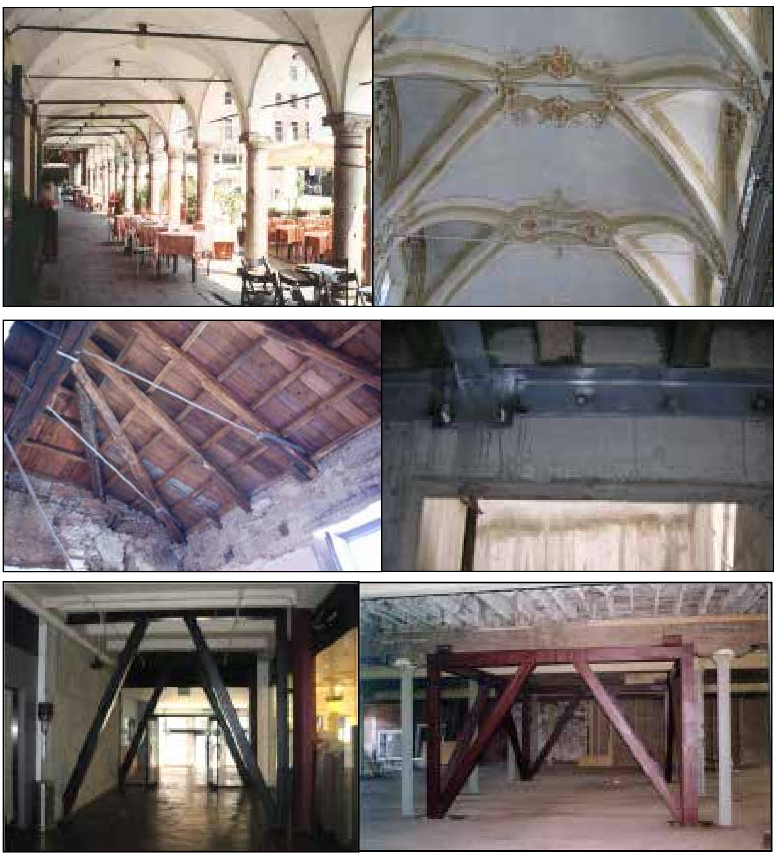
3.3. Where good quality coping stones exist and have been dislodged, it may be necessary only to clean the wall tops, clear them of vegetation and re-set the coping stones. Where most of the coping stones survive and just a few are missing, there is a good case to be made for introducing new material to replicate the originals, since the evidence of the original design survives on site.

3.4. Stitching refers to the tying together of cracked or damaged areas of masonry using modern materials. One of the most common applications of stitching is to re-tie a wall on either side of a crack using steel ties laid into joints at intervals. The crack can then be pointed up with mortar. Failed stone lintels can be repaired in place using stainless steel rods drilled in unobtrusively and set in epoxy mortar with the drill hole being concealed by a pellet of the original stone. This form of repair can also be used to strengthen arches in conjunction with wall core grouting, and to tie the outer and inner faces of the walls together to prevent



them from separating. Stitching can also be used to carry out *in situ* repairs on fragile masonry elements such as window tracery or detaching moulded stonework.

3.5. Any new material particularly moulded or carved stone, should relate directly to existing material of good provenance on the site. Rubble stone buildings, which have had elements of dressed stone robbed out, such as window and door surrounds or quoins, are best retained in that condition by careful stabilization of the surviving masonry around the openings. Missing facing stone should be replaced for the stability of the wall. Where small quantities of replacement stone are required, such as on verge cop-



ings or parapet copings, then an exact colour match may not be necessary as the replacement stones will not be overly intrusive. If the new masonry is required for structural reasons, and there is no clear evidence of the original detail, new stone of similar type and colour may be used to the same profile, but without any detail.

3.6. The existing walls can be improved by increasing the strength and stiffness of existing individual walls, whether they are cracked or not, due to grouting by drilling number of holes in the wall (2 to 4 sq. m). Then water is injected in order to wash the wall inside and to improve the cohesion between the grouted mixture and the wall elements. After that lime water mixture (1:1) is grouted at low pressure (0.1 to 0.25 MPa) in the holes, starting from the lower holes and continuing upwards. The other option will be to improve the strength of the inner walls by placing two steel meshes (welded wire fabric with an elementary mesh of approximately 50 x 50 mm) on the two sides of the wall, connected by passing steel each 500 to 750 mm apart. 20 to 40 mm thick lime mortar or micro concrete layer is then applied on the two networks thus giving rise to two interconnected vertical plates.

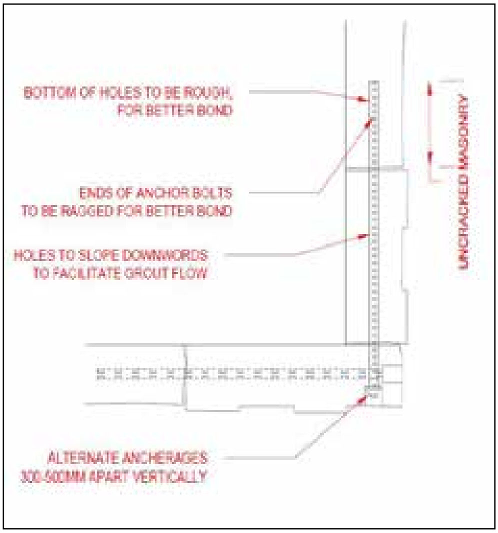
3.7. Long stones should be used at corners and junctions of the walls to break the vertical joints and provide bonding between perpendicular walls. Masonry walls and wooden floors should be connected with L-shaped steel plates. Another option is sewing of perpendicular walls by drilling inclined holes through them, inserting steel rods and injecting lime grout to increase the shear strength of walls. Moreover this will also improve the connections of orthogonal walls considerably. Pre-stressing (about 0.1 MPa) is also useful to strengthen spandrel beam between two rows of openings in case no rigid slab exists.

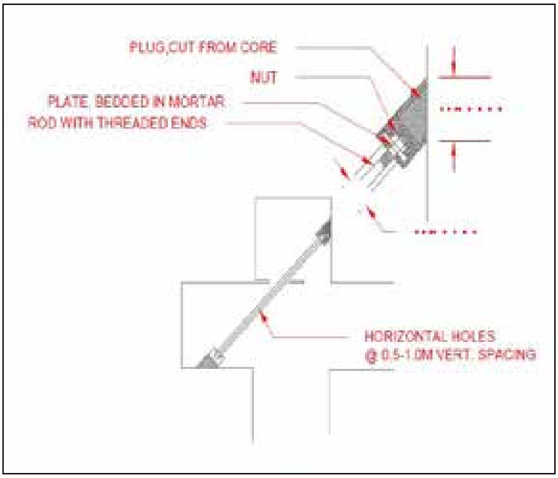
3.8. For bracing the longitudinal walls the anchoring should be done against horizontal steel plates on the two sides of the wall and strengthening them by turnbuckles. The same techniques had been done earlier at Central Tower and Band Porch portions of the building. This would strengthen the walls as well as bind them together. Some internal wall cracks developing for a long time should be filled up, but deep cracks in structural walls should be carefully monitored and action taken if they appear to be widening. In areas of dampness, applying a porous coating can assist in reducing the problem.

4. Strengthening of North-west area of Main Building: There are a number of vertical and near-vertical cracks in the masonry of the external west and north-west walls particularly near the junction of the facade with the internal wall at right angles, another on the single storey square projection coincides with a recess for a drainage downpipe together with its continuation in the second floor wall and the stairs and basement connecting to the underground vaults west of the building. The corners of the projection were strapped with flat steel bands at some time in the past. The Band Porch was observed to have visible slope downwards towards the main block of the building. The balustrades to the first floor veranda were also visibly distorted with the top seeming to buckle upwards in places. The corner piers of the Band Porch were also strapped with flat steel. The investigation of the north-west area of the building revealed fill materials to level the south-west corner of the site and presence of a water storage tank. Whether the settlement, having occurred in the past, is now complete or whether significant residual settlement is still continuing is yet to be cleared. To avoid or decrease the probability of out-of-plane structures, horizontal tie-rods should be used to connect parallel walls at the levels of the floors.

4.2. Repairs and strengthening of the masonry walls should be carried out, particularly where vertical cracking occurs. The bed joints should then be raked out to a depth of about 40 mm. A thin (6 or 8 mm dia.) stainless steel reinforcing bar or a length of stainless steel wire rope (about 6 mm dia.) should then be embedded in the raked out joints in a moderately strong mortar (e.g., 1: 2: 9 cement: lime: sand), leaving the outer 20 mm of the joint empty. The steel should extend 0.50-0.75m to either side of the crack and the ends should be staggered in alternate joints.

4.3. For the external corners, a possible technique would be "stitching" together by drilling horizontal holes of about 25mm diameter diagonally through the masonry with a core drill and forming countersinking at either end with a larger diameter core barrel. A threaded tie bar of stainless steel (or galvanized, wrapped in waterproof tape) can then be inserted and the nuts tightened, after which the countersinking be plugged with the shortened cores taken from the countersinking.





5. Strengthening of Central Tower: The Central Tower which contains the water tanks (and has also been provided with tie rods at the upper levels to prevent outward movement of the walls), has a flat, accessible concrete slab roof supported on iron girders with a decorative parapet wall having stone finials on either side of the central gable section. The parapet wall is in poor condition with the finial not secured properly by the rusted iron dowels and there is extensive seepage at the wall/slab junction. Some of the wrought iron or steel beams that support the tank room floors were seen to have some rusting of the flanges. One of these floors appeared however, to be of concrete, cast on permanent formwork of vaulted corrugated iron sheets, spanning between the lower flanges of the beams. Small areas of the corrugated sheeting should be removed in three or four places and the built-in ends of the beams should be exposed and examined for rusting. Some of the tie rods, inserted subsequent to the original construction in order to restrain any bulging of the walls, appeared to be slack so these should be tightened by wedging under the steel beams. To restrain bulging, steel plate straps had been applied earlier on the external walls.

The remedial measures to be taken are --- to reduce the load of the upper water tank located within the tower, so as to lower the load on the building and to create a hydro pneumatic system of water supply, and care should be taken to ensure that no over flows are allowed. The gables are a risk during earthquakes or exceptionally high winds. Therefore, to prevent them from falling outwards, these are to be anchored back to the roof by means of rods. The cracks on the top floor and the parapet walls should be filled up and water tightened and open joints be pointed after raking out the dead and decayed mortar. The damaged downpipes should be replaced and water outlets be improved and made functional.

6. Strengthening of Three-storied south-east corner of main block: The area on the south and east face is one of the sections of the main block with major structural defects due to faulty design of the roof support structure including absence of wall plates, which are required to distribute the load from the roof trusses on the walls, as well as the fact that the corner rafter is not provided with the floor level tie member to counteract the outward thrust. Vertical cracking from the porch roof up to the eaves level were observed. Internally, the walls of the grand staircase are wood-panelled; making it difficult to ascertain the extent of through-cracking, but some was noticeable. There is an extensive staining, being evidence of substantial roof leakage. In the roof space, the foot of the hip rafter supporting the roof corner had no restraining ties to take up the horizontal thrust. The cause of the cracking was due to the thrust from the hip rafter, the foot of which is at the other corner of the staircase was untied.

The remedial action should be to provide adequate tie-back to the hip rafter (east-west and south-north), and bolt back the separated corner masonry to be stitched together by drilling horizontal holes, about 25mm diameter, diagonally through the masonry with a core drill and form counter sinking at either end with a larger diameter core barrel. A threaded tie bar of stainless steel (or galvanized, wrapped in waterproof tape) can then be inserted and the nuts tightened, after which the countersinking be plugged with the shortened cores taken from the countersinking. Here, the downward slope (15-20 degrees) of the slightly larger holes may be required to facilitate grouting. The roof repairs, associated with this part, should extend to include the whole width of the wall in front of the grand staircase, and its returns. In order to restrain bulging of the wall, steel horizontal plate straps should be applied externally at intervals. The water outlets and downpipes should be improved and gutters made functional. The open joints between the top roof and parapet or gable walls should be sealed and water tightened.

7. Strengthening of south-east Bell Tower: Structurally the Bell Tower is in good condition and it was repaired in recent years by replacing the wooden members and water tightening the top roof with lead sheets. Active structural cracks in walls and ceilings have been stitched on account of damp intrusion. The exterior wooden members are to be repainted after removing the decayed layers of coating. The lower levels of the Bell Tower are to be taken up for repairing of structural cracks in the walls due to structural movement and material deterioration. The recommended remedial action proposed include consolidation of wall masonry by grouting and stitching of cracks; repairs to the rotten damp wooden roof support structure; restoration of masonry spiral staircase at lower level; repointing open joints in the external walls; replacement of GI sheets roof over pitched wooden board roofs of pediments with watertight detailing of junction with main domical roof; replacing flashing on ledges of pediment openings and sealing off sources of rainwater entry; providing waterproofing treatment on roof of projected oriel window on the south; detailing for weather protection of the windows in the external walls; replacement of decayed doors and windows; filling of internal cracks after stabilization and plastering and painting of internal walls; replacement of decayed sections of the rainwater downpipes and arrest leakages from sub-surface rainwater drains to the north and east of this area.

8. Strengthening and Stabilizing of East Porch: Due to differential settlement, there are localized active structural cracks and crushing of stone units. The recommended remedial action should be to stabilize the surface level and strengthen the foundation on the south-east portion; stitching the cracks in the masonry of the west bay; replacement of damaged weathered stones of the arcade, stairs and walls; waterproofing of the flat roof; removal of decayed plaster and re-plastering; pinning of the broken and displaced stone masonry lintels of the doors and windows; and ensuring that the underground water tank has no leakage. At few locations, stone cornice is found damaged which is to be repaired with matching stones.

9. Poorly bonded masonry junctions: Throughout the building, wherever substantial vertical cracks are found in re-entrant corners of the masonry and where it is considered inadequate, the two parts of the masonry can be repaired by grouting using hydraulic lime cement grout injections followed by stitching together by drilling horizontal holes, about 25mm diameter, diagonally through the masonry, with a core drill and form countersinking at either end with a larger diameter core barrel making the buttresses integral and monolithic with the supporting walls. A threaded tie bar of stainless steel or galvanized, wrapped in waterproof tape can then be inserted and the nuts tightened, after which the drill hole be concealed by a pellet of the original stone and the open joints be pointed. On the north-west corner of the Kitchen Wing the two buttresses at right angles to each other showed a vertical crack in the re-entrant corner indicating that the buttresses were poorly bonded together. Similarly, on the north elevation, adjacent to one of the spiral stairs, the masonry of the bay window was found to have a straight joint with the wall without any bonding whatsoever.

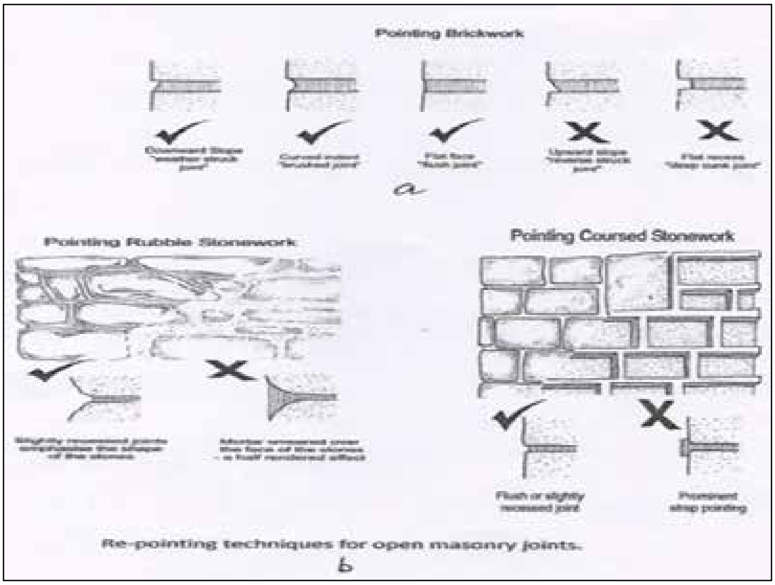
10. Strengthening of exterior stone stairs: The external stone stairs carry over their lifetime and become worn and considered unsafe and slippery and these masonry stairs require periodic maintenance and repair. These stairs suffer from structural defects such as evidence of past settlement or cracking and loose treads, gaps appearing between steps or cracking appearing in the masonry leading to water pooling. It is important that the sub-structure which supports the stairs remain sound. Where the structure is unstable, steps should be dismantled and rebuilt. Where wear is pronounced, it may be necessary to insert an indent or mortar repair to level up the steps. Biological growths such as mosses, grass and even small shrubs can establish themselves on steps in gaps between treads and the side faces of spandrels. The growth should be carefully removed to prevent the root structures creating further damage and the open gaps repointed with an appropriately specified lime mortar. Open joints left between steps and platt slabs also allow water to seep through, leaving the underside of the steps saturated with little chance of drying out.

For large or wide entrance steps, often only the centre of the steps becomes worn. If the steps are of sufficient thickness, cutting the worn patch and inserting a thin replacement piece of stone in its place can bring the upper surface back to its original level. Where steps are genuinely beyond repair, it may be necessary to replace the entire step or steps matching to the original. Stone balustrades and hand railings at few locations, particularly on the north and west side, are found damaged and suffered stone decay and broken. Similar repair principles should be followed and missing elements be replaced, matching the design and dimensions of the original and also efforts be made to retain the original members as far as possible. Where movement or rust staining is evident on stone balustrades, this is likely to be due to failings of ferrous metal fixings and these should be repaired. Care should be taken to retain existing steps wherever possible and consider the overall design and status of the building.

11. Repairs to ashlar sandstone masonry: Sandstone is the most commonly used stone for construction of ashlar walling, is inherently stronger than rubble stone structures and can withstand a considerable degree of erosion and distress when it is laid horizontal with the natural bedding planes. Where the bedding planes are set parallel to the external face of the building, such stone blocks are prone to failure through delamination or sheets of the stone detach and sheer off. The original construction should be studied and accurately measured to record the precise dimensions of the stones to be replaced after proper documentation of the existing masonry ensuring that the new stone fits exactly in the correct location, the angle and depth of the chisel marks the size of any borders and the number of grooves that are incised into the face of the stone. The joints between the two stones should be cut as finely as possible to help the indent tie in better and voids behind, if any, be firmly packed with mortar and in final positioning of the indent, it should beset so that the external face aligns evenly with the surrounding original face of the building. The replacement stone should have physical properties as close as possible to those of the original stone including strength, porosity and water absorption characteristics. Where an exact match is not possible, the new stone should be slightly less resistant to the effects of weathering compared to the existing stone.

12. Strengthening of rubble stone walling: In traditionally built rubble stone walling, it should be expected that the mortar used in its original construction will deteriorate over time and would need repointing. If repointed properly, a further century of life can be expected of the wall without much additional maintenance. Before work starts, it is always advisable to take detailed photographs of the area to be repointed. This will give a visual reference of what the wall looked like before any changes are made to it and the photographs can be regularly used to check the quality of the work against the original appearance as it progresses.

Repointing is necessary when the bedding or jointing mortar gets washed out from the wall and the stones become loose and risk falling out of place. If left unattended to, rainwater can readily penetrate the heart of the wall and lead to further deterioration. Recently, timecement mortars have been commonly used for repointing work but this is not recommended as it can also damage the stonework and lime-based mortars are much more appropriate and effective for masonry repointing work as they let the walls breathe. To provide a sound base for the replacement, mortar it is necessary to remove decayed mortar from the face of the wall and from around the stones. This should be attended with care to avoid damaging the edges of the underlying stones -- some of the stones will become displaced and fall out of the wall and the displaced stones should be set aside for re-use in their original position when the repointing work is taken up. In the raking out process, power tools should not be used as they can badly damage or leave a mark on the remaining stonework. The raked out areas should be carefully flushed out with water, taking care to also flush the loose debris down the entire wall-face rather than let it accumulate on the face of lower stonework. It is also important to ensure that all vegetation and any penetrating roots are completely



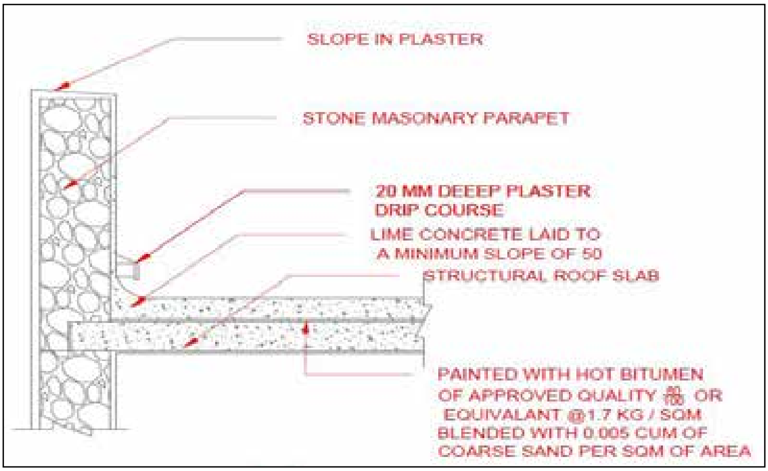
Re-pointing techniques for open masonry joints.

removed from the wall structure to avoid the risk of future damage to the repointed work.

In some cases, the loose section of the wall has to be dismantled and rebuilt during the repointing work. The process of repointing starts with the need to push new mortar back into the heart or core of the wall in a process called tamping by using appropriate tools for pressing the mortar well into the spaces created by raking out so that it comes into direct contact with the original mortar, thereby eliminating any voids. The lime mortar finish, on-shrinking type, around the stones could be flush or slightly recessed so that all the stone faces could be clearly seen. The re-pointed portion will be cured thereafter properly. Repointing work should not be carried out during periods of heavy rainfall or in frosty conditions.

13. Junctions of parapet walls and roof: To carry out water-proofing of this area, felt shall be laid as a flashing with minimum overlaps of 100 mm.

The lower edge of the flashing should overlap the felt laid on the flat portion of the roof and the upper edge be tucked into the



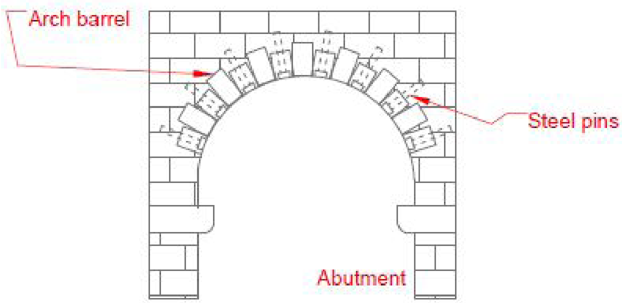
groove made in the parapet on the vertical face of the wall. Each layer should be so arranged that the joints are staggered with those of the layer beneath it. After the layers of felt are laid and bonded, the grooves should be filled with lime mortar in the ratio of 1:3 lime and sand which when set will satisfactorily secure the treatment to the wall.

14. Treatment of decorated stone elements: The ornamental elements such as finials and terminals are generally placed at the top of the gables, dormers, windows or roof-ridge. They serve a functional role and provide a design feature which increases the protection of the gables and turrets. One of the features of the roof over the entrance hall area is a projected section with a central gable wall with carving, finials and decorative carved stone elements at the parapet levels. These gable walls are considered a risk during an earthquake or in exceptionally high wind. They should be anchored back to the roof by means of tie to prevent them from falling outwards. There are similar ornamental features elsewhere on the building; these should be similarly assessed and if necessary tied back.

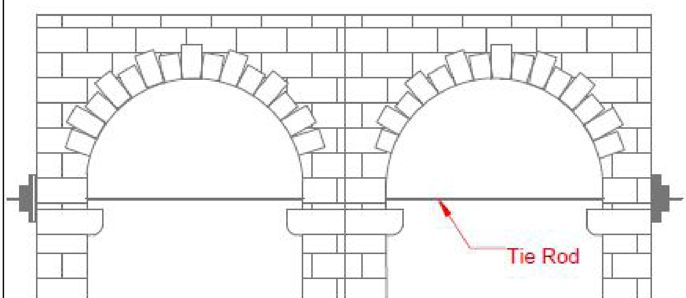
15. Repair treatment of stone lintels and columns: Lintels are flat, horizontal structural supports for the masonry above an opening such as windows and doors or more substantial cut and dressed stones spanning between columns. Single piece stone lintels have very little resistance to bending and, for the most part, depend on an arching effect in well-mortared masonry above the lintel to reduce the load on the lintel itself. Stone lintels have a limited ability to cope with structural movement which redistributes the load from the masonry overhead onto the lintel. The most common form of failure in stone lintels is straight-through cracking. They are often found in this condition with the masonry overhead surviving because a new natural arch develops within the masonry. There is, however, very little to stop such lintels from falling out. Cracked stone lintels over narrow openings should be repaired by first propping the arch, then using a technique of dowelling with a resin stone adhesive across the crack. Timber lintels, where decayed, should be replaced by an appropriate timber capable of withstanding exposed conditions but with a protective layer of felt bonded to the new timber over and at both ends.

16. Strengthening of masonry arches: Arches and vaults are structures relying on thrust at the springer to reduce or eliminate bending moments, thereby allowing the use of materials with low tensile strength or construction with dry stone blocks, etc. without mortar. Their load-bearing capacity is excellent and it is the movement of the springer, introducing bending moments and tensile stresses that usually lead to opening of the joints and eventual collapse. These arches are generally smaller in span and may have secondary masonry such as window tracery within the spanned opening and can suffer from all the defects. Their shorter spans make them appear to be much more stable. However, if a series of closely-spaced lancet lights lose lateral support to the springing of the final arch, then a progressive failure can occur through the entire set of windows. Smaller openings tend not to have shaped voussoirs and are therefore dependent on the mortar between the stones to keep the shape of the arch.

Damage to the arches has been caused by lack of thrust at the springer. Thrust will be achieved by inserting steel ties which should be post-tensioned for better effectiveness. The sheer resistance will be improved by tying each block to its neighbour with SS pins by drilling holes and grouting the same using epoxy adhesives. The failing arch needs to be supported in the first instance. Where there is evidence of spreading of the arch and obvious movement at its supports, lack of lateral support is the primary cause of failure. The remedial work to restore lateral support should be carefully designed and specific to the particular site.



Strengthening a masonry arch



Use of Tie Rod

Horizontal tie-rods can also be used in the arches to absorb horizontal impulses in arches. In rubble stone arches, where the stones of the arch may have slipped but are still in place, it is possible, when supported, to rake out the mortar and re-point the stones, making provision to grout the core of the arch by the insertion of grout tubes. It may be possible to re-set some of the slipped stones without disturbing the adjoining stones, but it is quite acceptable to consolidate the stones in the position in which they are found if they cannot easily be re-set. Once re-pointed, the core of the arch may have to be grouted.

If the walls have large arched openings, it will be necessary to install tie rods across them at springing levels or slightly above it, by drilling holes on both sides and grouting steel rods in them. Alternatively, a lintel consisting of steel channels or I-shapes should be inserted just above the arch to take the load and relieve the arch. In jack-arch roofs, flat iron bars or rods should be provided to connect the bottom flanges of I-beams, connected by bolting or welding.

17. Restoration of terracotta tiled roofs: The clay tile has one of the longest life expectancy among historic roofing materials -- generally about several hundred years, provided there is a regular maintenance program to determine condition, potential causes of failure or source of leaks, etc. The Viceregal Lodge has a strong character of terracotta tiled roofs cape on a series of regularly spaced horizontal battens attached to the rafters. These tiles have a projecting nib on the back and the small projection on the rear of the tile holds it in position when laid on the batten. The ridge of the tile roof is normally protected by ridge tiles, half rounded or V shaped depending on availability. The spacing of laths and battens are kept very carefully to ensure tiles sets properly over each other.

There are a number of issues which can arise with the tiled roofing such as loose and broken tiles, deterioration of tiles and battens and fixings, etc. Special care and precaution is required to preserve and repair them from both visual point of view as also the first line of defence against water ingress through the roof. Roofing tiles are mostly deteriorated because of frost damage and breakdown of the fastening system due to corrosion of iron nails. The deterioration of metal flashing, valleys and gutters can also lead to the failure of a clay tile roof. If gutters and downspouts are allowed to fill with debris, water can back up and seep under roofing tiles, causing the eventual deterioration of roofing battens, the sheathing and fastening system or even the roof's structural members.

At many places the roofing clay tiles have been loosely placed without proper laps. There are also many cracked and broken tiles. At junctions of masonry and tiled roof such as at the chimney stacks, GI sheets have been loosely provided as flashing, hence lead to weakening of the structural elements due to leakages. In cases of missing or broken tiles, replacement tiles exactly match the size, shape and texture. It is necessary to assess the condition of the entire roof from both inside and outside, before deciding any course of action. Before laying the tiles, copper or lead gutters, flashings and valleys must be installed, preferably using at least #26 gauge (20-24 ounce) corrosion resistant metals extending a minimum of 12" (30.5cm) under the tile from the edge. The cracked timber members should be replaced to match the well-seasoned original sections in the size, proportion and surface treatment.

The ridge of the roof should be capped with special tiles or lead rolls or flashings or metal cresting. Capping stones play an important role in ensuring that the building is watertight. Moss can take root in the joints between individual tiles. If allowed to grow unchecked it will force the joints to open up and allow water into the building. Moss also holds water against the surface of the roof cladding where it can cause deterioration. The growth should be brushed out from the joints, using a non-ferrous brush, and the debris cleared away so as not to block gutters and down-pipes, or to take hold on other parts of the building. Lichen and green algae growth are not generally considered to be damaging to tiles.

18. Treatment of timber roofing: There is a long tradition of using timber for the structures supporting roofs. If not properly maintained, wood can suffer from decay and damage through the action of a number of agents. Timber Trusses and rafters are generally in a relatively sound condition. However, at certain places, the joints appear to have opened up. There are very few timber members with cracks. The timber trusses resting directly on external masonry wall without any bed block or wall plate is an improper arrangement leading to weakening of the structure.

There is a variety of ceilings in the building, and the most common type is that of stretched fabric ceilings in a wooden framework. These false ceilings are historic being part the original construction. At various locations, there are signs of trace leakage and seepage from the rooftops. Untreated problems can lead to the saturation of ceiling joists and plaster laths. Rot is caused by damp and once a rot fungus is established in timber, it can spread and grow throughout the wood as long as the conditions remain conducive. The application of fungicidal fluid to an affected area of timber is a simple short term treatment with the help of brush or coarse spray. Wet rot comes in a variety of forms. It requires higher moisture content than dry rot, between 50-60%, and can in many ways be seen as the natural decay process of wood. It is important to treat it as early as possible by removing the source of moisture which created the conditions for the rot to develop in the first place and allow drying and then removing the affected portions.

For strengthening the joints which have opened up, strapping with splice plate and bolts should be done. Bed block should be provided *in situ,* using high strength micro-concrete below the existing truss ends after cutting out the masonry to create the bed block. The truss should be supported by underpinning before carrying out this operation. The deteriorated masonry at the support level between trusses should be replaced. As far as possible, replacement of decayed sections of roof support structure should be avoided after removal of the source of damp -- cleaning, removal of built-up layers of varnish and paint, filling of cracks and provision of protective coating. If the ceiling is of decorative plasterwork, it is particularly important that any re-fixing should only be done under specialist advice. Fine or hairline cracks in a ceiling are rarely a cause for concern. Ceiling cracks may indicate that the floor above is overloaded. If there is an item of heavy furniture or equipment above, this may be the cause of the overloading. A recent change of use of a building may have resulted in overloaded floors. Plaster ceilings are vulnerable to the failure of their backing materials. Where serious decay exists, a section of matching new fully seasoned timber can frequently be scarfed in and the joints are held with pegs or stainless steel bolts. Where active decay exists, the first priority is to eliminate causes of dampness and promote drying. Degraded surface material should not be removed without reason and keep the roof spaces clear of rubbish and debris etc. In some cases where water ingress has damaged the fabric, this too requires careful restoration or replacement in similar materials. It is critical to restore this historic ceiling by scraping off the layers of paint and restoring it to the original wood polish. The wooden roof ceiling of the main entrance is being used by bats. Bats together with their breeding and resting places are to be removed by involving Wildlife departments of the Government for shifting to other safer location.

19. Treatment of flat roof terrace: The roof and associated features of a historic building form important elements in defining their character and provide the first line of defence for the interior of a building against weather. To keep it in good repair condition and well-maintained, the rooftop gutters and downpipes should be routinely cleaned. Blockages of rainwater should be attended to immediately. Much of the recent re-roofing work seems to have been poorly executed. The gutters have been made so narrow that they are prone to clogging with debris, etc. The drainage defects of the flat roofs were seen to be many and widespread. They appeared to be largely due to inappropriate design details, such as, *inter alia*, falls of veranda floors being inwards, towards drainpipes located against the set-back walls and outlets being of inadequate bore and prone to clogging with debris.

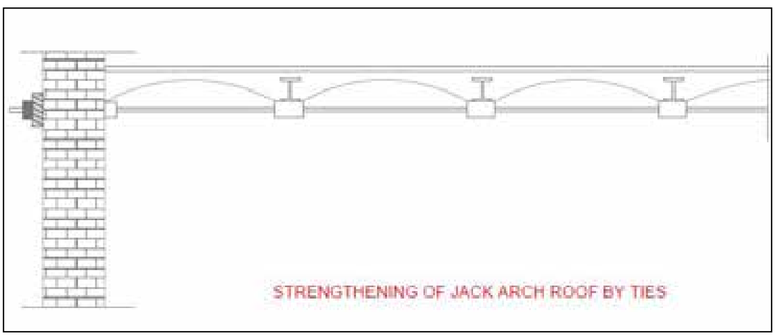
Most of the problems with the building having flat roof are the cracks on the surface of its flat concrete part, thus permitting water to penetrate into the inner part of the building causing serious damage to its integral parts. The existing water proofing treatment with lime concrete on the flat roof has deteriorated and needs replacement. To be efficient and lasting, water proofing treatment has to be carefully carried out from the time the surface is prepared to receive the treatment, such as, membrane, film, lime concrete, etc., to the finishing of the treated surface. For lime concrete treatment, the structural roof surface should be finished rough to provide adequate bond. Roof drain outlets should be cleaned to prevent accumulation of water. Masonry drain mouths shall be widened 2.5 times the diameter of the drain, and rounded with cement mortar (I: 4). Special attention and strict supervision has to be paid to proper overlapping of joints, particularly treatment around drainage openings in the roof and treatment of parapets.

The hot bitumen should be spread over the roof surface and allowed to cool to a temperature where the film may be laid without any damage to it. The polyethylene film shall be carefully laid on the bituminous layer and firmly but carefully pressed down with the help of a gunny cloth so as to prevent any damage to the film. The next length of the film shall be similarly laid down on the roof with proper longitudinal and end overlaps, and firmly pressed down on the bituminous layer. The joints and overlaps shall be carefully sealed with the help of cutback bitumen applied over the upper surface of the lower layer of the film. Excessive bitumen should not be used for bonding the film to the prepared surface, which may result in the film sliding and wrinkling. The film should not be overstretched, which otherwise leads to wrinkles when the film retracts. These wrinkles may get reproduced in the final treatment and are liable to get eroded and cause failure of treatment. The workmen should preferably walk barefoot or with canvas shoes in order to prevent damage to the film. If the polyethylene film is to be carried over from horizontal to vertical surface, it should be over a fillet and protected with cement plaster or any other treatment.

For lime concrete waterproofed roof finish, Class C (fat lime) in the form of hydrated lime should be used. Coarse aggregate should be of broken brick or natural stone aggregates. Water should be clean and potable water is generally considered satisfactory for use. The average thickness of lime concrete should not be less than 100 mm and it should then be rammed with a rammer and the surface brought to the required evenness and slope; further consolidation should be done by *thapis* with rounded edges; the beating should be done at least for 7 days until the *thapis* do not make an impression and rebound readily when struck. Compaction shall be done carefully at junctions with parapet wall. Every 40 sq. m area of roof shall have a 100 mm diameter rainwater pipe to drain rainwater. Lead flashing as per the original lead thickness should be restored as the second line of defence in the roofing, and the slopes of the gutters and water channels should be adequately created to ensure there is no future water ingress.

20. Treatment of Jack arched roofs: Jack arch roofs are provided in some part of roofs especially in outer corridors in the building. The steel joists and CGI sheet arch supporting the jack arch slab at first and second floor level on the north-west and north east portion of the main building are corroded at certain places. The visible extensive corrosion is in the verandas with jack arch type roofing having CGI sheets in arch shape placed over I-sections. Affected sections are to be treated with rusticides and passivators to arrest further corrosion.

The corroded and rusted steel sections are strengthened by welding additional flange at the bottom and if both flange and web are corroded the whole joist is to be replaced or provided with



additional joists adjacent or below the member in the case of the Jack arch. The rods shall be provided between the springing of the arches. This will relieve the walls from the thrust of the arches and the load transferred to the walls will be vertical. The top of the Jack arch having lime concrete shall first be grouted using lime cement grout. Finally, the steel members shall be treated with a coat of primer followed by epoxy paint.

21. Treatment of Hayward glass prism roof: Extensive leakage is from the prism glass ceilings in various locations of the verandas and open flat terraces of the building. At places, glass prisms are found broken or missing and not bonded property with the frame. The best course of action should be to take out carefully such prisms and glass bricks and the joints of supporting structures and the cast iron frame be cleaned properly along with the prisms and glass bricks. The cast iron frame is also to be treated with a coat of passivator followed by epoxy paint before re-fixing the glass prisms/ glass bricks using silicon and epoxy sealants after replacing the missing or deteriorated pieces as per the original.

22. Caring of fireplaces and stabilization of Chimney Stacks: Fireplaces are an integral part of the building. The basic components are the recess in the wall, the hearth, the grate, ashtray or bucket and the chimney piece. Historic fireplaces are as on date not in use. However, these fireplaces have to be preserved and maintained by regular cleaning with water and a little detergent. Many chimney pieces, particularly where soft wood was employed, were painted. Where this is the case, careful repainting will sometimes be necessary. The paint finish should match the original as closely as possible and any decorative finishes should be retained. Iron which is rusty or dirty can be rubbed down and burnished with wire wool and cleaned using white spirit.

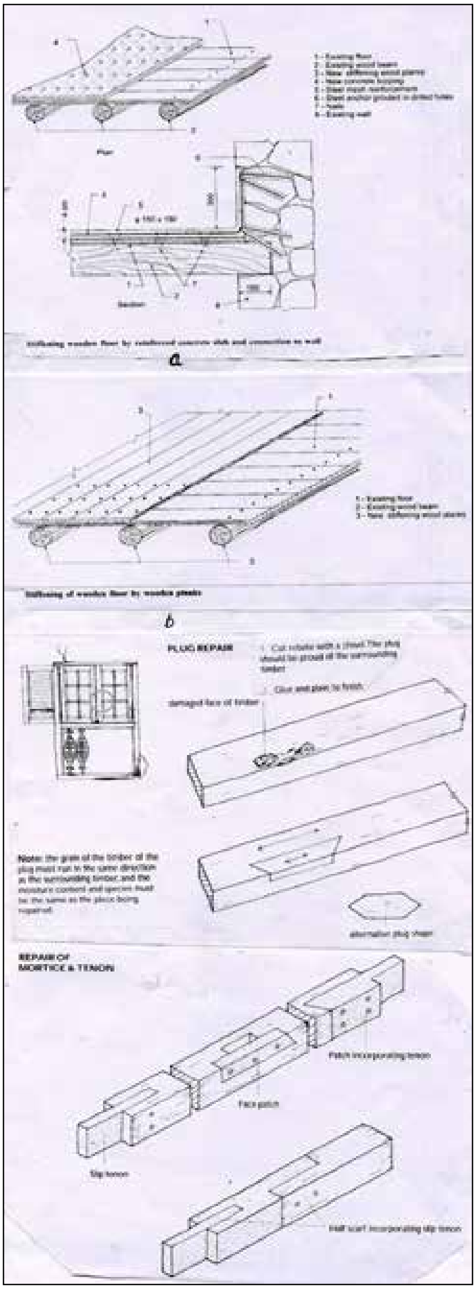
Chimney stacks are one of the most vulnerable elements of a building because of their high exposure and are usually the most inaccessible parts and are difficult to maintain as they are often the least accessible parts of the building. The shape of the flues is rectangular and the size and openings of hearths varied, mostly rectangular. These are built into the thickness of external masonry walls, frequently on the gable ends as well as on internal walls. Internally, the flues were lined with smooth plastered masonry. The chimney flue terminates at the chimney head -- sometimes called stack -- which is the element visible above the rooflines. The most slender of the Chimney stacks are found to be at risk during high winds and also from earthquakes. Erosion of mortar between bricks or stones in a chimney can lead to smokiness, dampness, increased risk and instability. Mortar joints are most susceptible to weathering at the top of a stack on the sides where it faces the prevailing wind, or the point at or just below, where it passes through the roof. Vegetation growth is another problem and can accelerate the decay of the chimney head and stack.

Flashings are narrow sheets of an impervious material, often lead, used to cover the junction between different materials or elements of a building to prevent water penetration. They play a very important role in ensuring that a roof is watertight. Check for damaged or slipped flashings where the chimney stack meets the surface of the roof. This junction may instead have been sealed using fillets of mortar and these should be checked for any cracking or missing sections. If repairing or replacing these fillets, use a soft lime based mortar rather than cement. The gaps in the wall masonry in the lower levels of the stacks in the Kitchen Wing should be grouted and cracks be stitched and open joints in the external masonry be repointed. The replaced chimney copestone should be placed in such a way that water is shed clear. The organic growth should be removed and the stumps poisoned. Providing some ventilation is maintained, disused flues can be capped after sweeping to keep out birds and help prevent dampness.

23. Overhead Glazing / Skylight Glass: The maintenance of glass and glazing system is generally limited to cleaning and replacement of missing or dried glazing putty wherever necessary. Glass is best cleaned using soft cloth and water. Abrasive cleaning agents should be avoided as these may damage the surface. Where window putty needs to be repaired linseed oil putty is usually the most suitable type. Rebates, the grooves into which the glass sets should be painted prior to inserting new putty and left to harden completely before painting. The small cracks in the corners of panes can be left *in situ* unless they pose a danger by admitting air or water. The glass used in the roof skylight of the building has broken and needs replacement. Shimla falls under wind zone II having a wind speed of 39 m/s. Therefore, for overhead glazing used to cover roofs/ skylights, tempered glass of 4mm thickness or laminated glass of minimum 5.38mm should be used.

24. Strengthening of stone and wooden flooring: Most of the historic floor coverings in the Viceregal Lodge building have survived and interior floors are of timber boarding. Floors and floor finishes are generally subject to more wear-and-tear than any other internal finishes. Valuable floor surfaces such as timber or stone can be damaged by foot traffic and must be protected in vulnerable spots using mats. If the building is surrounded by gravel or sharp stones, the provision of a mat or grid outside the entrance will greatly reduce the wear-and-tear of floors, caused by small stones being carried in and around the building on the soles of shoes. Timber floors for any dips or areas of excessive springiness will indicate rot or weakness in the floor joists which needs immediate attention. In old floors, physical wear can be quite pronounced, especially in areas of high foot traffic. While this can lend character, there may be trip hazards or weakness due to thinning of the timber. Badly worn timber will have to be replaced. Holes and gaps should be repaired with small timber patches; smaller holes and cracks can be repaired with proprietary filler. Wide gaps between the planks can be repaired with thin strips of softwood glued into the gap.

While re-fixing and re-laying, it is advisable to use woodscrews for extra strength and to allow adjustment and tightening. The heads of the screws can be countersunk and plugged to maintain the look of the floor. During this process, make sure any fixing goes into a joist, and not the void, or more importantly, into any services such as cables or water pipes that may be underneath.


a
b
PLUG REPAIR
REPAIR OF
MORTICE & TENON
Face patch
Slip tenon

When replacing damaged areas, it may be necessary to fix bridging pieces against joists to create a larger fixing area below.

Pinning techniques in terrace joists and insertion of dowel bars at corners and T-junctions will be useful in wooden floors supporting on wooden joists. This method will make the wooden joists/ floor integral and monolithic with wall thereby preventing sagging, separation of floor and maintaining its structural integrity as well. Another technique is the idea of including a horizontal bracing composed of steel tie rod and arranged in crosses on the floor. The floor and the masonry wall can be connected with L-shaped steel plates.

Damage to floors can occur through the need to install a range of cables and piped services. During refurbishment, planks have to be lifted. Sometimes the damage can be limited by cutting the tongues off by cutting along the joint with a handsaw. However, concealed nails often damage the saw and there is real risk of also damaging any underlying services. Thick continuous floor coverings should be used with caution, especially on wooden boarded ground floors. Thick rubberized carpet underlay can prevent moisture movement and create the right conditions for the wood beetle and other decay mechanisms to thrive.

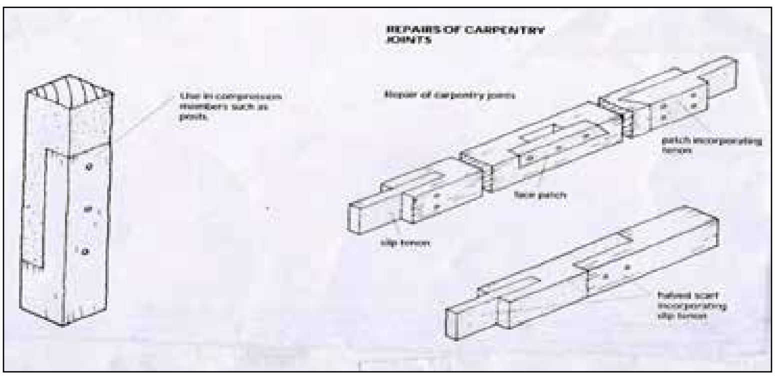
The historic chequered marble floor survives in the Kitchen and requires some non-abrasive cleaning and wax polish, while the timber boarding is uneven in many places and requires specialized restoration. Linoleum floors are inappropriate for a historic building and should be immediately stripped and removed. Unfortunately, as a result of major toilet upgradation works undertaken some years ago, none of the historic floor or dado finishes survive in the toilets. The terrazzo floor finish is seen in the ground floor verandas.

25. Strengthening of Timber Staircases: The condition of the service staircases and passages of the Viceregal Lodge interiors is especially poor and should be restored as these timber staircases are essential means of circulation and also important for users of the historic interiors. The wood panelling in the stairways and galleries should be re-polished. The loose wooden handrails and newels, wherever disjointed, should be set right by re-fixing the loose ones. The wooden landings of the passage, wherever found damaged and rotten, should also be removed and replaced as per the original. The corridors require careful restoration of plasters and sometimes even structural repairs by way of removal of dead and stitching cracks in the walls. The rusted concealed conduit pipes in the inner walls are to be removed.

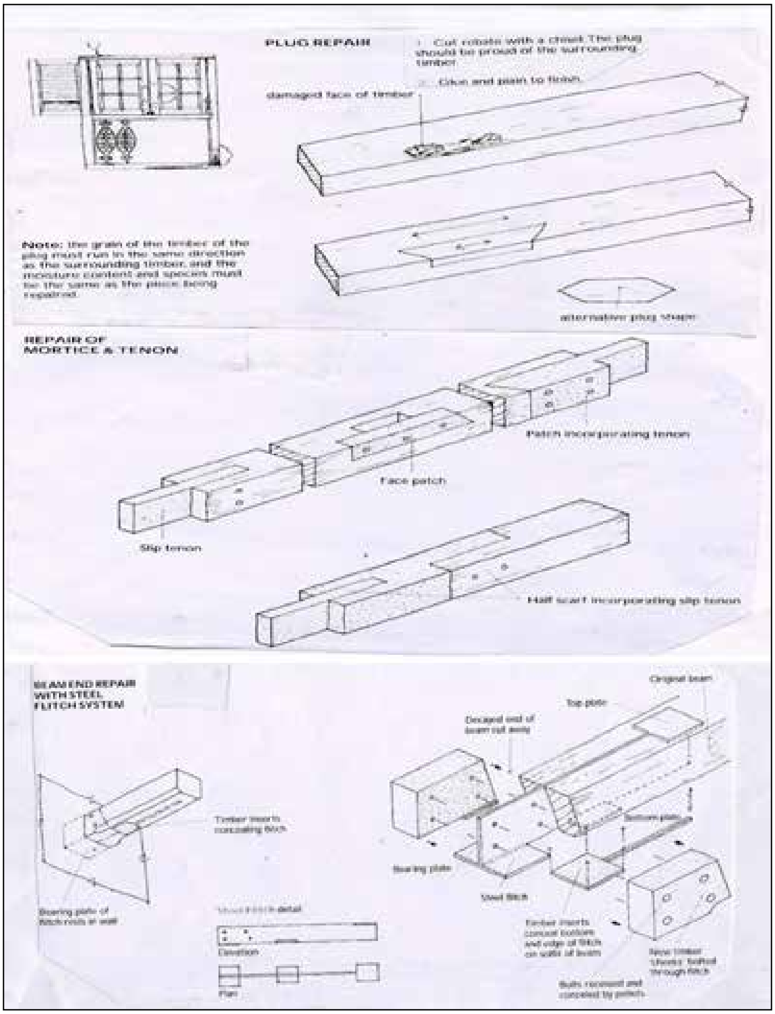
Creaking is one of other signs of defects in the timber staircases. The most likely cause of creaking stairs is the working loose of small wooden wedges which hold the treads and risers in place. If these have become loose, they should be carefully removed using a chisel, ensuring that the surrounding timber is not damaged. If these wedges are severely damaged, new ones should be cut from suitable wood to the same dimensions as the original. When the wedges are ready to be refitted, they should be firmly knocked into place with a hammer in their original position between the stringers and treads and risers. A small amount of suitable wood glue may be used to help keep these in place. Staircases can suffer from decay caused by either rot or insect attack when conditions are both warm and damp affecting the string course.

To avoid damp entering timber staircases, it is important to ensure that adequate ventilation is provided for the areas underneath stairs and that walls which abut on staircases are likewise kept dry and well maintained. Treads inevitably become worn over time and badly worn treads will need to be replaced as these can become a safety hazard. Where a tread has to be replaced, it is important to specify the style and the wood being used so it will match the original. If impact damage has only brought about a small scratch or gouge to the wood filler or small wood indent can be used to affect a repair. If more serious damage occurs that affects the structural stability of the staircase then the damaged elements will need to be replaced matching the original.

26. Treatment of windows, doors and shutters: The majority of the windows and doors are made of timber although some are of metal or have metal parts. Windows, shutters and doors are features that directly relate to a building's architectural style and is important to understand characteristics and components for ensuring routine maintenance. Windows are an important architectural feature as they provide character, ventilation and light and link interior and exterior spaces. Shutters are used today primarily for aesthetic purposes and can offer protection during winter nights and hot summer days. In addition to windows, doors are characterized by the size of the frame, the panelling design, decorative detail and the window openings. The doors and windows in this building are made of high quality Burma teak wood but a large section of the windows has deteriorated, especially along the open verandas. The frames have deteriorated and many window and door shutters are swollen with water ingress and do not shut property leading to windows being left open to shake in the wind and causing further damage and shattering of glass panes.



Maintenance tasks associated with windows and doors will involve ensuring that they remain weathertight and operational and that the different materials of timber or metal, glass and putty are kept in good condition. The sills and bottom rails of doors and windows are the more vulnerable parts and show signs of decay. Rotten or damaged timber should be replaced with a new piece to match.

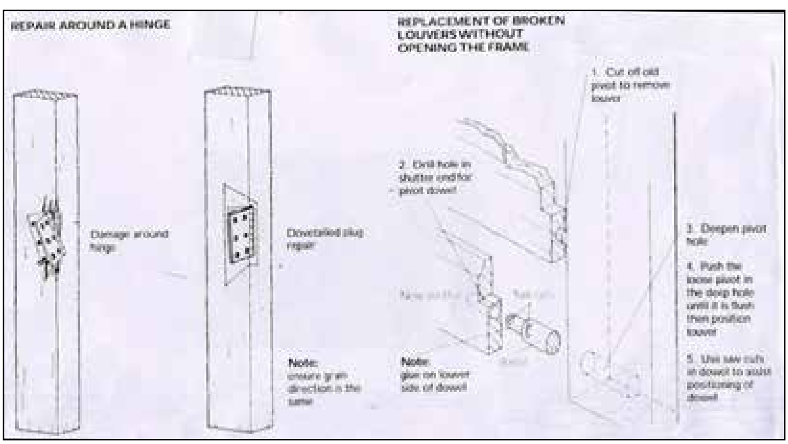


If windows or doors, or other external joinery elements, show signs of rot other than in the sills or bottom rails, it is essential that the root cause of the problem is identified and solved. A decayed end to a bottom rail must be renewed, complete with tenon and the joint pegged, re-wedged and glued. Sill plates are the horizontal bottom members of a timber frame that normally rest on masonry plinths. Open joints in timberwork or between timber and the surrounding masonry should be filled with an appropriate mastic filler to prevent decay.

During work, old glass and ironmongery should be protected against damage or loss. Replacement is the last resort, and should be like-for-like in terms of style and materials. To tighten loose hinges, it is sometimes necessary to re-fit them after driving glue-laminated dowels into the screw holes and re-drilling, especially where the holes have become enlarged due to slight re-positioning of the hinges.

Fully operational window shutters require little maintenance; the hinges can be kept in good working order by the application of oil. As with all internal timber the need for regular re-painting is necessary and earlier layers of paint have to be removed. While removing paint from shutters, it is important to proceed with caution as shutter panels are very thin and can be easily damaged by excessive scraping. Occasionally, shutters become affected by dry rot due to water ingress causing damage to the timber. Small cracks should be filled with wood filler. Wider cracks can be filled with slivers of timber and then sanded smooth before re-decoration.

The best way of repairing a metal window will depend on the type of metal used. Metal windows can often be economically repaired and made energy-efficient rather than be totally replaced. With the exception of cast iron, which is brittle and tends to crack,



the metals used for windows remain fairly malleable, so slight distortions can usually be corrected by carefully easing the frame back into alignment without the window being de-glazed. Metal windows can suffer from surface rust, distortion, excessive build-up of paint and failed hinges and fittings. It is essential to protect metal window frames from rust by maintaining the paint finish in good condition and regularly renewing it. If there are chips or other defects, repair them as soon as possible to prevent corrosion. Do not paint over rusted metal but clean off the rust first by acid pickling or flame cleaning and prepare the surface for repainting. Old knockers, knobs, locks etc., can make a small but valuable contribution to the character of the buildings. Maintenance will involve oiling locks and hinges. Where a door rattles, this can be cured by adjusting the keep of the lock. Special lever attachments allow existing door knobs to be retained. Historic glass should always be retained in place and great care taken to protect it while work is in progress. Chipping away at the putty to remove the glass involves a very significant risk of cracking it. Putties become very hard with age but can be softened by prolonged contact with solvent or caustic alkali type paint strippers or infrared heat treatment.

Paint finishes on both timber and metal frames must be kept in good condition and renewed approximately every 3-5 years, depending on the exposure and orientation of the window or doors. Paintwork on south-facing windows and doors will deteriorate more rapidly and require more regular renewal after carrying out all necessary filling, splicing, repair, re-glazing and removing dirt and grease by washing down the paintwork and rinsing off. Profiled paint scrapers can be used to remove paint layers from mouldings such as glazing bars.

27. Strengthening of traditional cast iron works: Cast iron has been one of the most popular materials for the manufacture of rainwater goods, such as gutters, downpipes etc., which carry out an important function in carrying water away from a building and preventing it from penetrating the fabric. Cast iron is strong and hard but is a brittle material. They form part of the building's architecture and style, along with parapet gutters and projecting stone gargoyles constructed to throw water clear of a building. Hopper heads are frequently enriched with ornamentation, and gutter brackets provided an additional opportunity for decorative designs. The misalignment of components, such as broken sections of drainpipes or gutters can be caused where fixings or holder-batts have not been maintained and have become loose. Where supporting gutter brackets or Rhone hooks have been lost, they should be replaced before the gutter sections become dislodged and damaged. Undersized replacement gutters and downpipes can lead to overflow and leaks, so care is required to ensure that replacement sections are of correct dimensions. Establishing a regular maintenance programme is the most effective way of preventing serious problems. Any signs of leaks or water ingress should be immediately investigated, and the cause identified and remedied. Vegetation leaves and debris should be regularly cleared out from rainwater goods, gulleys and drains. Leaf guards can be fitted to gutters, and wire balloons placed over the tops of downpipes, to help reduce blockages. It is always preferable to retain as much of the original building fabric as possible and the only components that are missing or are beyond repair should be replaced by new castings with a matching profile in size and appearance. Where downpipes are missing, existing gutter outlets will usually indicate where original downpipes were located. Replacement downpipes should be fixed away from the wall to facilitate repainting and to allow any leaking water to run down the back of the pipe rather than down the wall. Gutter brackets or Rhone hooks should be re-used where possible and cast iron rainwater goods should be periodically painted, taking care to paint inaccessible areas as far as possible to arrest minor corrosion. The rusted portions should be removed by wire brush and sandpaper prior to being re-painted. Existing sound paint should be roughened with sandpaper to help the fresh coats adhere well. For new castings, current best practice recommends two coats of a zinc-based primer, one coat of micaceous iron oxide, followed by two coats of gloss paint. The defective gutter joints should be re-sealed with an oil putty to stop leaks and small holes should be filled prior to painting to prevent water seeping in and getting trapped. Badly sealed, leaking joints are particularly prone to further corrosion and deterioration.

28. Treatment of metal windows: It is important to first understand the type of metal used for the window – whether ferrous (iron, steel) or non-ferrous (bronze and aluminium) – as this will determine the right treatment. Metal windows suffer from surface rust, distortion, excessive build-up of paints and failed hinges and fittings caused by general wear and corrosion, cracks in between the frame and the wall openings allowing moisture to penetrate around the window frames, casements that do not move properly, etc.

Rusting and corrosion is the main problem associated with un-galvanised steel windows whenever moisture penetrates the protective paint. A faulty weather-seal around the perimeter of a metal frame is equally damaging, allowing rust to develop. Flaking or blistered paint-work is often the first sign of corrosion. Probing the affected area with a pointed tool will detect the degree and extent of the rust, which in turn determines the required treatment. Rust and paint can be removed by acid pickling or flame cleaning. The jammed casements are to be freed and defective putties to be removed for effective operation. The superficially corroded steel should be rubbed with a wire brush, wire wool and wet-and-dry paper before treating with a zinc phosphate-rich metal primer and then repainting. Severely corroded sections of frame should be cut out and replaced by matching section. Care should be taken not to damage the galvanized parts. Historic glass should always be retained in place and great care taken to protect it while work is in progress. Putties become very hard with age but can be softened by prolonged contact with solvent or caustic alkali type paint strippers or infrared heat treatment. For re-glazing, the rebate must be cleaned, dusted and given a thin coat of primer and metal casement putty for metal frames. The hinges, bolts, catches, stays, gratings, grills, railings and metal windows are important heritage features and should be conserved and maintained. Brass and bronze should be gently cleaned with neutral soap and possibly a non-abrasive heritage metal cleaner and soft cloth. Allow repainting of metalwork once every5-7 years.

29. Treatment of steelwork corrosion: There are number of wrought iron and steel beams in the building. Corrosion has been observed at the ends of the iron beams embedded in the external walls. In order to assess the scale of the problem, the ends of a representative sample of steel / wrought iron beams must be exposed and checked for the degree of corrosion as soon as possible. In one location under the Council Chamber roof, where the end of one of the riveted compound steel girders was built into the wall, one face of the web was partly exposed by hammer-and-chisel and it was found to be in sound condition. Conversely, on one of the steel wrought iron (steel?) beams, carrying the second floor veranda, the web was found to be completely rusted through. This beam, and others in similar condition, will therefore have to be replaced. The steel joists supporting the jack arch slab at first and second floor level on the north-west side and the steel joists supporting the slab at the north-east side are corroded at certain places. The remedy is to strengthen by welding additional flange at the bottom. If both flanges and web are corroded, the joist would have to be replaced or provision is to be made for additional joists adjacent or below the member in the case of the Jack arch. Adequate rusticides and passivators would need to be used to arrest further corrosion. Iron and steel used in construction are alloys and their susceptibility to corrosion depends upon their composition.

Rusting iron fixings can cause significant damage such as spalling and dislodging entire stones. Regular maintenance is the most effective method of prolonging the life of iron work. Any sign of damage or decay should be dealt with promptly. Protection against corrosion of iron and steel requires first the elimination of rust from the surfaces by using wire brush, chisel, sand paper or other appropriate mechanical means followed by painting the surface with an appropriate product.

The most effective way is by using a paint finish which is regularly or frequently renewed. Where any (mild) rusting is found, the masonry should be removed so as to form an air pocket, and allow removal of rust. Subsequently, rust-inhibiting treatment should be given to the steel. Broken and damaged iron work can be repaired by using different methods including cold stitching, welding and other techniques. Missing pieces can be replaced with replica cast from the surviving original features or pieces.

30. Strengthening of foundations: In modern engineering terms, most of the foundation beneath historic structures would be considered inadequate; yet, the structure has remained standing, often for several hundred years. Seismic strengthening of foundation before or after the earthquake is the most involved task since it may require careful underpinning operations. Underpinning is the method of restoring solidity to the foundation of walls. It can involve the extension of the foundation down to firmer bearing strata, widening the foundation to reduce the bearing pressure, or the installation of piles which extend down to bearing strata and are then connected to the existing wall foundation. In this method, short excavations are made under the wall down to the new bearing strata where a new foundation of concrete is cast. The wall is then re-supported from that new foundation with either a concrete or masonry wall to connect with the original foundation. Apron around the building is to be provided to prevent soaking of foundation directly and draining off the water.

31. Treatment and maintenance of harling and wall renders: At few locations, the masonry is found covered with protective lime/ cement coatings, known as harling. In the case of rubble-built structures, this relatively thick coating was aimed at both regularizing the surface and protecting the stone to improve the finished appearance of the roughly built wall. In the ashlar built structures the coating is little more than a series of lime washes. At places, harling has fallen away, leaving little more than the residual fragments in the more protected areas. In those cases the damaged areas should be removed and photographic records should be kept. Where any harling is to be replaced, the composition of the cumulative layers of the original mixture should be analysed and then reproduced as compatible materials.

Most failures of old renderings are attributable to water penetration resulting in lack of maintenance or inadequate protection from the elements. Smooth stucco is in the state of deterioration and would need to be restored either by partial replacement or complete renewal and replacement. Areas which are extensively cracked or hollow, should be cut with sharp chisels to the backing with square edges and thoroughly remove all dust, loosely adhered material, efflorescence and any organic growth by bristle brushing and treatment with a biocide. Before any rendering is applied to a surface, the background must be dampened to reduce and control suction, especially in hot weather. If the substrate is not sufficiently damp it will soak water from the render as it is applied and reduce the effectiveness of the bond and strength of the render. The loose areas of render can be located by tapping. A hollow sound will indicate where the coating has detached from the wall behind. The detached area can be cut out and new render patched in. Lime wash is the traditional finish for soft, lime-based render coatings. It should be renewed regularly in multiple layers. One coat of lime wash will last approximately one year, depending on the exposure of the location. The so-called 'waterproof' coatings or sealants to the external wall surfaces of an old building should not be applied.

32. Treatment of dampness in the walls: Dampness is a common problem in heritage buildings. Moisture is drawn up the wall from the ground or the foundation. Heritage buildings were originally constructed with materials that allowed moisture to evaporate easily. Dampness can be caused by water penetration from leaks in the roof, defects in walls and masonry, moisture from the ground and inadequate ventilation. Water ingress routes might include the failure of roofing materials, defective rainwater goods, degraded detailing, or poorly specified interventions where work has been carried out using inappropriate materials. Symptoms include the blistering of paint, salts forming on masonry, tidemarks, discolouration of paintwork, peeling of wallpapers, mould and fungal attack (rot) and increased levels of condensation on cold surfaces. Water generally gets into a building or causes dampness in one or more ways. Rainwater is likely to enter a building because of cracks in external render finishes or chimney capping, gaps between slates or pan tiles, defective pointing between bricks or stones, blocked or leaking rainwater goods, or poor or damaged construction details such as slipped or damaged flashings. Poorly-fixed flashings may become detached and allow rainwater to soak into the building. They should be re-fixed or replaced as soon as possible. Water lodging at the base of walls can also cause dampness to penetrate. To treat penetrating damp, first locate the entry point of the water and tackle the problem at its source. Water can travel a considerable distance within the fabric of a building before finding its way to a surface where the problem is first noticed.

In this building, it has developed due to the water leaked through damaged plaster, damaged water proofing in bath room floors, defective plumbing and plugged drains, improperly designed / damaged sunshades, broken Mangalore tiles, etc. from clerestory area, roofs over projected windows, courtyards, flat roof terrace at Mezzanine level, flat slabs over arcades, external walls and arcades, retaining walls in the main building. There is ingress of water from the roof at the springing point of the arch on the south-east corner of the Council Chamber and at the adjacent staircase roof slab. The terrace waterproofing of Council Chamber has been modified even then the roof is leaking. The waterproofing of the top slab of the flag tower has failed, leading to water seepage into the floor below and damaging the walls and the structural steel members.

For effective treatment of the problem, the specific cause for dampness has to be identified and rectified before applying the treatment by arresting water leakage from source, i.e., broken rain pipes, defective plumbing, leakage from terrace, *chhajjas,* etc., by removing the affected wet/damaged plaster from the wall by cleaning the surface using brush wire and chip off the mortar from stone joints making V notch and allowing the wall surface and joints to get completely dry, applying a coat of lime mortar flushing with the existing wall plaster (one part of lime and four parts of *surkhi*/ sand and water proofing compound) and curing the surface for minimum one week time.Water is key agent of decay of heritage fabric. Efficient drainage of the site away from any built features is thus one of the most essential conservation interventions. In the gardens of the Viceregal Lodge, the retaining walls and the arched parapets are an important part. Traditionally, there was a drain edging all along pathways, remains of which can still be seen in some areas. It was either as stone slabs laid to slope or stone laid on edge. These drains need to be constructed along all the retaining walls and parapet walls to ensure that water does not affect them adversely.

33. Water ingress and rainwater disposal: The building has been badly affected by water seepage, leakage from the roof, bathrooms, toilets and plumbing leakages through toilets and plumbing, deteriorated pointing and open joints of stone masonry of external masonry walls. All plumbing of toilets and provision of adequate measures to check leakages through toilets, wash basins and other wet areas are to be upgraded followed by correction of damaged rainwater down takes after identifying the main source of water ingress and establishing the resultant impact of the condition of the building's fabric.

The roof top gutters are found choked or damaged and rainwater down pipes are missing, rusted or broken, leading to water ingress into the adjoining walls. Missing gutters or down sized gutters should be replaced with PGI / MS sheet gutters of sufficient thickness and carrying capacity as per current rainfall pattern.

The missing, damaged, broken sections are to be replaced by pipes of the same size, material and gauge. Spouts that are not connected to the down- takes be re-connected. Discharge outlets and manholes too are to be made functional by cleaning and removing blockages and debris that chokes the outlets. Lead-lined gutters behind parapets are vulnerable to blockages or damage from debris and their failure can result in saturation of the masonry below. Defective parapet gutters are especially damaging as the leak is directly into the wall head. Structural timber, plaster finishes and internal decoration can be severely damaged if the problem is not resolved. Exposed gables, chimneys, skew, copes and parapets must be properly pointed and detailed to shed water.

Conservation exercise has to be initiated to tap the water drainage system for the entire building, from roof to outer discharge pipes and manholes, as well as from toilets and wet areas such as kitchens and washrooms. It is critical to address the plumbing and drainage issues of the building in order to arrest water leakage and eventual structural problems.

The correction of drainage of water from the roof through gutters, spouts and water down take pipes thus is a critical need for the building. The cast iron water spouts, gutters and down takes need to be checked and where ever there are missing sections, these need to be replaced by pipes of the same size, material and gauge as the original rectangular section pipes. Joints need to be properly caulked in lead to prevent leakages.

Discharge outlets and manholes too need to be thoroughly cleaned to remove blockages and debris that chokes the outlets. Spouts that are not connected to the down takes need to be reconnected and care should be taken to ensure that original rectangular section cast iron pipes are not replaced by round sections that are visually not harmonious.

34. Salt encrustation and efflorescence: The building has an external stone facing of soft shale stone which is argillaceous sandstone and is vulnerable to salt encrustation and efflorescence and even delamination and deterioration in case of extended water ingress or hard pointing. The façade carvings, especially near the entrance porch, are exposed to surface deposits and dark staining, while the patches of masonry near water spouts on the north facade show salt deposits and sulphate skins. The stone requires gentle cleaning, using judicious application of conservation techniques.

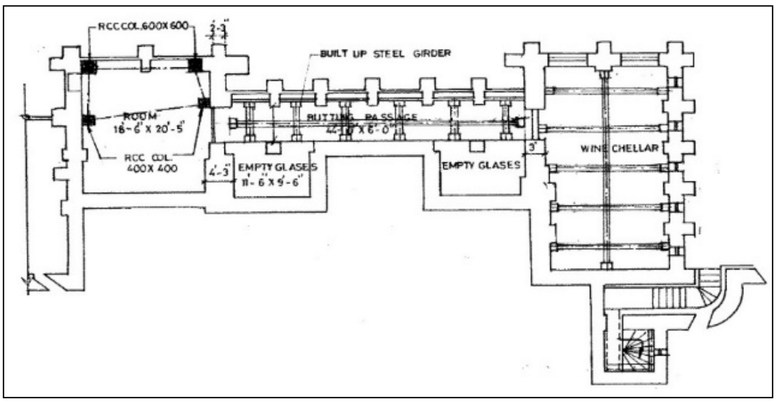
In case of encrustation of hard salts and for stubborn staining, especially seen in the mouldings and carvings, poulticing treatment is to be adopted by involving an ammoniacal paper poultice treatment or a clay poultice under controlled conditions. Mix till a thick consistency of putty-like mixture is reached. Cover the mouth of the container with a plastic sheet. After gently spraying the stringer/moulding patch with water to remove loose grit and dirt, a 20 mm thick layer of putty is applied to the surface. The pollutant, which has become soft and pliable by then, is scraped off gently using the wooden spatulas, water sprays and nylon brushes. The application should be repeated twice as required.

35. Strengthening the distressed portions of the Kitchen Wing: Kitchen Wing is one of the worst affected portions of the building due to the visually drastic appearance of the internal defects particularly large cracks in the vaulted ceilings. On examination, the flank walls revealed some minor cracking at high level, but found no evidence of any such downhill movement.

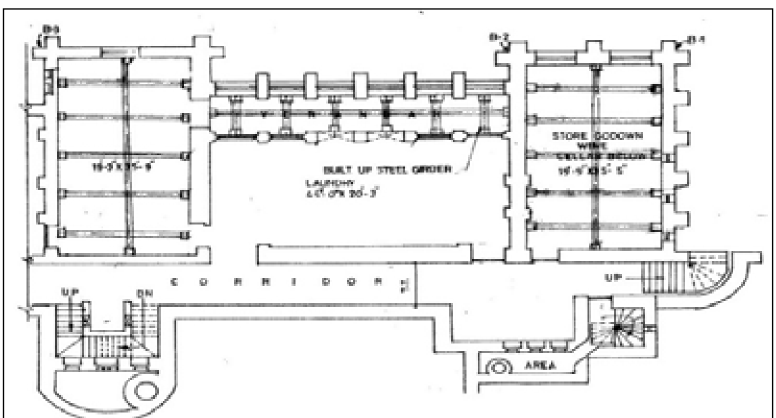
35.2. The Central Building Research Institute (CBRI), Roorkee carried out a detailed investigation of distressed Kitchen Wing to assess the extent of degradation in various floors due to leakage of water and weathering effect. Geo-radar mapping has been done to explore the possibility of foundation settlement. Damage to the building or its components depends on several factors like quality of material and workmanship, surrounding atmosphere, exposure of building or its component to atmosphere, factors related to the use and maintenance of building over its life. Accordingly, strategy has been developed to transfer partially the dead load from the structure through steel trusses and then to repair and strengthen the damaged components using various techniques keeping in view the initiatives taken earlier by the ASI in transferring partial dead load by using steel built up columns and beams in the two basement floors on the extreme north-east corner rooms.

35.3. CBRI also proposed retrofitting methods to partially transfer the load of basement floor-2, ground floor and first floor to the ground of the Kitchen Wing besides adopting grouting the stone masonry walls, strengthening the vaulted chambers, stitching the disjointed external buttresses. Grouting is a commonly adopted technique for historic buildings. The application of grouts consists of several steps, namely preparation of masonry to be grouted, preparation of mix to be injected, grouting and finally, cleaning and finishing the surface of the grouted masonry. Holes are drilled deep enough to allow both for injecting the grout at adequate distances, on both faces of masonry if possible, to form a grid and for controlling the overflow thereof. The location of holes on one face should not coincide with their location on the other face.

Transparent plastic tubes of 10.0 mm diameter are installed in all drilled holes. Plastic tubes reaching different depths in masonry

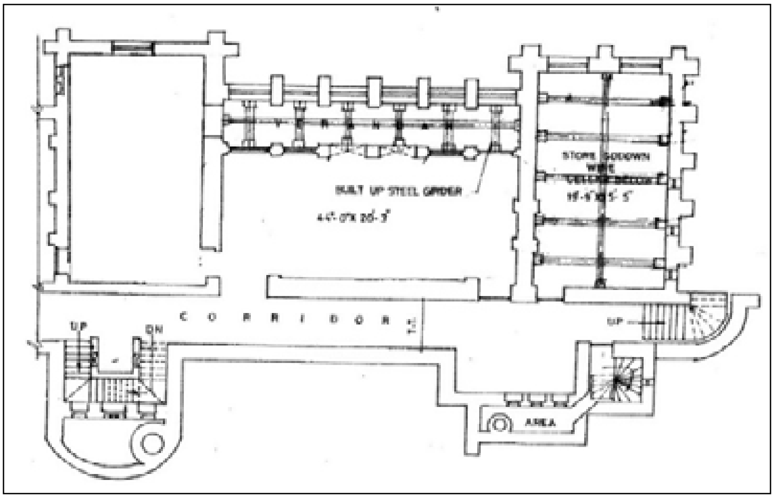


A. Plan of Sub-basement under kitchen



B. Laundry Floor Plan

should be adequately marked from bottom to top of masonry and reported in adequate drawings or sketches. The injection process is better controlled and the quality of the intervention can be ensured.



C. Kitchen Floor Plan

The grout is pumped into masonry using a flexible pipe with a nozzle of adequate diameter at its end equipped with a manometer to control the pressure. Before the initiation of injection process, the adequate functioning of the whole system has to be checked. The grout has to be injected at low pressure (0.5 to 1 bar). This is of major importance for the protection of masonry, as well as to avoid uncontrollable exit of the grout. Grouting starts from the bottom to the top, in order to ensure that the grout fills all internal voids. At the same time, a record is kept of tubes from which grout is introduced to or comes out from the masonry; the consumed grout quantity is also recorded. In case of vulnerable structures, grouting should not be performed to a height of masonry exceeding approximately 1m per day, in order to avoid excessive internal (hydrostatic) pressure of the grout that could damage the masonry. Once grouting is completed, masonry is adequately cured. The protruding length of plastic tubes is cut and masonry is re-pointed or plastered.

Re-pointing is necessary, when the *in situ* mortar at the surface of the masonry is in poor condition and, therefore, has to be replaced, to allow for efficient injection. Lime/pozzolan mortars or hydraulic lime mortars are normally used for re-pointing. Along with re-pointing, sealing of cracks and other surface voids is necessary to avoid uncontrollable leaking of the grout during its application.

35.4. Strengthening of Lime Concrete Vaulted ceilings of the Kitchen Wing are badly affected by internal defects, particularly the large cracks of the kitchen, laundry and long span arches indicate signs of distress in the center and at the springing points and the cracks started from arches and continue through the walls. Some of the vaults have been repaired and strengthened by providing steel joists / lattice girders supported either on walls or on steel columns resting on the base. On the floor above the kitchen, the wall was found to have severe sloping cracks, adjacent to the door opening. In this position, a beam carrying all heavy walls at right angles, belonging to an added attic, is bearing directly on top of the wall. Evidence of damp is there and mostly originates from rain during the winter but any deficiencies of the roof drainage will add to the problem. There is also the factor of rooms being unused and therefore not ventilated in summer and not heated in winter; this will encourage condensation on the inside of the walls and impair any drying out. The roof drainage is to be reinstated and open joints in external masonry walls sealed.

Where the vault material is found to be structurally adequate, problem of treating the cracks remains and some of these may be due to shrinkage, causing the particular vault to form a hinge at the apex, in order to cover the spans. Such cracks will be wider at the soffit of the vault than at the top. These have to be filled by placing a shutter board underneath and injecting a suitable grout, from below, through holes in the board. The grout mixture should be lime-based, with a pozzolan, such as fuel ash, added to assist the setting and accelerate the strength gain. Where the existing vaults are retained, consideration should be given to remove the fill over the vaults substituting timber floors, as these will accommodate slight movements without showing distress, as opposed to the existing stone floors. If any of the vaults have to be replaced, consideration should be given to replacing the present floors, supported on the filled vaults, with a system of beams (timber or steel) supported on the walls and carrying traditional floors of timber joists- and- boards. The vaults underneath could, if so desired, be re-created visually as suspended plaster construction hung off the floor structure.

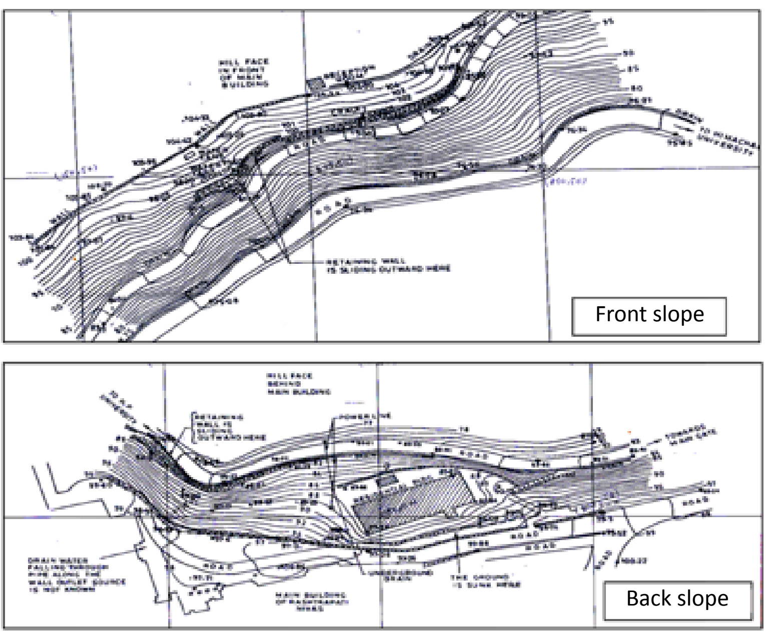
Alternatively, new vaults of reinforced concrete could be constructed and timber floors could be propped off these, whilst perhaps more "structurally honest", concrete vaults will be more rigid than suspended plaster and more difficult to repair, if cracked by continuing movement. A careful examination of the flank walls of the wing revealed some minor cracking at high level on southeast corner, but found no evidence of any downhill movement.

The wide variation of compressive strength (4.5 MPa to 9.1 MPa) of lime concrete in the vaulted floor as found from testing the cores taken from these vaults indicate severe degradation which requires urgent repair. The spalling and delamination of lime concrete in the vaulted floor has been found at many places and restoration to original thickness at many places may be required. To improve the mechanical properties of lime concrete, CBRI recommended grouting the lime concrete vaults with hydraulic grouts and to restore the original shape of vaults guniting /shortcreting the surface with lime mortar/lime concrete. The plaster on the external walls (which is probably hygroscopic) should be removed and the walls dry-lined in such a way as to create a ventilated air-space between wall and lining and to allow any water to drain away.

Visible cracks in buttresses are there in the back of the building, as the buttresses are separating out from the building lines. To strengthen the same, the cracks shall be grouted first using injection grouting with hydraulic lime cement grout followed by inserting and fixing SS anchors for anchoring and making the buttresses' integral and monolithic with the supporting walls as suggested above.

36. Remedial measures for slope stabilization: The geological and geotechnical investigations carried out by CBRI have suggested remedial measures to protect and stabilize the slopes in front and back of the building. The existing old and damaged dry stone retaining wall on the back slope is to be replaced by a new stone masonry wall bonded with cement mortar of 3m to 4.5m height all along the slope. The retaining wall should have perforated drainage gallery (weep holes). The drainage gallery should consist of perforated pipes embedded in coarse sand and pebbles. The drainage gallery should be 1.5 – 2m long inside the slope.

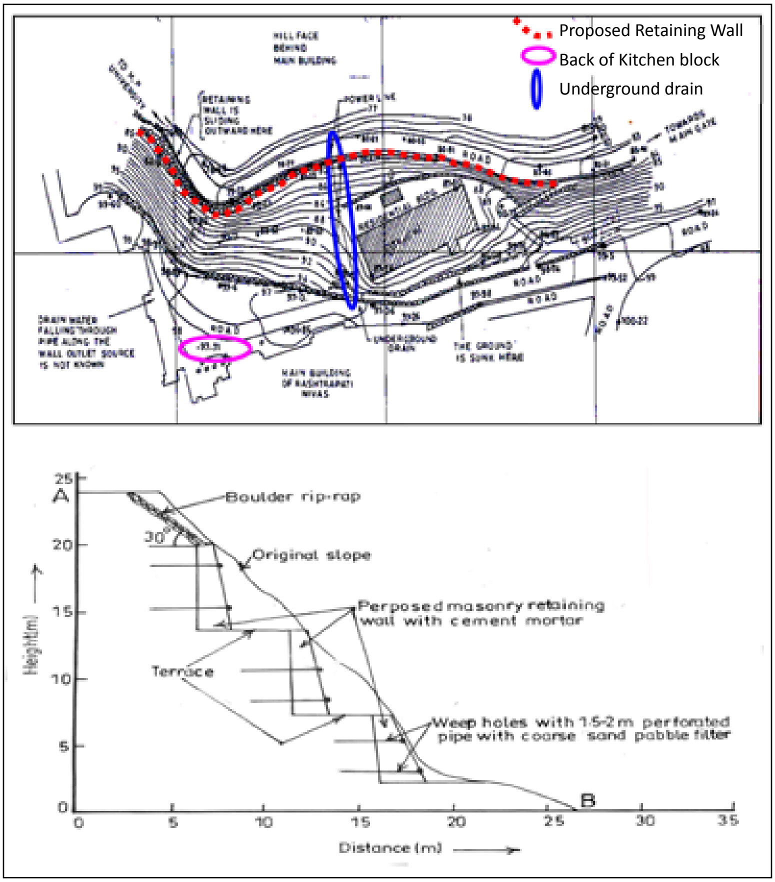
All the drains should be properly lined and be made impermeable. At present, the kitchen outlet pipe is broken and discharges



Map showing locations for proposed remedial measures.

waste water on the open backyard. It has to be reconstructed and connected to the main drain. The backyard of the kitchen should be cemented giving adequate slope to minimize the local water infiltration during rainy season. The rain and storm water of the area should be channelized through a surface drain to the main central drain.

Newly constructed retaining wall on the front slope is to be extended up to the end because the old retaining wall is completely damaged and does not serve its purpose. Slope modification with



Schematic diagram of slope modification with terrace and retaining wall terracing is recommended from the level of the reception hut in front of the main building up to the top of the retaining wall. For all the retaining walls, adequate weep holes with coarse material as filter are to be provided for proper discharge of pore water.

37. Preservation of historic services: Many of the historic services that were truly pioneering for Victorian buildings and especially novelty in British India still survive to this day in the building. These include a nearly intact Victorian Kitchen complete with an Aga Oven, coal ovens and preparation, and cooking areas, perhaps the best preserved in India. The refrigeration units by Carrier is perhaps the oldest existing in India, surviving mechanical laundry complete with drying rooms, boilers, pump rooms and their fittings, coal storage rooms and boilers for heating water and a series of service storage for wine cellars in the basement area, crockery and silver, servants' rooms and such ancillary services are other components of the building. These historic services are to be preserved for future generations as educational tools for interpreting the history of the building.

37.2. Fireplaces were an important component of the interiors. There is provision for hot water and cold water circulating systems, out of two hot water circulating system, one for the main block and the other for the Kitchen and the east wing have been provided with twelve wrought iron tanks of 400 gallons capacity, each connected with pipes and stopcocks kept on iron beams in the central tower of the main block for supply of cold water. The square section downpipes discharged into a concrete drain surrounding the plinth and conveyed the water to storage tanks for the garden use and water supply to the laundry. There were four of these tanks with an average capacity of 45,612 cubic feet. Sub-surface rainwater drainage system had brick wells to serve as indicators of the blockage in the system, running partially under the building and emptying into underground storage tanks used for the garden and fire-fighting purposes.

37.3. As per the reports, only two bathrooms were fitted with water closets sewage disposal system. These had proper pipes, traps and ventilating pipes and the soil pipe ended in a latrine down the hill. Sweepers' stairs were attached to all the other bathrooms for manual removal of waste. Bathrooms were provided with enamelled cast iron and porcelain fittings. The internal room panelling was designed in such a way that the removable skirting boards enclosed a space which was used to conceal the wiring for the call bells and telephones. Ice machine and storage facility with pre-WW II refrigeration equipment was installed in the rooms at the extreme north-west end of the central corridor of Kitchen level of the Kitchen Wing. The scullery was converted into ice making room with an ice pit and refrigerating equipment along the windows to the north and the wall to the west provided with special insulating doors, and sub-divided into three chambers with windows sealed off and refrigeration equipment located against that wall. Leaving aside the Kitchen dumbwaiter, other mechanical devices such as the roll down sunshades, lift and furniture hoist were probably installed in the Edwardian era.

37.4. It is important to address the issue of a comprehensive up gradation of the present electrical services, to ensure that the efficacy and safety of the system as also to uphold the visual integrity of the historic structure. Being the first building in the State to be provided with electricity, the Viceregal Lodge is a seminal example of historic electrical services. Original distribution boards, electric fittings such as brass toggles, switch boards and electrolysers survive and these should be carefully preserved to create magnificent text book of historic Victorian services. Each circuit contains re-wirable fuses with toggle switches. The wiring is also done using wooden casing capping, functioning in some sections of the building and is generally routed along the wooden skirting in the rooms. There is a range of historic electrical light fittings ranging from cast brass, to bronze, crystal and glass. These are historic and significant and should be carefully preserved. Historic chandeliers and fittings should be restored. The electrical routing of wires and conduits should be in a manner that is discreet and sympathetic to the historic fabric, taking care to avoid defacing architectural mouldings and details and made to route along skirting and wood panelling. The ad hoc placement of electric switchboards, wiring and fittings should be removed and re-located using discreet fittings and fixtures preferably concealed in the dado and wooden panelling or those replicating the historic designs. The coves in the plaster can also be intelligently used to place slim tubes or led and fibre optic lights to create an elegant and discreet lighting scheme for the rooms. The fluorescent tube lights fitted across historic ceilings that deface the interiors have now been removed and replaced with LED lights.

37.5. The entire Rashtrapati Niwas building has well-equipped fire fighting system containing the water pressure meter, hose reels, alarm and glass break tools in corridors and public access areas and fire-sprinkler system at the attic level. Refitted pulley and chain mechanisms at all verandas for escape in case of fire and fire fighting stations are at each floor level. The Lodge has an extensive wet riser system of fire hoses as well as sprinklers for fire fighting. A system of 16 fire hydrants outside and 15 inside the main building was connected with the underground rainwater and grey water storage tanks located to the south-west, north, north-east and east of the main building through a peripheral sub-surface drain running around the main building. A system of well-designed fire boards including alarms, hose-pipes, fire blankets etc., connected with the water storage tanks in the central tower (capacity 78000lts.) was placed within the main building at various locations. Fire poses a serious threat to both life and property and fire prevention is the best approach. These surviving historic remnants or systems are invaluable, perhaps the best preserved system, and comprises of internal and external hydrants in arched stone niches and well-designed internal fire boards as part of the original service infrastructure in the main building and also connected with the Council Chamber. Some of the more fire-prone construction elements such as the wooden panelling, were treated or backed with fire retardant materials. The fireman's room had been provided in the original corridor at the ground floor level connecting the Kitchen and east wings with an alarm bell in the fireman's quarters on the estate.

37.6. The original fire fighting system is still operational and modified over the years and these are to be checked regularly. In addition to restoring and preserving the historic fire fighting system, it is necessary to ensure that basic fire fighting equipment and provisions which were once carefully maintained are made functional as far as possible. The sand buckets should be filled with sand. Fire fighting stations at each floor level should be checked and made functional and it should be ensured that fire hydrants are also in serviceable order. Most of the fire escape pulley system installed in the open verandas is in a decayed and damaged condition due to exposure and rusting. Efforts should be made to rescue this equipment from further damage. The fireproof paint that used to be applied regularly during the colonial period was last repainted in 1956 and is now hardly ever repainted. This repainting in fire retardant paint should be part of the maintenance program, as well as ensuring a periodic fire drill to train staff and visitors on evacuation.

37.7. Toilets, water supply, plumbing lines, overflowing tanks, sewerage lines, peripheral storm water drains etc., in the building are a major source of concern as the original plumbing schemes were fitted for bathtubs without floor traps. In subsequent toilet renovations, the bathtubs have been removed by floor traps resulting in introduction of new plumbing runs, mostly visible along the veranda spaces. Leakage from the toilet pipes results in water eventually seeping into the building fabric; thereby there is urgent need for up-gradation and monitoring and repair/replacement of plumbing. A small tunnel-like opening has been created under the building with its exit almost beneath the Tagore Centre, to collect rainwater through down-take pipes dropping in the open shaft of the building. Sanitary lines are also passing through the tunnel near the inlet. Masonry walls and floor bed of the tunnel have deteriorated over passage of time. The tunnel, its masonry walls, lining, bed etc., has to be restored and retrofitted by providing a concrete lining with reinforcement to ensure waterproof structure in order to stop ingress of rainwater in the foundation and the sewage as well as rainwater directly falling in the tunnel, as revealed during site visit from time to time. However, there is no need to lay separate new lines.

37.8. The original sanitary fittings including bathtubs, basin, tiles, etc. are of great historic importance, contributing to the character and interest of historic buildings. Most of these fittings have been replaced during renovation of the toilets. Still some original surviving bathtubs and fittings of the building are stacked in the basements of the Kitchen Wing and found in other buildings of the estate. The stored original pieces should be salvaged and restored or be displayed for public view.

37.9. Viceregal Lodge is a repository of historic furniture and though in a rather poor condition and in need of restoration, much of the historic furniture survives. This historic furniture is found in different rooms of the building and dumped in the basement areas. Proper records should be maintained so as to create a document and record of the surviving historic furniture and for careful restoration of the woodwork as close to original as possible. While some pieces of furniture had horse hair for filling, others in the campus were later filled with have coconut fibre. Many leather upholstered chairs and Council Chamber furniture require re-upholstering and restoration in genuine leather while some high back chairs of the Elizabethan style require re-weaving of wicker backs and seats. Brass castors found on many original sofas and chairs should be restored.

37.10.The service equipment, particularly the three 30 horsepower engines and three dynamos, a force pump which fed the boilers of these engines, two hot water circulating systems, the heating apparatus for drying attached to the laundry and the Ice Machine, a pre-WW II refrigeration equipment in the basement and sub-basement level of the Kitchen Wing have not been in use for quite a long time leading to their dilapidated condition due to corrosion and rusting on account of dampness and water seepage from top and also from the walls. These innovations included the recently invented electric light (1888), making it one of the earliest buildings to be designed for electricity. Efforts have not even been made to clear or clean the dust and dirt from the surface. It is also found that the floor slabs and walls have been punctured for making space for laundry-pipes, etc. Structurally too, the condition is not sound. Therefore, it is now high time to preserve these historic equipment/ apparatuses by shifting them from the present spaces since these are now no longer required for active use in the Institute. After proper repairs these should be displayed/exhibited in the open space under reversible sheds so that the visitors can have a glance of these historic equipment/ apparatus. The usable space after shifting these can be utilized for the very purpose of expansion of the Library which at present is found to be inadequate.

38. Removal of biological growths: Biological growth found on the masonry includes algae, fungi, lichen, mosses and higher plants, but not necessarily problematic in terms of either aesthetics or preservation. In fact, much biological colonization is harmless and goes undetected and is not necessarily responsible for damage which may be due to other factors affecting the structure. Fungal strands may penetrate stone surfaces to get nutrients and secrete small amounts of acids which may cause some superficial damage to the limestone. Lichens may provide some protective benefits by both blanketing the stone as well as interacting with the outer stone surface to reduce moisture ingress. In rare cases, some species may cause bleaching, blistering or pitting of stone surface. Mosses are found mostly in cracks and crevices and in slopes, such as roofs. Thick algal layers located within the joints between the stones may create an environment that encourages growth of woody plants. Some species produce excessive amount of slime that may expand and contract upon wetting and drying which may cause flaking or spalling of stone surfaces.

Owing to heavy rainfall during monsoon, most of these growths embed their root systems into inaccessible areas like balconies, roofs, towers, ledges and stringer courses, which are not easily approachable and also restricts maintenance inspections and periodic monitoring of these areas. The biological growth should be removed as otherwise very serious damage may be caused by the unchecked growth on the structures, particularly penetrating into crevices, loose and dislodged stones, weak and insufficient bonding with the core of the walls. The roots of the plants draw their nourishment from the lime mortar and expand, resulting in the easy penetration of water. The stems of the plant should be cut at convenient places above the roots. If the root is springing from the walls it should be killed by pouring a corrosive acid into the holes bored into the stump. When the plant growth withers, it can be removed easily but care should be taken to avoid dislodging of any loose masonry.

Staining of the stone masonry is extensively seen in the Viceregal Lodge with layers of grime and soot deposited on the stone façade. This issue, though not structurally threatening to the building, does compromise the visual quality of the building and may also, over a period of time, encourages algae and lichen growth. These surface accretions could be tackled with basic stone cleaning. The stone cleaning of softer sandstone detailing and carved areas such as stringer courses and balusters may require poulticing treatments. Gentle water misting systems using soft nylon brushes are recommended. Removal of these growths should only be done when their damaging effect has been confirmed.

39. Strengthening of terraced arched parapet walls and boundary walls: The arched parapet walls on terraced gardens are also vulnerable and exposed on both sides. These walls are usually built on rubble walls over shallow foundations. Copingstones are protecting the wall from the rain and preventing it from washing out the mortar and saturating the wall itself. There are evidences of structural cracking, budging and dislodged due to deflections and settlements. Clear excessive plant growth from walls, in particular ivy growth should be removed, as this will damage the wall. Make sure the ivy has been treated with herbicide and allowed to die off before removing it. Otherwise, parts of the wall can come loose and be dislodged. Plant growth with shallow root systems can be attractive on a garden wall and, providing it is kept under control, should not cause irreparable damage. Certain species of hedging or trees have deep roots which can undermine or damage foundations; these should not be planted or allowed to take root near the buildings. All coping stones are securely fixed and that any missing stones are replaced to match and joints be filled up. The damaged and missing coping stones should be replaced matching the original. The bulged out and dislodged portions of the walls should be set right and cracks be stitched. The area on the south-west and north of the main building complex has been fenced with chain-link mounted on dwarf walls. At places these fencings are found damaged and tilted which needs immediate repairing.

40. Strengthening of external iron works: There are many historic ironwork features associated with a building including gates, railings, window boxes and glasshouses. Historic ironwork generally falls into one of two categories: wrought iron or cast iron. It is essential to keep the paint covering intact on both wrought and cast iron to prevent corrosion. Ironwork which is exposed to the air and water will rust. In rusting it can expand to several times its volume. Rusting iron fixings can cause significant damage such as spalling stonework and in extreme cases, dislodging entire stones. It is essential to keep water and rain away from iron surfaces. The most effective way of doing this is by using a paint finish which is regularly and frequently renewed. Where there are chips or other defects, they should be repaired as soon as possible to prevent corrosion. Paint should be worked into all the joints in the ironwork to ensure that there are no gaps that would allow water to reach the iron surface. Clean off the corroded iron rust first and prepare the surface properly for repainting. Corroding iron will expand up to ten times its volume as it rusts. Where iron that is fixed into stonework rusts, this expansion can literally blow the stone apart, shattering it into pieces and exposing the ironwork to further corrosion. Repair can include use of different methods including cold stitching, welding, and other techniques. Missing pieces of ironwork, such as finials on railings, can be replaced with a replica cast from surviving original features.

41. Restoration of the building for re-use: Heritage conservation doesn't mean freezing a building in time. Instead it seeks to maintain the significance, care for the building and provide an economic asset. Continued and careful use of heritage buildings is essential for their survival and conservation. Over many decades, this heritage building is being used to suit a new need. The level of facilities and amount of usable space are found to be inadequate even at the present time, especially so at the time of the conferences, symposia, etc. which are a regular feature of the academic life. In view of the IIAS's plans for expansion and intensification of activities, the present functions and efficiency of space utilization in the main building complex have been analysed and future potential assessed. The present space usage reveals that in the main building about 30% of the area is under-utilized.

It is usually expected that monuments will be conserved in the state in which they have come down to us -- there are some cases where the best way of preserving a monument may be its restoration for reuse. It is particularly important that the character of a monument should not be modified.

In most cases, proposals for restoration will only be viewed favourably when the monument can be restored authentically on the basis of the surviving architectural evidence alone or on the basis of a combination of the surviving architectural evidence and authoritative pictorial evidence. Conjectural restoration should be avoided in such cases. It is important to have a full understanding of all records relating to the building, and of the historical and cultural climate within which it was created. When a monument is to be restored, the presumption is that all surviving historic fabric will be retained unchanged within the restored building. Restoration is therefore not necessarily in itself a permanent solution and it is important that the work should be carried out in a way that will allow the historic fabric to survive such future changes in an identifiable state. All new work should be discreetly distinguished from the original work. In the case of works that are as inevitably far-reaching and invasive as restoration, it is essential that full records are made both before and after the works have been carried out in the building.

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XI

Recommendations and Priorities for Implimentations

The Viceregal Lodge is one of the most prestigious living monuments and its architecture of the colonial period is the main attraction and as such it was declared protected as a monument of national importance. Many additions and alterations have taken place over time, affecting the uses and services from originally planned and thus causing major behavioural changes in the structure. With the passage of time, the building has been deteriorated to such an extent that some components of the building have developed major cracks and almost all the roofs and terraces are profusely leaking, causing severe damages to the entire structure of the monument. The architectural integrity of the building is affected on many counts such as deterioration and de-lamination of the building stone, water ingress, inconsistent finishes and incongruous additions over time. Service issues such as the condition of plumbing and water drainage is also causing a major threat of water penetration into the building fabric, later often manifesting itself as structural or architectural problems.

2. The responsibility of its conservation and maintenance is both jointly with the Archaeological Survey of India (ASI) and the Central Public Works Department (CPWD). Maintenance of all the structural components, roof terraces, water proofing, leakages from terrace/roofs and structural retrofitting, etc. of the monuments within the protected limits are under the ambit of the ASI whereas the works which are beyond the scope of the ASI, includ-

ing regular annual service repairs and maintenance, sanitation and plumbing, fire-safety, electricity etc,. and general upkeep works on specific requirements and sanction basis are being looked after by the CPWD.

3. Regular maintenance and correct repair practices will extend the life of the historic building. Conservation process includes regular monitoring,the continuous care of a monument and its setting to prevent any further deterioration of the structure following internationally accepted norms. It also includes procedures regarding authenticity of materials, techniques and processes. It should be based on reliable documentary or *in-situ* archaeological evidences and not on a conjecture or artistic imagination with minimum – and sometimes only -- necessary interventions, so as to maintain its authenticity and integrity. Attempts should not be made to restore an entire building as that will falsify history and will compromise its authenticity. In certain cases, where a monument is being restored with the intention of merging with the original fabric for the sake of maintaining architectural integrity by matching the original material/details, such interventions, as far as possible, should be reversible in nature. The monument should be kept in its original state or in certain cases, restored to an earlier known state or to a state as it was discovered at the time of its notification as a monument of national importance.

4. Regular inspection must be undertaken to ensure routine visits to monuments to examine the condition of a monument and to draw up inspection notes which will aid in the preparation of necessary conservation plan for the maintenance of the property identifying work that will be required in the short, medium and longer term. As rainwater goods are frequently liable to blockage, especially during the autumn when leaves clog Rhone's and cause overflows. A twice-yearly check and clearing out of Rhone's and downpipes should be a regular task. Roofs are the first line of defence in preventing rainwater entering a building and need regular maintenance. Roof coverings must be intact and rainwater goods free of blockage so that they can drain water quickly and efficiently away from the roof. A rooftop inspection should

be conducted at least once a year; gutters and downpipes should be routinely cleaned twice annually, while blockages of rainwater goods and gullies, and slipped or missing tiles should be attended to immediately. If there are a significant number of slipped or missing tiles, it may be caused either by a failure of the nails or of the timber battens into which they are fixed. Broken or missing tiles should be replaced to match the existing ones in terms of size, colour and thickness. The ridge of the roof play an important role in ensuring that the building is watertight by capping with special tiles or flashings or metal cresting. Check that there are no cracked or missing tiles or areas of capping, if so, the same should be replaced. Check that the roof falls correctly to the rainwater outlet and that it drains properly. Ensure that there is no build-up of moss or fallen leaves on a flat roof. Mosses also hold water against the surface of the roof cladding where it can cause deterioration. The growth should be brushed out from the joints, using a non-ferrous brush, and the debris cleared away so as not to block gutters and downpipes. Pressure hoses should not be used to clear plant growth off a roof as this may drive water into the interior of the building.

5. Establishing a regular maintenance programme is the most effective way of preventing serious problems from arising, such as emerging and visible leaks and overflows during heavy rainfall. Any signs of leaks or water ingress should be immediately investigated, and the cause identified and remedied. Vegetation leaves and debris should be regularly cleared out from rainwater goods, gulley and drains, particularly where the property lies close to trees, after leaves have fallen in the autumn or following a severe storm. Leaf guards should be fitted to gutters and wire balloons placed over the tops of downpipes to help reduce blockages. These also require regular checks to prevent a build-up of debris around them.

6. The entire pitched roof system is appearing to be disturbed in which gutters and valleys are badly damaged. Tiles on the roof are missing and also broken in pieces. Base sheets are also damaged. The trusses need repairs and repainting. The central atrium has a

false opaque, glass ceiling. Damaged and deteriorated frames of the ceiling should be repaired by replacing the affected portions. Glasses have broken and at places the roofing tiles are loosely placed without proper laps. At junctions of masonry and tiled roof, GI sheets flashing have been loosely provided. At certain places the timber boarding has been replaced by corrugated GI sheets with clay tiles on top. The timber trusses are resting directly on external masonry wall without any bed block or wall plate leading to the weakening of the structure.

7. Extensive leakage is visible and present from the prism and glass ceilings. At places glass prism blocks are broken or missing and not bonded properly with the frame which have to be taken out carefully. Special care should be taken at the junctions of glass tiles so as to avoid future leakages by taking out and replacing after applying modern silicon and epoxy sealants. The cast iron frame supporting the glass tiles should be cleaned and provided with coating of passivator followed by epoxy paint before re-fixing of glass prisms/tiles.

8. Flat terrace waterproofing treatment is visible to be not effective. Below all the roofs, there are visible serious stains of leakage at the springing of the arch on the south-east, where there is no false ceiling, and also visible de-lamination cracks. The flat terraces are covered with grey stone slabs as wearing course with wide joints filled with reddish mortar (lime-*surkhi*) most of which have opened up. The existing lime terracing with slate slab surfacing should be taken out and replaced with a water proofing layer in the form of Membrane type water proofing, having two components spray applied polyurethanel /polyurea based coating of approx. 2mm thickness at bottom after making proper slope using lime concrete grading material, followed by a layer of geo-textile on top and finally with stone slabs with joints grouted with polymeric material sealants. For lime concrete treatment, the structural roof surface should be finished rough to provide adequate bond.

9. Leakages from the toilet pipes results in water eventually seeping into the building fabric and therefore up-gradation and constant monitoring and repair/replacement of plumbing should

be done. Plumbing and drainage issues for the building should be addressed in order to arrest water leakage and possible structural problems. The wet patches on wall should be repaired by way of arresting leakage, removing damaged plaster, cleaning the surface, applying a coat of mortar.

10. Roof drain outlets should be cleaned to prevent accumulation of water. Masonry drain mouths should be widened 2.5 times the diameter of the drain. Special attention and strict supervision has to be paid to proper overlapping of joints, particularly treatment around drainage openings in the roof and treatment of parapets. To carry out the waterproofing of junctions of parapet wall and roof, felt shall be laid as a flashing with minimum overlaps of 100 mm. Rhones should be regularly checked for debris and blockages. The joints between the lengths of Rhone should also be confirmed as sound and watertight. Rust marks will often indicate where a leak is developing. Check that downpipes are secured to the masonry with proper fastenings or brackets. Stained or damp masonry may indicate a failure of roof drainage. To prevent leaves and blown material from entering downpipes, small wire 'balloons' can be fastened at the top of a downpipe. The existing rain water, storm water, waste water drainage system should be restored to the original and the damaged system should be strengthened and repaired by first cleaning of the tunnels/ drains followed by providing cement concrete in the bed followed by providing of welded wire fabric connected to the surface using MS. shear connectors, finally finished with 75 mm.

11. Chimneys and areas of high-level masonry are often overlooked as they are difficult to access. The cope and chimney should be secured and the pointing around the chimney stack and the masonry of the chimney should be in good condition. Staining around the base of the chimney and the gable end can indicate defective masonry and pointing. Mortar for repointing or re-bedding bricks or stones should normally be lime-based. Ensure that chimney pots remain well-seated and secure. Mortar fillets, lead flashings and other weathering to chimneys should be well maintained to prevent water penetration. Mortar fillets with

cracks should be repointed or if cracking is extensive, re-formed using lime mortar. Metal flashings should be repaired or replaced. Lead back gutters behind chimneys often leak where they are not cleared out or snow collects against them. Flashings around the base of the chimney should be checked for water tightness. The bottom part of the flashing needs to be securely fixed to the roof covering and to extend far enough over the roof covering to get the water well away.

12. In the Kitchen Wing area, lime concrete vaults have failed at springing levels. There are severe signs of distress in the vaulted ceiling. The cracks start from arches and continue through the walls. In the instant case of the Viceregal Lodge building, following methods will be adopted, depending upon the intensity and gravity of the ailment from location to location by grout injection, crack stitching using FRP laminate, using tie rods, inserting steel pins and grouting using epoxy adhesive and re-plastering using welded wire fabric and lime cement plaster. Stitching using FRP laminates and grouting of cracks with compatible pre-designed modified hydraulic lime cement grout having same consistency of the mortar used in the original construction to increase the structural strength and consolidate the structural matrix. Thrust will be achieved by inserting steel ties with plates and bolts at ends. The ties should be post-tensioned for better effectiveness. Dead load of basement floor-2, ground floor and first floor should be transferred to the ground through steel trusses, as suggested by CBRI in their reports. Damage to arches caused by lack of thrust at the springer should be achieved by inserting steel ties. The ties should be post-tensioned for better effectiveness. The shear resistance will be improved by tying each block to its neighbour with SS pins by drilling holes and grouting the same using epoxy adhesives.

13. Structural cracks in the masonry wall of the Kitchen Wing probably in the form of concealed concrete stitch beams across the stabilized cracks at specified vertical intervals and gravity or pressure grouting and filling of superficial cracks in the internal plaster using material of the same composition. On deteriorated material of the unreinforced lime concrete vaults by vault consol-

idation with lime grout, cutting out and repair of eroded surfaces by repointing the joints between facing stones on the external walls or reconstruction.

14. Masonry walls with concentration of multiple cracks in the same portion and weak wall regions should be repaired by micro-concreting along with reinforced Gl wire fabric. Minor and medium cracks to be repaired by pressure injection of epoxy. Use of 20 mm diameter bolts at a spacing of 1m is recommended for cracks wider than about 5 mm or for regions mild steel tie plates (width 125, thickness 10 mm) in the outer walls at three levels between the floors. Proper steel packing plates and washers should be used for packing.

15. Cracks developed on Central Tower due to local stresses, decay of parapet elements, defective parapet wall/floor slab junction should be strengthened by providing ties at the points where tie rods have been inserted and cracking has occurred. The concealed stitch beams across the vertical and diagonal cracks in the corners should be inserted and cracked roof slab be consolidated by waterproofing treatment and provision of adequate cove fillet at the parapet wall/flat slab junction.

16. Parapet stone coping joints should be made watertight and damaged decorative stone elements to be reset after replacing decayed stones. External window, door frames and broken panes should be repaired by repointing cracks and re-plastering and painting of the interior. Water ingress from the window openings should be stopped by sealing plaster/frame joints, providing sills with drip courses and repairing bracketed *chhajjas*. Decayed and weathered wooden elements of the windows and doors should be replaced.

17. The outward thrust caused by diagonal rafters on the south-east corner of the Entrance Hall of the Main Block should be removed by providing horizontal connectors within the masonry walls at the floor level; rebuilding upper section of the south and east walls and a section of the roof. The decorative carved stone elements at the parapet level should be replaced and cracks in the internal wall plaster at lower levels should be filled.

18. Severe active structural cracks in the walls and ceilings of the Vaults on the west of the main building due to structural movement and material deterioration should be consolidated by grouting after renewal of waterproofing layer on roof below the lawns. Active cracks in the vaulted area below the Band Porch and west annexe of the main block should be stabilized.

19. Deflected corner walls and corner triple columns of roof structure of the Band Porch and North Portico should be rectified by concealed horizontal ties between ceiling and lintel/arch level and deteriorated material of vaulted roof slab of north portico be consolidated and top water-tightened. The separated joints in the masonry should be repointed and decayed stones be replaced. The decorative cast iron staircase should be repaired and re-painted after removing the rusted portions.

20. Masonry finials should be inspected annually to ensure that both stone and mortar are all sound. Decaying mortar should be replaced using an appropriate lime mortar. Where a finial needs to be replaced, the details of the original should be matched in size, shape, colour, texture, qualities of durability, and surface finish. Where metal cramps have corroded, these should either be stripped down or painted where they are still sound or replaced with ones made from non-ferrous metal or stainless steel.

21. Check the condition of the pointing between flagstones and repair this where necessary. Hard pointing can possibly be cut out with hand tools, such as chisels or quirks and a light club hammer. The use of a hammer and bolster is not recommended. Cutting discs, reciprocating blades and air tools with adapted masonry carving chisels can be helpful in removing detrimental cement mortar. Incorrectly used, power tools can cause untold damage to stone or brick surfaces.

22. Attic spaces and cupboards are common areas for concern with a tendency for accumulation of seldom used household items; storage in such areas should be minimized. The glass ceiling in attic, clerestory and bay windows to be replaced with tempered / laminated / toughened glass ceiling along with damaged wooden shutters and frames. The broken glasses used in the roof skylight

should be replaced with tempered glass of 4mm thickness or laminated glass of minimum 5.38mm should be used.

23. Buttresses on the rear side of building at few places have separated and developed cracks. To strengthen same, the cracks first shall be grouted using injection grouting using hydraulic lime cement grout followed by inserting and fixing SS anchors for anchoring and making the buttresses' integral and monolithic with the supporting walls.

24. The dust, dirt, soot, salts and later additions such as paint layers, etc. on the exterior surfaces should be removed along with the biological agents without damaging the patina after thorough research and documentation. Inappropriate chemicals for cleaning monument surfaces should be avoided keeping in view their incompatibility with the original fabric.

25. All damaged internal plaster to be scrapped and re-plastered using lime cement plaster and surfaced with POP and followed by plastic emulsion paint and the rest of the portions should be scrapped and repainted using plastic emulsion paint. The inner top roof trusses to be painted using fire proof paint.

26. The corroded and rusted steel sections in the Jack arch roofing should be strengthened by welding additional flange at the bottom or if both flange and web are corroded the whole joist should have to be replaced or provision of additional joists adjacent or below the member in the case of the Jack arch. The top of the Jack arch having lime concrete shall first be grouted using lime cement grout. In verandas with Jack arch type roofing having CGI sheets in arch-shape placed over I-sections, there is visible and extensive corrosion. The rods should be provided between the springing of the arches which will relieve the walls from the thrust of the arches and the load transferred to the walls will be vertical. Adequate rusticides and passivators should be applied to arrest further corrosion. Finally, the steel members shall be treated with a coat of primer followed by epoxy paint.

27. Cast iron rainwater goods should be periodically painted, taking care to paint inaccessible areas as far as possible. Never paint over rust; the surface should be clean and free from corrosion, dirt

and grease. Defective gutter joints should be re-sealed with an oil putty to stop leaks. Any small holes should be filled prior to painting to prevent water seeping in and getting trapped. Where downpipes are missing, existing gutter outlets will usually indicate where original downpipes were located. Replacement downpipes should be fixed away from the wall to facilitate repainting and to allow any leaking water to run down the back of the pipe rather than down the wall. Gutter brackets or rhone hooks should be re-used where possible.

28. Rafter/collar, rafter/wall plate and tie beam/wall plate connections of the roof should be improved with steel plates, angles and straps respectively. If mild rather than stainless steel is used, it should be galvanised or painted with a rust-inhibiting primer. Steel flitch plates may be inserted into fractured or weakened tie beams. Rafters can sometimes be reinforced with additional timber 'splinted' alongside. Pinning techniques in terrace joists and insertion of dowel bars at corners and T junctions should be used in wooden floors supported on wooden joists. This method will make the wooden joists/floor integral/monolithic strong with wall thereby preventing sagging, separation of floor and maintaining its structural integrity as well.

29. The majority of historic windows and doors are made of timber although some are of metal or have metal parts. Timber sills and bottom rails of doors and windows are more vulnerable parts and show signs of decay. Rotten or damaged timber should be replaced by cutting out the damaged section and splice in a new piece to match. If windows or doors or other external joinery element show signs of rot other than in the sills or bottom rails, it is essential that the root cause of the problem is identified and solved. Open joints between the frame and the wall should be filled with an appropriate mastic filler to prevent decay. Paint finishes on both timber and metal frames must be kept in good condition and renewed every 3-5 years, depending on the exposure and orientation of the window or door. Before repainting, carry out all necessary filling, splicing, repair, re-glazing, or re-cording of sashes. Historic timber window shutters are a valuable asset and

require little maintenance. Hinges should be kept in good working order and regular re-painting is necessary after removing the earlier layers of paints. Where the rot is in a relatively small area the wholesale removal of large areas of timber should not be necessary.

30. Stairs suffer from stone decay if not properly maintained. Excessive wear on treads can lead to water pooling which can result in decay from freeze. Moss, grass and even small shrubs in gaps between treads and the side faces of spandrels should be carefully removed to prevent the root structures being further damaged. The open gaps are to be repointed with an appropriately specified lime mortar. Open joints left between stairs and Platt slabs also allow water to seep through, leaving the underside of the steps saturated with little chance of drying out. This should be repaired as soon as possible to prevent further decay. One of the first signs of defects arising in timber staircases is creaking. The most likely cause of creaking stairs is the small wooden wedges which hold the treads and risers in place working loose. If these have become loose they should be carefully removed using a chisel, ensuring that the surrounding timber is not damaged. It may be possible to reuse these wedges but if they are severely damaged, new ones should be cut from suitable wood to the same dimensions as the original. When the wedges are ready to be refitted, they should be firmly knocked into place with a hammer in their original position between the stringers and treads and risers. A small amount of suitable wood glue may be used to help keep these in place.

31. Protect historic glass and door and window furniture like handles, hinges and sash fittings. Check the condition of the hinges and repair them as necessary rather than replace them. Hinges should be oiled at regular intervals.

32. Original / historical materials or details such as architectural members, decorations and ornamentations, if found degenerated beyond recognition due to loss in its inherent material strength, should be replaced as a last option to exercise in order to prevent further deterioration or decay of other portions of the structure. Original members, as far as possible, are to be stored in a safe environment for the purpose of conducting further investigations

/ research, or it may even be put on display for the purpose of education or study.

33. Fireplaces have been an integral part of the building and due to a wide range of different fireplace designs and features, they became highly decorative and the focal point within a room. There are a number of simple steps which can be taken to care for a historic fireplace. It is important to regularly clean a fireplace both to ensure performance and to maintain a good visual appearance. Care should be taken not to use anything which will abrade the surface or cause long term damage when cleaning any element of a fireplace.

34. There is a range of historic electrical light fittings ranging from cast brass, bronze, crystal and glass, distribution boards, electric fittings such as brass toggles, switch boards and electroliers. The wiring, also done using wooden casing capping and functioning in some sections of the building, is generally routed along the wooden skirting in the rooms. Historic brass toggle switches, distribution boards, electrical fixtures and original wiring system should be restored and preserved. The ad hoc placement of electric switchboards, wiring and fittings should be removed and re-located using discreet fittings and fixtures. Original distribution boards, electric fittings such as brass toggles, switch boards and electroliers survive and these should be carefully preserved to create a magnificent text book of historic Victorian services. Electrical installations should be checked regularly by a qualified electrician and old wiring should be upgraded to modern standards. Ensure that there are smoke detectors fitted in strategic locations and that they are kept in good working order.

35. The service installations in the building must be correctly maintained and kept in good order to avoid damage to the rest of the building. Check all pipe work, including radiators, for leaks. Water Supply, Sanitation & Plumbing Services need to be carefully salvaged, restored and possibly re-used in some bathrooms as part of a restoration exercise. Cast Iron pipes and historic fixtures and fitting too need to be preserved and restored. Removal of the boiler equipment, laundry pipes and ice making equipment and

repair of punctured walls and floor slabs; upgrading and providing toilet facilities as a reuse plan; modifying sewage and drainage to the structure and installation of heating system in some areas to be reused as the Library are also important features to be looked into. The original Fire Fighting system and Fire Sprinkler system in the attic should be taken up for repairs wherever necessary. The entire building has fire stations at each level which typically contain the water pressure meter; hose reels, alarm and glass break tools which are to be preserved. Basement services including Victorian Kitchen complete with an Aga Owen, coal ovens etc., and boiler equipment, laundry pipes should be preserved from decay and damages due to dampness. These items should be removed from the present locations and displayed for public view.

36. Regularly clip back climbing plants and hedging growing against the building. Plants such as ivy and buddleia are destructive as the roots penetrate deep into joints and crevices, forcing gaps to widen and open up the core of the wall or even the interior of the building.

37. Where a monument is in use and continues to perform its originally intended function, attention is to be paid to review existing conservation approaches keeping in mind conservation concerns as well as functions that are being performed within the monument. The level of facilities and amount of usable space are found to be inadequate at the time of conferences, symposia etc., which are a regular feature of the academic life at the IIAS. At various locations, serviceable and unserviceable building materials are found dumped. These building materials should be sorted out and serviceable, particularly timber materials, be used for repairing of doors, windows and window shutters. The unserviceable ones should be removed and the spaces so vacated be made presentable and properly utilized.

38. With the gardens becoming a major attraction, staffing levels for the upkeep and care of the gardens will also have to be enhanced. These include posts for guards, malis and sweepers. The greenhouse structure, an important feature of the nursery, is in urgent need of restoration. The stone bird bath and the stone

bench on the front main terrace, the two floral tanks and water fountain in the rear lower terrace of the late colonial period, should be preserved and restored by replacing cement concrete basin. The original drains all along the retaining walls and the arched parapets should be made functional by reducing the raised levels of the planting beds due to addition of mulch and soil over the years and connect these drains with the drainage system or towards the original water harvesting tanks within the site.

39. Bulged out retaining walls of the terraced garden should be stabilized by reconstructing the portions. The broken parapet wall of the lowest rear terrace garden needs to be restored. The coping stones that have been dislodged at places also need to be reset. Damaged and broken stones of the steps should be restored in stone matching to the original. Wild vegetation growths in the joints of the paving and retaining walls should be removed and joints be filled up with suitable mortar.

40. The level of the road at the entrance has been changed due to successive bitumen layering and at places the level of the road is higher than the entrance porch. This has to be lowered and replaced with the flag stone paving. The level of the road needs to be brought back to its original level, as evident in parts of the edging of the road. The level of the gravel surface also needs to be lowered at the front porch of the main building. Plinth protection should be laid all around the base of the walls. Planting beds at many places above the level of the plinth should be taken below the planned plinth protection.

41. Water hydrants, electrical boxes and all other services at various locations need to be appropriately sited and camouflaged to improve the aesthetics of the site. Service pipes need to be appropriately concealed in the ground.

42. The historic sundial indicating the plans of the hills around and the frame for the protection of the plate illustrating the mountain peaks plan in the western terraced garden should be preserved to avoid defacing. The Lady Minto commemorative plaque is found preserved by providing protection frame.

Phasing and Priorities of Conservation Operations

Rashtrapati Niwas or Viceregal Lodge is a protected monument declared under the provisions of Ancient Monuments and Archaeological Sites and Remains Act, 1958. As such, the entire responsibility of maintenance of the building including safety, security and watch and ward of the monumental complex is with the ASI. The quantum of conservation work required at different wings is quite large; as such it has to be planned in a phased manner. Each phase having two working seasons, i.e., February to June and August to December. Structural conservation works will have to be executed by adopting a systematic approach to achieve best and long lasting results on a priority basis keeping in view the available favourable seasons for the work depending upon the local climatic conditions. As per the records, CPWD in consultation with the ASI and IIAS had prepared a Detailed Project Report of the building and based on it, the CPWD initiated to take up structural conservation of the distressed portions of the Kitchen Wing a few years back. But the work is yet to be taken up. Being a protected monument, structural conservation of this portion of the building should be taken up by the ASI departmentally.

2. A suitable accommodation both for site office as well as residence for the ASI staff posted at the site should be provided within the campus but outside the main monument for effective maintenance and upkeep and also watch and ward vigil of the building.

3. In order to review the progress of maintenance and conservation works of the monument, a permanent project implementation committee comprising of representatives from the ASI, CPWD and IIAS, under the chairmanship of Director, IIAS should be constituted for assessing the item of works to be taken up on yearly basis and the progress of the ongoing works once in every 2-3 months of working period. This committee will also help the executing agencies with the technical requirements that may arise at any stage of the work.

5. Phasing of conservation operations have been attempted in the following chart so that the area with the same types of problems

can be initiated, simultaneously keeping in view the conditions of the structures at various locations within the time frame and the techniques and methodology as explained in detailed in the previous chapters.

Phasing	Area to be covered	Priority of works and recommended measures	Time frame executing Agency
I	1.Pitched roof, opened flat roof, Jack arched roof, 2. Plumbing and drainage issues 3. Pending projects	1. Arrest seepage and leakage from the roof top by repairing damaged sloping roofs, replacement of clay tiles, gutters, flashing and valley sheets and downpipes, water tightening the flat terraces including glass prisms sections, chimney stacks, parapet and gable walls 2. Roof drain outlets, down pipes, toilet pipes etc., to be attended to arrest the leakage and seepage of water in to building fabric. 3. While examining the available records/documents, it is found that the maintenance projects initiated by the ASI have not been completed and kept pending for quite a long time. ASI should complete all the long pending works including the work of reconstruction of the retaining wall in front of the Public Entry Building to avoid future complications in consultations with IIAS.	six months/ ASI Three months/ CPWD ASI

II	Cracks in Exterior façade on SE corner, NW corner, SW corner tower, north portion of Kitchen Wing and SE corner of East Wing	Strapping bulged out portions and vertical cracks of exterior walls particularly on the south-east, south west corner and north-west corner walls of the main block, north portions of the Kitchen Wing and south-east corner of the east wing by horizontal steel tie plates at regular intervals as attempted earlier on the Central Tower and Band porch. Then the cracks should be filled up and sealed by grouting methods.	Six months/ ASI
III	Door and windows, spiral stairs, etc. 2. Church building	1. Cracking, excess layers of varnish or paints, weathering effect on wooden doors and windows, damaged carved surfaces, rusting of metal windows and stairs, etc. 2. The Church building, a part of the Viceregal Lodge estate is in ruined condition which should be taken up on priority so as to save the building from collapse.	Eight months/ ASI
IV	North section of Kitchen wing and west vaulted chambers	The vaulted chambers on west side and various levels of the Kitchen Wing are in different stages of decay due to horizontal cracks on the ceiling, deterioration of lime concrete vaults, salt efflorescence on the walls, mortar and plaster composition.	Twelve months/ ASI

		Consolidation of deteriorated vaulted roof structures and wall masonry are to be taken up by removing the decayed masonry and grouting the portions after stabilization of active cracks as explained in the previous chapter following the techniques proposed by the CBRI.	
V	External façade, outer arcades, Masonry railings, stone stairs and porches, etc.	Stone decay, cracking, powdering due to salt efflorescence, weathering, spalling, splitting, contour scaling, decayed pointing, broken cornices and ornamental stone carvings, damaged and disjointed chhajja slabs and brackets, organic growths, staining and discolouration etc., at different levels of the building. Defective stones to be replaced, open joints in the coping stones, chhajja slabs and string courses to be filled up, damaged and broken carved and decorated stones to be replaced, discoloured and stained surfaces to be cleaned, organic growths to be removed and the active cracks in the stones are to be stabilized. The dead and decayed mortars should be removed and repointed. These items are to be taken up in a	Twelve months/ ASI

		phased manner and are time consuming. This should be attended on regular basis.	
VI	Interior wooden staircases and structural damages	Extensive damage to the plaster of the staircase north east corner; damage due to water penetration from upper section; structural cracks diagonally from window to lower corner; original colour of wooden members of the staircase replaced by white paint.	Six months/ ASI
VII	Other buildings in the complex	Repairs to the buildings within the protected limits of the monument should be taken up in consultation with the ASI	CPWD

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