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IBC Journal
September 2016

Focus on
Built Environment

From

Editor-in-Chief's-Desk

In the second edition of 'IBC Journal' the focus is Maintenance of Built Environment. We have included seven papers in this issue.

(i) "Building Maintenance in CPWD" is authored by Shri Rakesh Misra, Former Director General, CPWD who has wide and rich experience while heading the public works department at the Centre. Besides describing methodology adopted for routine maintenance, he has given insight of the Online Maintenance Services – "CPWD Sewa" introduced recently. Using this service the residents can lodge their complaints in respect of residential or non residential buildings maintained by CPWD either by taking assistance of 24X7 call centre services or by directly logging into CPWD Sewa portal. The status of previous lodged complaints can also be found online.

(ii) "Role of Municipal Bodies in Maintenance of Buildings in Delhi" is authored by Shri V.R. Bansal, Superintending Engineer, North Delhi Municipal Corporation. He has wide experience in the field of maintenance both at planning and implementation stage. Municipal Bodies have a very wide role to play in metropolitan cities like Delhi. They have to maintain roads and bridges, water supply, sanitation, conservancy, solid waste management, slum improvement etc. He has given an overview of history of Delhi and formation of various local bodies in the capital since British era. He has given details of the procedure followed for removal of dangerous buildings, especially in the walled city area.

(iii) "Asset and Facility Management: Planning, Strategy and Implementation" is authored by Shri Deepak Narayan, Former Engineer-in-Chief, PWD Delhi. He has practical experience and deep knowledge of different aspects on Asset and Facility Management. There are several technical papers to his credit. He has emphasized that effective facilities management, combining resources and activities, is vital to the success of any organization. At a corporate level, it contributes to the delivery of strategic and operational objectives. On a day-to day level, effective facilities management provides a safe and efficient working environment, which is essential to the performance of any business – whatever its size and scope be. A well-defined facilities maintenance strategy supports the organization's goals, whereas, a poorly defined or absent strategy could have significant adverse safety and commercial consequences for an organization.

(iv) "Initiatives and Innovations for Maintenance of CPWD Buildings at Delhi During Eighties" is authored by Shri K.B. Rajoria, Editor-in-Chief. I have been working in built environment sector including maintenance for almost 50 years. The issues related to maintenance of residential colonies, office complexes, hospital complexes etc show that there are challenges for Engineers in attending to maintenance and achieving client satisfaction. Besides, management skills are required to motivate Engineers and improve productivity. It is also observed that by optimizing resources, total output can be increased. The critical examination and analysis of maintenance problems lead to improved design for the exist-

ing building. The feedback was also helpful for design of new buildings. Orderliness and economy for maintenance of buildings gives satisfaction of accomplishment.

(v) "Conservation of Precious Heritage - A Moral Responsibility" is authored by Ms. Indrani Sarker, Former Jt. Director General (Arch.), MES. She has conducted detailed study of heritage structures, which are still in use including I.M.A. Dehradun and Fort William Kolkata. MES has framed conservation policy and evolved techniques/technologies, to restore heritage structures. In fact the strategy evolved by them should be made applicable for all heritage structures of our country.

(vi) "Maintenance of Buildings – An Essential Aspect" is again authored by Shri Rakesh Misra, Former Director General, CPWD. When a building is designed for maximum "ease of maintenance" and minimum life cycle cost - both in terms of money spent as well as in terms of energy consumed, it automatically conforms to sustainability standards. And when the building is maintained efficiently, it not only reduces cost of running and maintenance of installations and of course their replacements, it also helps us save huge amount of energy and it's carbon footprints in terms of efficient use of scarce materials and other resources as a result of reduction in manufacturing of replacements. This not only applies to various components of the buildings, but also to building as a whole.

(vii) "Durability of the Built Environment and Environmental Characterization" is authored by Shri Svein Haagenrud who is well known international expert in the field of maintenance of built environment. Use of materials Performance data can achieve all the needed environmental data by collaboration with the environmental research area. Such a collaboration should also have the mutual benefit of establishing much more sound cost benefit data for the maintenance of Europe's built environment. This is a very much needed documentation that should serve as a basis for a more comprehensive market-oriented and strengthening effort on the maintaining of built environment.

(viii) An abstract on "Urban Communication-Survival in City" authored by Shri William C. Arnold and Shri J.L Bulay is included in the last. In our country, the urban population is increasing on account of birth and migration to cities. A number of cities are approaching to become metropolis and metropolis are moving towards status of megapolis. In turn, urban miseries are multiplying many fold. Still there is no solution. There are many difficulties and constrains. Whether it is possible to think of and/or plan urban renewal to make life comfortable. It will be interesting to know, thoughts and propositions of thinkers and experts regarding survival in the city. This book extract will add to our thinking, for urban renewal initiatives.

2. In the context of Delhi, we all know it is very important city being capital of India. The population of National Capital Territory of Delhi is exceeding 10 millions (one crore). Therefore it is one of the most populous city of India. Considerable share of it's built environment is created, managed and maintained by different agencies. Input given by important agencies is helpful to understand issues related to built environment related to buildings of:

(i) Central PWD Govt. of India –Rashtrapati Bhawan, VIPs bungalows, Central Govt. office complexes including Central Secretariat, Central Govt. Habitats, Institutions, educational institutions, residential buildings for central govt. employees etc. are under jurisdiction of Central PWD. The biggest share of estate management is with Central PWD, working with Ministry of urban Development, Govt. of India.

(ii) MES, Govt. of India – MES is maintaining a number of residential buildings and other non residential buildings in cantonment area and other places.

(iii) Indian Railways, Govt. of India – Functional areas of Railway Stations and many non-residential and residential complexes are maintained by Indian Railways

(iv) Other Central Govt. Departments and Organisations like Ministry of Communication, Information and Broad Ministry etc. have their Engineering Wing and maintaining residential and non residential building under their charge.

(v) Govt. of Delhi - The PWD Delhi is maintaining buildings under the administrative control of Govt. of Delhi. It includes office complexes, schools, hospitals, other functional buildings, residential buildings etc.

(vi) Municipal and Development Bodies - Delhi has five Municipal Bodies consisting of Delhi South Municipal Corporation of Delhi (SMCD), (ii) North MCD,(iii) East MCD (iv) New Delhi Municipal Committee and (v) Cantonment. These Municipal Bodies and Delhi Development Authority (DDA) are having their engineering wing and maintaining schools, hospitals, sports complexes, residential buildings under their charge.

(vii) Other State Govt. Organisation like DSIDC, Slum Board etc also maintain buildings under their charge.

(viii) Private buildings like hospitals, schools, malls, shopping complexes, factories etc. are either maintained by individual owners or welfare associations.

3. Beyond what is covered by under organized maintenance by indentified agencies detailed above, a major share of buildings are owned by privates and it is to be seen as to whether these buildings are maintained or not. These are broadly categorized under following groups.

(i) DDA or Other Agency, after completion and allotment of housing projects, handover certain obligations of maintenance to welfare associations. The condition of maintenance is generally not bad.

(ii) Old Delhi (walled city and other areas):- A number of buildings are more than 200 to 300 years old and a number of these buildings are in precarious conditions. The status is to be ascertained and obligations of individuals owners and government are to be understood and reviewed. The repair and rehabilitation of heritage buildings is being initiated by Government.

(iii) Private Colonies : A major portion of Delhi's habitat is in private colonies, developed by developers, DDA, other bodies etc. These buildings have deteriorated with passage of time. Several buildings are being redeveloped.

(iv) Resettlement colonies were developed in early seventies by DDA and had no parallel in whole world. 21sqm plots were given to Juggi and Jhopri dwellers. Common toilets were provided. After almost half century it is necessary to appreciate the developments in these colonies. Almost all the structures are unauthorized.

(v) Regularized Unauthorised Colonies have grown in Delhi without any approval and acceptance for land use, landownership etc. From time to time these colonies were regularized. In the world history of habitation it might be a unique example in Delhi and other

cities. The fact is that unauthorized colonies continue to grow. It is necessary to review status of buildings in these colonies as a number of accidents and deaths are reported in these colonies on account of failure of structure.

(vi) Slums- There are identified slum areas in Delhi, being administratively controlled by an agency of State Government as local body. The condition of habitat is to be ascertained and measures necessary for ensuing safety.

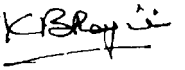
(vii) Urban Village and Urban Extension- Village Jurisdiction in Delhi has special status and for construction of buildings, no approval of local body is required. These villages and extensions have developed in unauthorized manner. It is necessary to review status and see whether any improvements are possible.

(ix) Other areas not covered under any of above categories do have habitats and without approval and sanction by local body. These are to be identified to ascertain vulnerability.

4. Broad classification of habitat is given in para 2 and 3 above. In order to appreciate and understand condition of habitat and bring out measures to be taken, if required, it will be necessary that different experts conduct detailed study under different group as brought at above. These studies can be done by top executives in their organizations, with independent experts, faculty of professional institutes etc. The purpose is to bring out a competitive document on habitat in Delhi covering mainly status, requirement of maintenance in these structures, action to be taken, agency, funds etc.

5. We have heritage structures in our country, as old as 2000 years. These structures are with lime mortar or without any mortar. These structures have stood test of time and are looked after as heritage structures. But when it comes to structures with cement mortar, cement concrete, reinforced cement concrete etc, we have to appreciate and understand about deterioration of structures where cement is basic material. Initially when reinforced cement concrete (RCC) was invented, it was thought that like steel structures, these structures will not need any maintenance. There has been mammoth growth of structures with RCC. But time has proved that most of the structures built with cement concrete are found to be distressed, a few years after construction. Premature deterioration of concrete structures is an international problem. Therefore, we have to appreciate and understand that buildings with cement mortar, and RCC will need special repair or replacement. At Delhi itself, many private buildings particularly non-engineered buildings need replacement or repair/rehabilitation. It may not be possible for private owners to tackle this issue and some solutions will have to be worked out by providing funds by Government.

6. European experience as brought out in the book Abstract included shows that Europe faced difficulty regarding maintenance and rehabilitation during eighties and nineties of last century. They evolved, developed, coordination to fulfill objectives. In our country we work in isolation. In the same city one agency does not share knowledge and experience with other agency. Solutions are not found in consultation with experts and academics institutes. Every body wants in isolation. We have to develop the attitude for active coordination and cooperation. The IBC can provide the plateform for making coordinated efforts.



(K.B. Rajoria)
Editor-in-Chief

Building Maintenance in CPWD

Rakesh Misra
Former Director General, CPWD

Prologue

Building maintenance is work undertaken to keep, restore or improve every facility, its services including horticulture operations to a currently acceptable standard and to sustain the utility and value of the facility. Maintenance aims at effective and economic means of keeping the building and services in usable condition.

As the building ages, there is deterioration to the various parts of the building and services. Therefore, preventive and regular maintenance of the buildings is very necessary to keep them fit for use of the occupants.

Shri Rakesh Misra, former Director General, CPWD is a well known expert in built environment. Through his experience in the field, author has put forth the documented policy, guidelines and instructions for carrying out building maintenance including the services.

The author has well described the type of maintenance works, methods of undertaking the maintenance, estimates/ annual action plan, routine maintenance, preventive maintenance by employing department labour or outsourcing. He has also highlighted various provisions of CPWD maintenance manual. The article is of considerable interest and offers guidelines to the professionals in the department and the occupants of the Govt. buildings in general.

-Editor-

Introduction

Central Public Works Department is more than 160 years old department of the Government of India, which has been traditionally responsible for construction and maintenance of all central government assets throughout the length and breadth of the country.

CPWD is maintaining a very large building stock comprising of residential accommodation and office buildings apart from hospitals, educational buildings, research institutions and sports infrastructure etc. along with services e.g. water supply, sewerage, drainage and roads. Some of the most prestigious buildings are under the charge of CPWD e.g. Rashtrapati Bhawan, Parliament House, North and South Block, India Gate etc. which also have heritage character and need special attention and care. As on date about 1.50 Lakh residential units and 40000 non-residential units are under

maintenance of CPWD all over India, out of which about 85000 residential and 25000 non residential units are in Delhi itself.

CPWD has a well documented detailed set of policy guidelines, procedures and instructions for carrying out building maintenance, which have been compiled in CPWD maintenance manual.

Objectives

Building maintenance is defined as work undertaken to keep, restore or improve every facility i.e. every part of a structure or building, its services including horticulture operations to a currently acceptable standard and to sustain the utility and value of the facility.

The main objective of maintenance can be described as : -

- To preserve building and services, in good operating and habitable condition.
- To ensure safety of the occupants and the public at large
- Where so required to Upgrade, renovate, retrofit the facilities to improve specifications and standards

Maintenance aims at effective and economic means of keeping the building and services in usable condition. It involves different skills as per requirement of occupants and the expected performance level. Programming of works to be carried out to keep the building in a good condition calls for high skills. Feed back from maintenance is a continuous process to improve the designs and specifications. The use for which buildings are designed is a prime factor in determining the requisite standard of care.

Types of maintenance works

The repair works are basically classified as:

- Day to day repairs to buildings and related services
- Annual repairs including preventive maintenance
- Special repairs:

The expected economic life of the building under normal occupancy and maintenance conditions is considered to be as below:-

- Monumental buildings 100 years.

- RCC Framed construction 75 years.
- Load bearing construction 55 years.
- Semi permanent structures 30 years.
- Purely temporary structures 5 years.

The life of the buildings mentioned above is only indicative and it depends on several factors like location, utilisation, specifications, maintenance and upkeep/caretaking. The replacement, renovation and major repairs become inevitable as the life of all the components are not identical.

As the building ages, there is deterioration to the various parts of the building and services. Major repairs and replacement of elements become inevitable. It becomes necessary to prevent the structure from deterioration and undue wear and tear as well as to restore it back to its original conditions to the extent possible. The following types of works in general are undertaken under special repairs: -

- White washing, colour washing, distempering etc., after completely scrapping the existing finish and preparing the surface afresh.
- Painting after removing the existing old paint from various members.
- Provision of water proofing treatment to the roof. All the existing treatments known are supposed to last satisfactorily only for a period of about ten years.
- Repairs of internal roads and pavements.
- Repairs/replacement of flooring, skirting, dado and plaster.
- Replacement of doors, window frames and shutters. Replacement of door and window fittings.
- Replacement of water supply and sanitary installation like water tanks, WC cistern, Washbasins, kitchen sinks. pipes etc.
- Re-grassing of lawns/grass plots within 5-10 years.
- Renovation of lawn in 5-6 years.
- Replanting of hedges in 8-10 years.
- Completely uprooting and removing hedges / shrubbery.

- Replanting of

  (a) Rose beds in 5-6 years.

  (b) Perennial beds in 5-6 years.

  (c) Canna beds in 1-2 years.

- Shifting of any garden feature from one site to another within building.

The building services fixtures including internal wiring, water supply distribution system etc. are expected to last for 15-20 years. There after it may be necessary to replace them after detailed inspection. Electrical special repairs in general are whole sale replacement of the wiring and the electrical installations. Earthing is also to be attended. Useful life of various electrical equipments/installations etc. are also specified.

In addition to above the following works are taken up as required from time to time:

- Additions and alterations works in the buildings
- Upgradation to bring up to currently approved standards
- Retrofitting and aesthetic improvement
- Supply and maintenance of furniture and furnishing articles for Ministers, MPs and Judges of Supreme Court, High Court and other VIPs in Delhi.

The maintenance works are undertaken through one of the following methods:-

- Directly employed labour
- Through contracts :

  (a) Contracts for specific works

  (b) Comprehensive outsourcing

  (c) Running rate contracts

Service Centre

CPWD carries out the maintenance work through a net work of Service Centres which are located in various Govt. Colonies/ Office complexes. All complaints received at the Service Centres are noted in complaint register and given a specific

complaint number. This is the basic document maintained at the Service Centres. Complaints of different nature are passed on to specific registers from the complaint register. Complaints are also received through web-based portal CPWD-Sewa which is used for receipt and disposal of maintenance complaints which are lodged by the occupants online or through 24x7 call centre.

As of now there are 612 service centres for residential colonies and 394 service centres for non residential buildings all over India.

Register of Buildings

Every division is required to maintain a Register of Buildings under it's charge in the prescribed format and keep it updated with the cost and extent of maintenance operations and other addition, alteration and special repair works undertaken in each building. This is inspected by the Superintending Engineer during his inspection of the Divisional Office. Similarly a garden Register is maintained by Horticulture Division indicating therein the original works, addition and alteration works and special repairs.

Safety of Buildings

All buildings/structures borne on the Register of Buildings are required to be inspected once a year by the Assistant Engineer in-charge to ensure that the building/ structure is not unsafe for use. The Junior Engineers are required to inspect such structures/installations twice a year and record certificates to that effect.

In case of any deficiency is found in the structure/installation, necessary report is made to higher authorities and immediate steps taken to get the same inspected by the Executive Engineer and further action taken to remedy the defects. The Divisional officers will also inspect important buildings/gardens once a year and bring to the notice of his Superintending Engineer, cases where he has reasons to doubt the structural soundness of any building/structure/installations.

In case of any deficiency found in the important buildings like Prime Minister's house, Cabinet Minister's House, Vice-President's House and houses of other V.I.Ps, report about unsafe condition of the house is sent to the Department /Ministry concerned directly or through the Ministry with recommendations and proposals for repairs or disposal of the building.

Services not within the purview of CPWD

Generally following services do not come under the category of maintenance and hence not rendered by CPWD in non residential buildings.

- Housekeeping - It is distinctly different from building maintenance. It includes day to day cleaning/scavenging of the areas, which is arranged by user Department.

According to Govt. guidelines coordination committee is formed by user departments in case more than one Department/Ministry are located in an office complex and such services are arranged by Coordination Committee.

- Maintenance of Fire Extinguishers-Whereas maintenance of fire detection and fire fighting equipment/services is within the purview of CPWD, maintenance and filling of fire extinguishers installed at various locations in the building are the responsibility of user Department.

- Security of building-Security of the building is the responsibility of user departments, which is discharged by them directly or through Ministry of Home Affairs.

- Pest control.

- Monkey menace.

However in case of GPRA / residential buildings CPWD takes up the responsibility of sweeping, cleaning, mopping of common areas e.g. staircases, lift lobbies, corridors, terraces etc. also.

Annual Building Survey

This is the most important activity in the maintenance of buildings. Every year end an exercise is required to be carried out to physically survey all the buildings borne on the Register of Buildings or otherwise maintained by a sub divisional officer to identify all works of repairs, minor works and upgradation works required or anticipated. Assistant Engineer is required to submit report of the Annual Survey of the buildings also highlighting defects of structural nature in the buildings, if any, which require personal investigation by higher authorities to Executive Engineer. This will also contain details of Special repairs required to eliminate leakage and dampness in buildings which should be given priority and completed before the monsoon. As far as possible it should be ensured that all other repair works both Civil and Electrical are completed before finishing works are taken up. For this the Assistant Engineer of both the streams shall submit a time frame of the repairs, minor works and upgradation works required or anticipated to the Executive Engineer in charge of the Service Centre, who shall be responsible for circulation of a coordinated time frame for carrying out the repairs by 31st January for the ensuing financial year.

Annual Action Plan

Based on the annual building survey the Assistant Engineer shall under intimation to his counterpart Assistant Engineer level officers of other disciplines, takes action to forward by 15tn December proposal for an Annual Action Plan for the ensuing financial year. These officers of the other disciplines shall similarly forward their Annual Action Plan to their superiors.

Annual works programme based on consolidated Annual Action Plan, indicating the activities of all disciplines is to be approved by Superintending Engineer who is in charge of the Service Centre. There after the Annual Work Programme is circulated to all officers from JE to CE as well as to the RWAs by 31st January. The Annual Action Plan of all disciplines, shall thus have the same Annual Work Programme.

The Annual Action Plan, which shall be based on the survey, the major complaints pending as well as on past experience and anticipation, shall include, indicating quarter/ building / blockwise detail of work to be carried out, the following:

Extract of works through contracts contemplated in the

- Estimate for Annual Repairs
- Estimate for Special Repairs (including Extraordinary Repairs)
- Estimate for maintenance and repairs

List of up-gradation works and minor works to be carried out.

An Annual Work Programme giving start and completion of each of the above jobs and activities

A time frame for invitation of tenders and award of work and completion thereof.

The Executive Engineers then see to it that estimates within competence of division are sanctioned by 15th January and where approval of higher authority(s) is required, the proposals are forwarded by 5th January so that these are also sanctioned by 15th January.

Action for call of tenders and award of work or supply are to be taken in time so as to start the works at the beginning of the next financial year i.e. 1st April.

The Annual Action Plan is reviewed before 30th September and if necessary a revised Plan may be approved and additional tenders etc. may be invited.

Online Maintenance Service (CPWDSewa)

For monitoring of complaints related to maintenance of assets being maintained by CPWD, the CPWDSewa portal is being operated. Each service centre has been given ID and password to login-in to the system. The CPWDSewa portal has four main modules.

Residents' Module: Under this module, an occupant can lodge one's complaint in respect of residential or non residential buildings being maintained by CPWD either by

taking assistance of 24 x 7 Call Centre service or by directly logging into CPWDSewa portal. The type of complaints (i.e. Residential or Non-residential) can be selected after log-into CPWDSewa website from the drop down menu shown at left panel of the screen.

The complainants using CPWDSewa portal can select a residential quarter or non-residential building through multiple options e.g. house details, service centre, building name, general search or one's own mobile number. The complainants can choose any of the above options as per their convenience. The resident can also view the detailed list of complaint types in respect of Civil, Electrical and Horticulture. Against a specific complaint lodged, the residents are allowed to choose their preferred day and time for complaint attendance. Upon submission of needed details, the confirmation screen appears with the Unique Complaint Number, which is auto-generated by the system.

The status of a previously lodged complaint can also be known on line through multiple options e.g. direct by giving complaint number or by selecting particulars of building/quarter and then the specific pending complaint. The residents can also get the complaint history in respect of their particular quarter during a specified period.

The SMS-es are generated and sent to the registered mobile of the user at various stages namely making the complaint lodging i.e. immediately after the complaint is lodged, the complaint is assigned to the worker and when the complaint is attended. The user has also been given the option to submit their feedback via SMS.

Once the complaint gets attended by the respective CPWD Service Centre, the resident is asked to give feedback in three different modes as under:

a. Satisfied with the work done;

b. Not satisfied with the work done; and

c. Attended but claimed to be not attended by the allottee.

This feedback is taken automatically through an SMS responded by an user in response to SMS reporting complaint compliance. If not satisfied with complaint compliance, the user has option to re-activate the complaint through Call Centre. Against a re-activated complaint, the worker is required to re-visit and attend the complaint to the satisfaction of user.

Service Centre Module: This module is created for looking after the complaints handled at the operational level i.e.Service Centre. Each service centre is owned by Junior Engineer and he has been allotted a Login ID and password and when logged-in, it shows online numerical abstract of registered complaints assigned and remain-

ing to be assigned to workers for that Service Centre. This is displayed to all three JEs / SO(Hort) (i.e. Civil, Elect & Hort) in regard to all complaints under that Service Centre. The analysis for bench marking can also be done for the complaints lodged for selected period.

CPWD Management Module: This module is to provide access to all the AEs and above level officers to monitor pendency and attendance of complaints. They can securely log in the system by using their own Login ID and password. A dashboard is displayed to CPWD officer as the first Welcome Screen. This indicates live and online information regarding registration, pendency and disposal of all minor and major complaints.

Reviewing and recording comments against any of the minor or major pending complaints pertaining to all or any of the 3 disciplines viz Civil, Electrical and Horticulture is conveyed to concerned CPWD officer with options available in CPWDSewa.

There are various sub-menus under this menu where the management can take advantage of generating various reports as per their convenience.

Benchmark reports for analysis purpose are also generated as per colour coding in respect of complaints, which have been attended during the specified period in respect of minor as well as major complaints. Feedback reports can be generated for all service centres for a specified period for further analysis by the management. CPWDSewa software also periodically generates MIS reports and automatically sends through-mails

Call Centre Module: The call centre on 24 x 7 basis receives all the complaints via toll free numbers. At the call centre, there is a facility of receiving calls and lodging the complaints through the same websitehttp://cpwdsewa.gov.in on a real-time basis.

After the complaints are lodged by the call centre on to the website, it is attended by the respective service centre. Consequently, upon attendance of the complaint, the call centre takes feedback of such attended complaints telephonically. The feedback is taken basically to assess the satisfaction level of occupants and assess efficacy of efforts put in by CPWD team in giving the maintenance service to users of properties being maintained by CPWD. The feedback report is generated as MIS report which can be seen by respective JE and officers concerned.

Preventive Maintenance

Preventive maintenance is very essential to keep the buildings and services in serviceable condition. Preventive maintenance differs from the annual repair and maintenance as well as to special repair estimates in the sense that precaution should be taken in respect of the buildings and services so that the avoidable maintenance

problems can be minimised. The preventive maintenance in real sense starts with the planning stage of construction of the building itself and it runs upto the stage of real serviceable life of the building.

- Preventive Maintenance at Design Stage: Precaution should be taken while designing the building of the structure so that any designer lacunae can be avoided which otherwise would create burden/difficulties during the maintenance stage of the building.

Architectural System : The layout of the campus, the layout of the buildings, its components etc. should be designed in such a way that maintenance aspect are smoothly carried out after the building is put to operation. It is essential that all the architectural features should be designed in such a way that their replacement or repair can be carried out smoothly.

Accessibility to Maintenance : This is somewhat related to the development of architectural plans but the idea is to focus on the accessibility aspect during the maintenance like size of the shaft should be such that vertical stacks are changed whenever required smoothly. Also platforms may be introduced at intermediate levels to provide workers platform to work. Similarly, design of the structural components and any deficiency in design of the building components may lead to serious implication in the serviceability of the building or its component. Therefore, every precaution has to be taken at the design stage and the designer should foresee the anticipated problem during the maintenance. Special precaution should be taken to design thin members of the building components like chhajha, fins, balcony railings, parapet walls etc. It has been the experience that the maximum damage and corrosion in the steel is found in thin members because of less cover or because of structural difficulties in casting of concrete thin members.

Design of Services:

(i) Provision of future requirements of services should be ensured at the time of conception of project.

(ii) Any deficiency in the design of services be it civil or electrical will definitely create maintenance trouble at some stage. While designing the system, the functional aspect has to be seen but at the same time, maintenance aspect has also to be kept in mind.

(iii) To avoid seepage from A.C. pipes, a network of pipes with an outlet of considerable size should be catered for at the time of construction.

Preventive Maintenance at Construction Stage : Construction stage is one of the important stages wherein the aspects of preventive maintenance are taken care of.

This can be broadly specified in under mentioned categories:-

(a) With the advancement of technology, the new approaches to the construction are being adopted. While the focus is mainly on the construction when such technologies are adopted but the efforts should be made to keep in mind the maintenance aspect while adopting any new technology for construction.

(b) New design of fittings and fixtures

There is advancement in development of new fittings and fixtures in civil as well as electrical. So, while deciding such factors, the aspect of its easy repairs, maintenance and replacement should also be seen. Also, specification for the new items and materials should be elaborated in details.

(c) Selection of materials

While selecting any specific material for construction, it should be seen that if there is any requirement of repair or replacement in part, whether the same or similar material of the matching specification would be available in future, otherwise any damage in the localized area may need complete replacement with some other material which will lead to costly maintenance.

(d) Workmanship

Workmanship during construction stage is one of the most important component which affects the serviceability of the building. Any deficiency in workmanship will lead to problem during the service life of the building which would create avoidable pressure on maintenance. Therefore, the construction team has to be fully alert to ensure that there is no such lacunae which may affect the service life of the building.

Maintenance of VIP Residences

Official residence of President, Vice President, Prime Minister, Former Presidents, Chief Justice of Supreme Court, Lok Sabha Speaker, Former Prime Ministers, cabinet ministers of Union, Leaders of Opposition in Lok Sabha and Rajya Sabha, Deputy Chairman Planning Commission, Judges of Supreme Court of India, Comptroller and Auditor General, Chief Election Commissioner of India, Chairman of UPSC, Deputy Chairman of Rajya Sabha, Deputy Speaker of Lok Sabha, Members of Planning Commission, Ministers of State of Union, Attorney General of India, Cabinet Secretary, Chiefs of Staff, Chairpersons of CAT, Minorities Commission, SC/ST Commission, Chief Justice and Judges of Delhi High Court, Members of Parliament and other senior government functionaries as appointed from time to time have been defined as VIP residences.

Most of the residences and offices of these VVIPs / VIPs are located in Lutyen's Bungalow Zone and are very old. Many of these buildings are heritage structures like President House, South and North Blocks, Parliament House etc. There are strict restrictions on construction as well as addition / alteration / renovation of these buildings to maintain their original character. Detailed guidelines have been laid down in CPWD Maintenance Manual for any work to be undertaken in these buildings.

Ministry of UD has laid down guidelines for additions/alterations and fixed annual monetary limit/tenure monetary limit for carrying out addition/alterations. These addition/alterations are carried out subjected to technical feasibility.

Outsourcing of Maintenance

Recently CPWD has successfully introduced outsourcing by engaging a single agency for a defined geographical area on contract for carrying out the comprehensive maintenance operations, which will include day to day repairs, special repairs, addition/alterations, minor works (carried out on cost sharing basis), annual repairs such as white washing, painting etc. This agency will be responsible for maintaining not only the civil component but also responsible for the electrical fittings/fixtures and horticulture works on a composite basis. Further, where caretaking is also being done by CPWD this would also be included in scope of work of the agency. The move has in general been welcomed and appreciated by occupants.

Scope of Outsourcing Work:

Day to Day Maintenance:- The single agency is for carrying out day to day maintenance activity through the deployment of required trained manpower under the supervision of a supervisor. The agency will also provide the services of computer literate enquiry clerks to man the front offices of the service centres. It will be responsible for receiving the service requests from CPWD e-Sewa/IVRS/ various allottees and allotting the same to the workforce and keeping a detailed record of the work done in the computerized maintenance service of CPWD being run at the website http//cpwd.sewa.nic.in. The maintenance activity will include the cost of material required for attending of day today complaints and the payment shall be made on the basis of unit plinth area being maintained per month. A detailed list of items, which will be considered as falling in the category of day to day repairs shall be enumerated and included in the agreement. For justification of rates at which the work is to be awarded, the requirement of labour shall be assessed on the basis of laid down yardsticks available for maintenance in CPWD and this requirement shall then be rounded off to nearest whole number for provision of manpower which shall be provided. Suitable provisions for recovery in case of non-compliance by the agency may be incorporated in the NIT conditions.

Special Repairs:- Provision for special repairs and addition/alterations is made as distinct subheads and the items of works required to be executed are enumerated, as are being done at present also, and the contractor is required to quote rate for individual items. The quantities for these repairs are based on an assessment made for the works executed in the preceding years and on the basis of requests for such items available on record with CPWD.

Annual Repair:- The item of annual repair i.e. white washing, painting etc. are included as distinct subhead with the quantities for this subhead based on the yardstick for these items for the buildings considered to be covered under outsourcing.

Conclusion

CPWD Maintenance Manual which is invariably followed in all maintenance works in the department is a unique compilation of instructions on best practices in maintenance of government buildings. It provides detailed instructions, yardsticks, guidelines on various types of maintenance to a great variety of building types available in the government sector. This paper summarises these provisions and throw light on it's salient features as also the problems faced and solutions evolved as embodied in the manual.

Role of Municipal Bodies in Maintenance of Buildings in Delhi

V.R. Bansal
Superintending Engineer, North Delhi MC

Prologue

Municipal Bodies have a very wide role to play specially in metropolitan city like Delhi. They have to maintain roads and bridges, water supply, sanitation, conservancy, solid waste management, slum improvement. In addition they look after safety of buildings constructed by public. One of the major problematic area is unauthorized colonies where buildings are mostly built without following any regulatory norms, building by-laws etc and they are vulnerable to mishaps. The local body cannot normally interfere with private structures unless the building is considered to pose danger to life and property to the inhabitants as well as general public. In such cases they can compel the owner or occupier of building to demolish or repair within a specified time.

Shri V.R. Bansal has got wide experience in Delhi Municipal Corporation and has ably described history of Delhi, the function of local bodies and specific problems of walled city. He has also dealt on the role of Municipal Body in disaster management.

-Editor-

Introduction

The capital city of Delhi has a long history, and has been an important center of power play for centuries. Delhi is a city with a majestic and imperial past that has witnessed the rise and fall of many empires. The history of Delhi is as exciting as the city itself. Delhi is said to be one of the oldest cities existing in the world, along with Damascus and Varanasi. Its existence can be traced back to the times of the Indian epic Mahabharata that narrates the creation of Indraprastha by the Pandavas. However, much of Delhi's ancient history finds no record and this may be regarded as a lost period of its history. Extensive coverage of Delhi's history begins with the onset of the Delhi Sultanate in the 12th century. Since then, Delhi has been the center of a succession of mighty empires and powerful kingdoms, making Delhi one of the longest serving Capitals in the world. It is considered to be a city built, destroyed and rebuilt several times. The core of Delhi's tangible heritage is Hindu, Islamic (spanning over seven centuries of Islamic rule over the city) with expansive British-era architecture in Lutyens' Delhi dating to the British rule in India.

It is, however, widely accepted that Delhi was built and rebuilt atleast seven times in the past apart from the newest city of New Delhi. These have been :

Lal Kot: or Qila rai Pithora, built in the 12th century as per available historical records, was the capital of Prithviraj Chauhan. The ruins of its ramparts are still visible around Qutub Minar and Mehrauli.

Siri: It was built by Alauddin Khilji. Among some of the remaining ruins is part of the Siri Fort in the greater Hauz Khas area.

Tughlakabad: This was established/built in AD 1326–27 by Ghias-ud-din Tughlaq who established the Tughlaq dynasty and set out to rebuild a Delhi of his own. His dream was to build an impregnable fort to keep away the Mongols. Thus, he founded the city of Tughlakabad, the ruins of which still remain.

Jahanpanah: Muhammad bin Tughlaq later founded Jahanpanah. Lying in the area between Siri and Qila Rai Pithora, this was the fourth medieval city of Delhi.

Ferozabad: Feroz Shah Tughlaq, son of Muhammad bin Tughlaq, created the next city of Ferozabad, or Feroz Shah Kotla as we call it today. It was a well-planned city with palaces, mosques, pillared halls, and multi-floored water tanks.

Dinpanah or Shergarh: In 1526, a new chapter was written in Delhi's history. Babur defeated Ibrahim Lodi in the First Battle of Panipat and established the Mughal dynasty. In 1540, a sway of imperial power saw Babur's son Humayun defeated by Sher Shah Suri. Sher Shah established another Delhi. The city, known as Shergarh, was built on the ruins of Dinpanah that Humayun had set up. The remains of Shergarh are at Purana Qila near the Delhi Zoo. Once Humayun returned to power, he completed the construction and proceeded to rule from Shergarh.

Shahjahanabad: After Humayun, Mughal emperors shifted their base from Delhi to Agra. But Shah Jahan, Humayun's great-grandson, returned to Delhi and established Shahjahanabad- a city with the colossal Red Fort and its 14 gates. The fort still stands along with the olden architecture of the Jama Masjid and Chandni Chowk. Some of the gates like the Delhi Gate, Lahori Gate, Turkman Gate, Ajmeri Gate and Kashmiri Gate still exist. Shahjahanabad is a city which is still largely alive even today.

Delhi passed into the direct control of British Government in 1857 after the First War of Independence of 1857. The city received significant damage during the 1857 siege. The last titular Mughal Emperor Bahadur Shah Zafar II was exiled to Rangoon and the remaining Mughal territories were annexed as a part of British India.Calcutta was declared the capital of British India but at the Delhi Durbar of 1911, held at the Coronation Park, King George V announced the shifting of the capital back to Delhi. Thus, a monumental new city on south-west of the walled city, designed by the Brit-

ish architect Edwin Lutyens to house the government buildings, was established and inaugurated in 1931 after its construction was delayed due to World War I. New Delhi was officially declared as the seat of the Government of India after independence in 1949.

Local Bodies

Local bodies are institutions of the local self-governance, which look after the administration of an area or small community such as villages, towns, or cities. The Local bodies in India are broadly classified into two categories, viz: the local bodies constituted for local planning, development and administration in the rural areas are referred as Rural Local Bodies (Panchayats) and the local bodies constituted for local planning, development and administration in the urban areas are referred as Urban Local Bodies (Municipalities).

The origin of local self-government had very deep roots in ancient India. On the basis of historical records, excavations and archaeological investigations, it is believed that some form of local self-government did exist in the remote past. In the Vedas and in the writings of Manu, Kautilya and others, and also in the records of some travelers like Magasthnese, the origin of local self-government can be traced back to the Buddhist period. The Ramayana and the Mahabharata also point to the existence of several forms of local self-government such as Paura (guild), Nigama, Pauga and Gana, performing various administrative and legislative functions and raising levies from different sources. Local government continued during the succeeding period of Hindu rule in the form of town committees, which were known as 'Goshthis' and 'Mahajan Samitees'.

Independence brought a new kind of activity in every sphere of public life. It opened a new chapter in the history of local government in India. The present Constitution came into force in 1950 and the local self-government entered a new phase. The Constitution of India has allotted the local self-government to the state list of functions. Since Independence much important legislations for reshaping of local self-government have been passed in many states of India.

The Constitution (74th Amendment) Act, 1992 is a landmark initiative of the Government of India to strengthen local self-government in cities and towns. The Act stipulates that if the state government dissolves a Municipality, election to the same must be held within a period of six months. Moreover, the conduct of municipal elections is entrusted to statutory State Election Commission, rather than being left to executive authorities. The mandate of the Municipalities is to undertake the tasks of planning for 'economic development and social justice' and implement city/town development plans.

Local Government is a State subject figuring as item 5 in List II of the Seventh Schedule to the Constitution of India. Article 243 G of the Indian Constitution en-

shrines the basic principle for devolution of power to the Local Bodies. In the nation's journey towards becoming an economic power, local bodies play an important part in enabling infrastructure availability to the citizens.

The many roles that the local government is expected to play today include:

- A Regulator, namely the administration of various acts and regulations
- A Provider, that involves providing urban services efficiently and equitably by managing its accounts effectively and efficiently.
- An Agent that takes the schemes of higher levels government to the people. This includes promotion of popular participation
- A Welfare Agency, which provides active assistance to higher level governments in the equitable distribution and delivery
- An Agent of Development, who strives for improvement in the quality of life through the augmentation of infrastructure

Constitution of Municipalities: As per Article 243Q, every State should constitute three types of municipalities in urban areas. The constitution of three type of municipalities by every State are as under:

- Nagar Panchayat: Nagar Panchayat (by whatever name called) for a transitional area, that is to say, is an area in transition from a rural area to an urban area.
- Municipal Council: A Municipal Council is constituted for a smaller urban area; and
- Municipal Corporation: A Municipal Corporation is constituted for a larger urban area.

Type of Area: The Governor declares a transitional area, or smaller urban area or larger urban area based on the population of the area, the density of the population therein, the revenue generated for local administration, the percentage of employment in non-agricultural activities, the economic importance or such other factors as he may deem fit, specify by public notification for the purposes.

Duration of Municipalities: As per Article 243U of the Constitution, every Municipality, unless sooner dissolved under any law for the time being in force, shall continue for five years from the date appointed for its first meeting and no longer provided that a Municipality shall be given a reasonable opportunity of being heard before its dissolution.

Civic Administration in Delhi

The origin of civic Administration in Delhi can be traced back to year 1862 when Delhi Municipal Commission came into existence. The first meeting of the Municipal Commission was held on 23rd April 1863. At that time, the city was confined to an area of two sq. miles with a population of 1.21 lac. During 1863, the sanitation and conservancy committee was set up; public latrines were constructed, an Unani dispensary started at Sadar Bazar and for the first time, registration of Birth and Death was introduced. The Clock Tower and Town Hall building were constructed in 1866 and the Town Hall building was reconstructed in 1947. Fire-fighting system was introduced in 1867 and first water works was planned in 1869.

Later, Delhi Municipal Commission was replaced by the 'Delhi Municipal Committee' which functioned as the only Civic body for about half a century and covered the whole of Urban area. This Municipal Committee consisted of 21 nominated members out of whom six were Government officers and the remaining were non-officials comprising three Europeans, six Hindus and six Muslims.

The democratic norm of election of members through adult franchise was first accepted in 1884 and consequently, in the following year, elections were held. The Committee, thus constituted, consisted of 4 Government officials, 5 nominated members and 12 elected members, each representing one of the 12 wards. Delhi's Deputy Commissioner was ex-officio president of the Committee.

The constitution of the Committee was further changed in 1912 at the time of creation of the Delhi Province and the number of ex-officio and elected members was brought down to three and eleven respectively while the number of nominated members was raised to eleven.

In 1911, the British Government decided to shift the capital of India from Calcutta to Delhi and it was temporarily established in Civil Lines area. In the wake of this development, 'Civil Station Notified Area Committee' came into existence on 16.01.1913, apart from Delhi Municipal Committee. It was also decided by the British Government to have a place of residence for the Viceroy of India as well as the new administrative centre. Raisina Hill was selected as the site for the new capital and going by the magnitude of the task, it was decided to entrust the task to a central authority and consequently, 'Imperial Delhi Committee' was constituted on 25th March, 1913.In February 1916, the Chief Commissioner, Delhi, created the 'Raisina Municipal Committee' which was upgraded to a 2nd class Municipality under the Punjab Municipal Act, on 7th April 1925 and subsequently renamed in 1926-27 as 'New Delhi Municipal Committee'. Delhi Cantonment Authority was set up in 1914 to oversee the civic administration in the Cantonment area.

With the expansion of the city in subsequent years, more local bodies like the West Delhi Municipal Committee and South Delhi Municipal Committee came into

being to provide civic administration to the new colonies for displaced persons.

Chronologically, various civic bodies in Delhi were created in the following order: -

1.	The district board, Delhi	1883
2.	The Notified Area Committee, Mehrauli	1910
3.	The Notified Area Committee, Nazafgarh	1910
4.	The Notified Area Committee, Civil Lines	1913
5.	Delhi Cantt Authority (now Cantonment Board)	1914
6.	The Municipal Committee, Delhi-Shahdara	1916
7.	The Notified Area Committee, Narela	1919
8.	The Notified Area Committee, Red Fort	1924
9.	New Delhi Municipal Committee	1925
10.	The Municipal Committee, Delhi	1951
11.	The Municipal Committee, South Delhi	1954
12.	The Municipal Committee, West Delhi	1955

The parliament, on 28th Dec. 1957, enacted The Delhi Municipal Corporation Act (LXVI of 1957) and consequently, after first general elections for the Corporation held in 1958, Municipal Corporation of Delhi came into existence on 7th April 1958 and nine of the eleven Local Bodies and district amalgamated boards, which looked after the civic needs of the rural areas. However, Delhi cantonment Board and New Delhi Municipal Committee continued to exist as independent entities. The statutory bodies providing water, electricity and transport were converted into Municipal Undertakings and placed under the overall control of the Corporation. Later in 1972, Central govt. formed a separate Corporation for transport. Still later, an amendment in DMC Act in 1993 paved the way for the formation of separate Boards for water and electricity in the year 1996 and 1997 respectively.

In the year 1963, decentralization took place in the Corporation and a number of powers which were hitherto vested with the Corporation were delegated to the Zonal Committees and Zonal Officers.

Subsequently, vide The Delhi Municipal Corporation (Amendment) Act 2011 (Delhi

Act 12 of 2011), Municipal Corporation of Delhi was split into three entities namely, North Delhi Municipal Corporation, East Delhi Municipal Corporation and South Delhi Municipal Corporation with Principal Secretary, (UD), GNCTD to act as Director to Local Bodies to co-ordinate between the three Municipal Corporations. Thus, at present, there are five Local bodies providing Civic Administration to the people of Delhi, namely: The three Corporations i.e. North DMC, SDMC and EDMC; New Delhi Municipal Council and Delhi cantonment Board; within their respective jurisdiction. Besides, there is Delhi Development Authority, which is primarily responsible for the formulation of regulations of built environment in Delhi besides development of residential/commercial/public infrastructures, Delhi Urban Shelter Improvement Board (DUSIB) which is responsible for the development and subsequent maintenance of the resettlement colonies and JJ clusters and Delhi State Infrastructure Improvement Development Corporation responsible for development and upkeep of Industrial areas in Delhi.

Built Environment in Delhi

Built environment in Delhi has different facets like bungalow area of Civil Lines, planned colonies developed by DDA and private developers, walled city with its own heritage value, urban and rural villages, unauthorized colonies, resettlement colonies and slums. Buildings by and large can be categorized under two broad groups viz: (i) Those belonging to Government, local bodies as also organized private group and (ii) Those belonging to privates. Buildings can be residential, office complexes, educational buildings, medical buildings including hospitals, commercial buildings including shopping complex and malls, industrial buildings, transport related buildings such as railway stations, bus stands and airport complex buildings etc.. By and large, the maintenance and caretaking of non-residential buildings and residential building with Government and organized private sector are managed by professionals, as per guidelines and as required, funds are provided.

Buildings of Private Sector:

Residential Buildings belonging to the privates can be broadly classified under the following groups:

(i) plotted development, (ii) Residential flats constructed by development agencies or private developers, (iii) Old buildings constructed before development agency or municipal body was formed, (iv) Slums, (vii) Urban villages and urban extensions (viii) Rural villages. There might be some more categories. Many of these buildings are in very bad shape and neglected by owners and occupants for varied reasons which may be socio-economic, litigations/disputes between the landlord and tenant or between two or more individuals, neglect of common areas by the group of people residing therein etc. etc.. Local bodies generally do not have much interference to improve level of maintenance of these buildings, except when its condition is perceived to pose danger to the general public.

Buildings of Government and organized private sector:

(i) Central PWD, Govt. of India,-C.P.W.D is maintaining Rashtrapati Bhavan, VIP bungalows, Central Govt. office complexes including Central Secretariat, Central Govt. Hospitals, Educational Institutions, residential buildings for central govt. employees etc. The biggest share of estate management at Delhi is with Central PWD, working with Ministry of Urban Development, Govt. of India.

(ii) MES, Govt. of India – MES is maintaining a number of buildings and other non -residential buildings in cantonment area and other places.

(iii) Indian Railways, Govt. of India –Functional areas of railway stations and many non -residential and residential complexes are maintained by Indian Railways.

(iv) Other Central Govt. Departments and Organizations like Ministries of Communication, Information and Broadcasting Ministry etc. have their engineering wings and maintain residential and non- residential buildings.

(v) Govt. of Delhi – The PWD Delhi is maintaining buildings under the administrative control of Govt. of Delhi. It includes office complexes, schools, hospitals, other functional buildings and residential buildings etc.

(vi) Municipal and Development bodies –Delhi has five municipal bodies. These are (i) South Municipal Corporation of Delhi [SMCD], (ii) North MCD, (iii) East MCD, (iv) New Delhi Municipal Committee and, (v) Cantonment Board. These Municipal Bodies and Delhi Development Authority (DDA), are having their engineering wing and maintaining schools, hospitals, shopping complex, residential buildings etc. under their respective jurisdictions.

(vii) Other State Government bodies viz DSIIDC and Delhi Urban Shelter Improvement Board etc, also maintain buildings under their jurisdiction.

(viii) Private buildings like hospitals, schools, malls, shopping complex, factories etc. are either maintained by individual owners or welfare association.

A major share of buildings is owned by privates and these are broadly categories under following groups:

(i) DDA or Other Agency, after completion and allotment of housing complexes projects, hand over certain obligation of maintenance to welfare association.

(ii) Old Delhi (walled city and other areas) - A number of buildings are more than 200 to 300 years old and most of these buildings are in precarious conditions. The status is to be ascertained and obligations of individual owners and government agencies are to be understood.

(iii) Private colonies under the control of local bodies – A major portion of Delhi's habitat is in private colonies, developed by Govt. of India, (like Rehabilitation Colonies), private developers, DDA, etc. These colonies are now under the control of Municipal bodies.

(iv) Resettlement colonies were developed in early seventies by DDA and had no parallel in whole world. Twenty one sqm size plots were given to jhuggee jhopri dwellers, common toilets were provided. After almost half century it is necessary to appreciate the status of colonies.

(v) Unauthorized and Unauthorized-Regularized Colonies: Unauthorized colonies have grown in Delhi without any approval. From time to time, these colonies were regularized. In the world history of habitation, it might be a unique example in Delhi and other cities of India. The fact remains that unauthorized colonies continue to grow and are most precariously placed when counted in terms of quality of construction and consequent maintenance since these are generally inhabited by the people from the financially weaker section of society. These colonies are most vulnerable to natural calamities e.g. earth quake etc. also as the building there are constructed without any technical supervision or following any norms.

It is necessary to review status of maintenance of houses in these colonies. A number of accidents and death are reported in these colonies, on account of failure of structures.

(vi) Slums – There are identified slum areas in Delhi, being controlled by Delhi Urban Shelter Improvement Board.

(vii) Urban Villages and Urban Extensions - Village Jurisdiction within Lal Dora has special status and for construction of building in these areas, no approval of local body is required. However, the builder is required to follow the building bye-laws and other applicable norms while constructing a building. However, these villages and extensions have developed in a unique manner which cannot be considered proper from architectural or engineering point of view.

As regards the maintenance of buildings, residential as well as non-residential, belonging to the Government Organizations/local bodies, most of the Govt. Departments /organizations have a dedicated engineering wing of their own and the maintenance / upkeep of the buildings under their control is done by professionals to a reasonable to very good condition. The Government organizations which do not have any dedicated engineering wing of their own, entrust the task to the Central or the state PWD and thus, the maintenance / upkeep of the buildings under their control is also taken care of. The same can also be said for the buildings with the organized private sector or large private organizations who also like to maintain a reasonable

level of standard with respect to maintenance of the buildings under their ownership. However, the same cannot be said for the buildings under the ownership of private individuals. Many of these buildings are in very bad shape and neglected by owners and occupants for varied reasons which may be socio-economic, litigations/disputes between the landlord and tenant or between two or more individuals, neglect of common areas by the group of people residing therein etc. The problem gets aggravated for the buildings in the private domain where there is no single identifiable owner and the ownership lies with multiple hands, each one owning his own share of the property and no one owns the responsibility of maintaining the building as a whole, specially its common areas which, in the absence of any tangible maintenance, tend to deteriorate with the passage of time.

Similarly, in the residential sector, while the buildings in the planned plotted development are found fairly well maintained, the buildings in the unauthorized colonies, unauthorized regularized colonies, resettlement colonies, JJ clusters and also the buildings in the old walled city and other areas are most vulnerable, owing to the socio-economic reasons specific to the area. In the unauthorized colonies, the buildings are mostly built without following any regulatory norms e.g. building bye-laws etc. as also without following any structural safety norms and are therefore, vulnerable to mishaps.

Local bodies generally do not have much interference to improve level of maintenance of these buildings as the public money cannot be spent on the upkeep/maintenance of the private buildings, for obvious reasons and it is practically an extremely uphill task, if not at all impossible, to make people carry out the upkeep/maintenance of their buildings to a desired level. The local Bodies can intervene only if the condition of the building is perceived to pose danger of life and property to the inhabitants as well as general public.

Section 42 of DMC Act 1957 enumerates the obligatory functions of the Corporations while Section 43 of the DMC Act describes its discretionary functions. The obligatory as well as discretionary functions of the Corporation as described under these sections cover almost all public utility services which can be provided and maintained by the Corporations but there is no-where any mention of the private properties which is obvious also. There is also no provision in the DMC Act 1957, amended to date, which empowers the Corporation to make a private owner to maintain the property under his possession to an acceptable level. However, only in case the building is perceived to be unsafe or dangerous to pose danger of life to the inhabitants as well as general public that the DMC Act empowers the Municipal authorities to take action.

The Unified building bye-laws 2016, vide clause 1.4.123, define the 'unsafe buildings' as under:

"Unsafe buildings are those which are structurally unsafe, insanitary or not provided with adequate means of egress or which constitute a fire hazard or are other-

wise dangerous to human life or which in relation to existing use constitute a hazard to safety or health or public welfare, by reason of inadequate maintenance, dilapidation or abandonment and are a danger to human life."

Municipal Corporations, on their part, carry out an annual exercise in the pre-monsoon season in which all the buildings, whether under the Municipal or the private ownership, are surveyed to find out any dangerous buildings in their respective jurisdiction, as empowered by its obligatory as well as discretionary functions. This exercise starts from mid-April and efforts are made to complete the same by mid-june i.e before the onset of monsoon in Delhi region. During this exercise, door to door survey of the buildings falling within his respective jurisdiction is carried out by the officials of the Municipal Corporations. The survey is based on the principle of random visual inspection. In case, any apparent defects or deficiencies are noticed, notice u/s 348 of the DMC Act is served upon the owner/occupier of the premises to repair the same by himself at his own cost. In case any imminent danger is perceived during the survey and the building is perceived to be unsafe, the owner/occupier of the premises is served notice to demolish the dangerous portion of the premises by himself at his own cost. In case of failure by the owner/occupier of the building to act upon the notice so served within a reasonable period of time, the Corporation can demolish the dangerous portion by itself at the risk and cost of the owner/occupier. To facilitate the same, the Corporation is empowered to issue vacation notice u/s 349 of the DMC Act to the occupiers of the dangerous portion or as deemed necessary, to vacate the premises. This is an obligatory function of the Municipal Corporations. Section 348 and 349 are also reproduced hereunder:

348. Removal of dangerous buildings

If it appears to the Commissioner at any time that any building is in a ruinous condition, or likely to fall, or in any way dangerous to any person occupying, resorting to or passing by such building or any other building or place in the neighborhood of such building, the Commissioner may, by order in writing, require the owner or occupier of such building to demolish, secure or repair such building or do one or more of such things within such period as may be specified in the order, so as to prevent all cause of danger there from.

The Commissioner may also, if he thinks fit, require such owner or occupier by the said order either forthwith or before proceeding to demolish, secure or repair the building, to set up a proper and sufficient hoard or fence for the protection of passers-by and other persons, with a convenient platform and hand-rail wherever practicable to serve as a foot-way for passengers outside of such board or fence.

If it appears to the Commissioner that danger from a building which is in a ruinous condition or likely to fall is imminent, he may, before making the order afore-

said, fence off, demolish, secure or repair the said building or take such steps as may be necessary to prevent the danger.

If the owner or occupier of the building does not comply with the order within the period specified therein, the Commissioner shall take such steps in relation to the building as to prevent all cause of danger there from.

All expenses incurred by the Commissioner in relation to any building under this section shall be recoverable from the owner or occupier thereof as an arrear of tax under this Act.

349. Power to order building to be vacated in certain circumstances

The Commissioner may by order in writing direct that any building which in his opinion is in a dangerous condition or is not provided with sufficient means of egress in case of fire or is occupied in contravention of section 346 be vacated forthwith or within such period as may be specified in the order:

Provided that at the time of making such order the Commissioner shall record a brief statement of the reasons therefore.

If any person fails to vacate the building in pursuance of such order the Commissioner may direct any police officer to remove such person from the building and the police officer shall comply with such direction accordingly.

The Commissioner shall, on the application of any person who has vacated, or been removed from any building in pursuance of an order made by him, re-instate such person in the building on the expiry of the period for which the order has been in force according as the circumstances prevailing at that time permit.

DMC Act 1957 section 332 requires any person who intends to erect a building (as defined in section 331 of the Act) to seek prior approval of the Commissioner to do the same. Similarly, under section 334 of the Act, any person desirous of making any additions to or repairs to the buildings must apply in the prescribed form, with all the documents and plans, to Commissioner for sanction of the same before commencement of his work. However, to facilitate the general public at large, Building bye-laws 1983 vide para 6.4.4, detailed out certain repair activities for which no sanction, prior or otherwise, was required. Unified building Bye-Laws 2016 have included the same in its clause 2.14 and also extended its scope. Clause 2.14 of the UBBL 2016 is reproduced below:

Building permit not required - No notice and building permit is required for addition/ alterations which do not otherwise violate any provisions regarding building requirements, structural stability, fire safety requirements and involves no change to the cu-

bic contents or to the Built up area of the building as defined in bye laws, (at the risk and cost of the Owner/Architect/Engineer/Structural Engineer) for the following:

a. *Plastering/cladding and patch repairs, except for the Heritage Buildings where Heritage Conservation Committee's permission is required*

b. *Re-roofing or renewal of roof including roof of intermediate floor at the same height;*

c. *Flooring and re- flooring;*

d. *Opening and closing windows, ventilators and doors opening within the owners plot. No opening towards other's property/ public property will be permitted.*

e. *Rehabilitation/repair of fallen bricks, stones, pillars, beams etc.*

f. *Construction or re- construction of sunshade not more than 75cm. in width within one's own land and not overhanging over a public street;*

g. *Construction or re-construction of parapet and also construction or reconstruction of boundary walls as permissible under Bye Laws;*

h. *White washing, painting etc. including erection of false ceiling in any floor at the permissible clear height provided the false ceiling in no way can be put to use as a loft /mezzanine etc.*

i. *Reconstruction of portions of buildings damaged by storm, rains, fire, earthquake or any other natural calamity to the same extent as existed prior to the damage as per sanctioned plan, provided the use conforms to provisions of MPD.*

j. *Erection or re-erection of internal partitions provided the same are within the preview of the Bye-laws.*

k. *For erection of Lifts in existing buildings in residential plotted development (low –rise). Change/Installation/ re-arranging/relocating of fixture/s or equipment/s without hindering other's property/public property shall be permitted.*

l. *Landscaping*

m. *Public Art*

n. *Public Washroom, Security Room, Bank ATM, up to a maximum area of 9.0 sq. m only (permitted in setback area, provided it does not obstruct fire vehicles movement) in plot more than 3000sqm. See Chapter 12.*

o. Placing a porta cabin upto 4.5sqm within the plot line subject to free fire tender movement.

Walled City Area

Walled city area or Shahjahanabad still contains a number of buildings of the Mughal era which are 200 to 300 years old. Erstwhile unified Municipal Corporation of Delhi has identified a list of 775 buildings/structures of Heritage value in Delhi which have been notified vide notification no. F7(367)227/2002/UD/841 dated 25th Feb. 2010 but most of them fall in the Walled city area. It is estimated that there are around 525 hevelis in the Shahjahanabad or the Walled City area. Generally built in the 19th and early 20th centuries, these havelis depict the influence of Hindu, Mughal, British and mixed styles of art and architecture. Today, these havelis are structurally, architecturally as well use-wise in a very pathetic condition. Most of these structures are under private ownership and a fair percentage of these buildings are not properly maintained. There are varied reasons for this. *Barring a few of them, which are still used by original owners for residential purposes by themselves, majority of them have fallen in to disuse or misuse owing to family or landlord-tenant disputes or multiple ownerships. A large proportion of them have been converted in to godowns and ware-houses due to economic reasons.* Many of the buildings are rented out since long to the tenants on rent which is negligible when compared to the present market rent and the owner to make expenditure even on its routine maintenance is financially unviable. In many cases, the properties are locked in the legal battle and no maintenance is carried out. In most of the cases, the owners have moved out of the area and do not wish to spend much on its maintenance. The growth of wholesale trade in the walled city area has made use of these havelis as godowns or warehouse more profitable, thus neglecting on their maintenance aspect. Nevertheless, be whatever the reason, the fact remains that many of the buildings in the walled city area have poor maintenance and some are even in dilapidated condition. The building bye-Laws of 1983 were modified in 2004 to amend section 23 of the bye-laws to incorporate a full chapter on conservation of Heritage sites. The contents have been retained as Annexure –II in the Unified Building Bye-laws 2016 now applicable to Delhi. This section of bye-Laws made it a duty of the owners of the heritage buildings or buildings in heritage precincts or in heritage streets to carry out regular repairs and maintenance of the buildings and the Government, the Municipal Corporation of Delhi or the Local Bodies and Authorities concerned shall not be responsible for such repair and maintenance except for the buildings owned by the Government, the Municipal Corporation of Delhi or the other local bodies.

This heritage tag also imposes certain restrictions, as contained in section 1.3 of Annexure-II of Unified BBL 2016, on development/re-development/repairs etc. of the building. It prohibits any development or redevelopment or engineering operation or additions/ alterations, repairs, renovations including painting of the building, replacement of special features or plastering or demolition of any part thereof of the said list-

ed buildings except with the prior permission of Commissioner, MCD, Vice-Chairman DDA/Chairman NDMC who shall consider granting such permission only after consulting the Heritage Conservation Committee (HCC) to be appointed by the Government and shall act in accordance with the advice of the Heritage Conservation Committee. Similarly, before granting any permission for demolition or major alterations / additions to listed buildings (or buildings within listed streets or precincts) objections and suggestions from the public shall be invited and shall be considered by the Heritage Conservation Committee.

However, to compensate for the restrictions imposed, the authorities i.e. Local Bodies or the DDA, on the advice of the HCC and for reasons to be recorded in writing, may alter, modify or relax the developmental control norms prescribed in the MPD or Building Bye-Laws, if required, for the conservation or preservation or retention of historic or aesthetic or cultural or architectural or environmental quality of any heritage site. It also provides for incentive use of such Heritage buildings, by allowing such buildings located in the non-commercial use zone, if the owner /owners agree to maintain the listed heritage building as it is in the existing state and to preserve its heritage state with due repairs and give a written undertaking to the effect, they may be allowed with the approval of the Heritage Conservation Committee within permissible use zone to convert part or whole thereof of the non-commercial area within such a heritage building to commercial /office use/hotel.

Shahjhanabad Redevelopment Corporation is considering a scheme for the restoration and adaptive reuse of notified heritage buildings in the walled city area wherein it proposes to extend certain incentives as well as provide financial assistance in the shape of soft loan in case the owner of the building agrees to restore their havelis while preserving and conserving their heritage elements and put them to one or more prescribed adaptive re-uses. When approved and implemented, the scheme will go in a long way in the preservation and maintenance of the built environment in the Walled City area.

Disaster Management in UBBL 2016

Chapter 9 of the UBBL 2016 describes the provisions for Structural safety, Natural Disaster, Fire and Building Services. The provision of Disaster Management, though not directly related to the maintenance aspect of the building, somehow finds relation with it, as it provides for seismic strengthening / retrofitting of even existing structures as well.The relevant provisions are reproduced below: -

Seismic Strengthening/Retrofitting: *Prior to seismic strengthening/ retrofitting of any existing structure, evaluation of the existing structure in regard to structural vulnerability in the specified wind/ seismic hazard zone shall be carried out by a Structural Engineer. If as per the evaluation of the Structural Engineer, the seismic resistance is assessed to be less than the specified minimum seismic resistance as given in the*

note below, action will be initiated to carry out the upgrading of the seismic resistance of the building as per applicable standard guidelines.

Hon'ble High Court of Delhi, in the matter 'Arpit Bhargava v/s Govt. of India and Ors.' has directed the Delhi Government to finalize and submit an Action Plan for ensuring that all the buildings in Delhi, new or existing, are made seismically compliant.

Needless to mention, if retrofitting is carried out to a structure to make it seismically safe, then its maintenance is also simultaneously taken care of, atleast for the time being.

Way Ahead

Finances play a major role in any aspect of built environment. In case of buildings owned by Government Department/organization, the maintenance aspect is compromised many a times due to paucity of funds for the purpose. The Governments, central as well states shall ensure that adequate funds are provided to various departments/organizations to carry out routine as well as special maintenance of the buildings under their control. Also, the maintenance is mostly carried out from the revenue funds which are generally not sufficient to maintain the buildings to the required standards. Therefore, the authorities or the policy makers must consider allowing the maintenance of the building or atleast the special repairs out of the Capital or plan funds.

As regards the maintenance aspect of buildings under private ownership, nothing much comes to mind which can ensure their proper maintenance except for what has already been explained above. However, Government can consider providing soft loans to individuals from economically weaker section of the society to carry out special repairs to their buildings, something on the lines of 'Pradhanmantri Awas yojna' which provides financial assistance to the poor for new houses.

Nevertheless, like any other Government initiative, the maintenance of built environment to an acceptable standards cannot be achieved without the active and wholehearted participation of the general public at large.

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Asset and Facility Management: Planning, Strategy and Implementation

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Prologue

Asset and facility maintenance management is required to maintain the performance of building structure, fabric, components and installation in a clean, safe and sanitary condition. When a new facility is being procured, the organization should ensure that operational requirements including those concerning maintenance are properly taken into account. These include requirements for the interior as well as exterior elements of the property. A minimum level of safety and sanitation for both the general public and occupants is required including maintenance requirements for structures and appurtenant lands. The owner and occupants of the structure should meet the minimum conditions and responsibilities for maintenance of structure, equipments and exterior property.

Maintenance strategy and policy should be included in the maintenance plan. Facility maintenance can embody different methods of maintenance such as corrective, preventive, condition based or a combination of these. The planning and control of finance is of almost importance as well, to ensure that the owners are getting value for money and that the maintenance proposals justify the requirements of funds proposed to be utilized.

Requirements for performance management should be formulated as part of the facilities maintenance strategy and policy and communicated to concerned stakeholders.

The importance of records and documents including the facility handbook and asset register cannot be over emphasized. Proper Building Management System is equally important for maintaining and monitoring electrical, mechanical and other engineering installations of the concerned facility.

-Editor-

Introduction

Asset is an item of property owned by a person or an organization performing predetermined function to facilitate the users. Facility is a tangible asset that serves and supports an organization. Asset / Facility Management is an integration of processes within an organization to maintain and develop the agreed service which support and improve the effectiveness of the primary activities of an organization. A central data

base of information about the facility in terms of specification, date of acquisition, initial cost, maintenance costs, requirements, additions/alterations over a period of time etc. is kept in the Asset Register maintained for the purpose. Building maintenance is the work undertaken to maintain or restore the performance of the building fabric and its services to provide efficient and acceptable operating environment to its users.

Facility maintenance management is a process of ensuring that an effective and efficient maintenance programme is formulated and delivered to ensure that assets continue to perform their intended function. Facility assets need to be maintained to ensure that they are suitable for their intended purpose; they continue to perform their function in a safe and efficient way throughout their useful life and that their value is protected. Lack of proper maintenance results in incurring needless additional costs at a later date. The failure of proper maintenance of the structure and fabric can affect its function. It also presents safety risks in addition to reducing the value of facility as assets.

Facility related services may include cleaning, security, wastes disposal, pest control, building maintenance, building services maintenance, minor construction works, helpdesk, energy supply and I.T. In procuring facility related services externally, organization has to take a decision whether to outsource or not. It is important to ensure that this is carried out in a way that is both consistent and thorough, taking into account all the necessary factors which are likely to result in end user satisfaction and selection of services that demonstrate best value for money.

Requirements of health and safety of persons in and around a facility are the prime essential of maintenance management. The maintenance requirements of a facility are a consequence of its original design and construction. Inefficient design, inappropriate specifications and unsatisfactory quality of work result in shortcomings which are subsequently difficult and costly to diagnose and remedy. Inadequate maintenance and repairs amount to unnecessary costs and inconvenience while attempting to remedy these shortcomings.

A policy should be developed to support the preparation of operational plans in accordance with maintenance strategy. The policy should outline the scope and cause of action that should be taken to achieve organization's goals. Organizations should ensure that suitable expertise is available for maintenance and its management at all levels within the organization. Where such expertise is not available external resources could be employed instead.

Maintenance Policy, Planning And Financial Management

Maintenance policy

The maintenance policy should embody the principle of best utilization of resources to

protect both the asset value and the resource value of the facility. The policy should cover:

a) The organization's anticipated future requirements for the facility for example:

- The use of the facility, i.e. anticipated likely upgrades.
- A change of use for the facility.
- The anticipated date of renovation or refurbishment work;

b) The method of maintenance, taking account of cycles of maintenance together with the requirements of the organization.

c) Holding spare parts and other items to replace those that are beyond repair.

A permit-to-work is a formal system that states, in precise terms, the work to be done and when, and which parts of it are safe. A permit-to-work is a means of communication between site management, plant supervisors and operators, and those carrying out the work.

One of the functions of maintenance management is to determine which procurement option, or combination of options, for the delivery of maintenance-related services best fits the core business and primary processes of an organization. It is important for organizations to understand the full maintenance requirements and the capability and capacity required to deliver these services.

Facilities Maintenance Planning

Maintenance plans should be driven by and support the intended outcomes stated in the facilities maintenance policy and strategy and should be fully aligned with them. Maintenance plans should be prepared in consultation with stakeholders, taking account of the following as a minimum:

a) the organization's requirements for production and operational demands and constraints;

b) the organization's financial circumstances and/or taxation position;

c) feedback data on maintenance outcomes, including associated costs.

An organization should assess the benefits of maintenance planning, basing the assessment on the following:

- The effectiveness of the facility in supporting the organization's goal and operational plans;

- The availability and reliability of the facility at minimal cost;
- Asset management strategy;
- The protection of the value of facility assets;
- The provision of data on facility asset performance;
- The provision of data on environmental performance;
- The basis for service life planning
- The contribution to energy management;
- The awareness environmental sustainability;
- The contribution to the facilities management strategy;
- The contribution to total quality management;
- The contribution to procurement and supply chain management.

A facility, and the individual assets that it comprises, should be maintained to deliver the most effective outcomes in terms of minimal cost and risk.

Maintenance Costs and Finance

Financial control is an important aspect of maintenance management; this ensures that maintenance proposals justify the funds requested and that organizations obtain best value for money.

A maintenance strategy, and its associated maintenance programme(s), should include estimates of the cost of known work and provision for work that might be required but where the extent is unknown. These estimates should be used as the basis for preparing budgets for maintenance in line with an organization's overall financial planning and management accounting requirements. Budgets should include, but are not limited to, repair/replace decisions, the optimization of planned preventive maintenance, surveying/inspection costs and whole-life costs.

Financial considerations start with the development of maintenance programmes and the preparation of budget proposals. They also include the preparation of the detailed maintenance programme following the allocation of budget funds. These will involve decisions regarding optimum repair reaction items and the choice of the most appropriate method of execution (directly employed labour or contract and the best

type of contract). This will lead to the need for budgetary control during the course of the financial year.

Implementation Strategy

General

A baseline should be set by the procurer for the procurement of facility-related services. The procurer should be realistic about its needs and should differentiate between those services that are absolutely necessary and which are desirable or which might be, for example, justifiable or affordable at a later date. The procurer should determine and document current and likely future needs in regard to facility-related services, including any phasing or deferral until a later date.

Stakeholder Engagement

Stakeholders should be involved in discussion about the arrangements for facility management in general and facility-related services in particular to an extent that is determined by the outcome of a stakeholder impact assessment. Stakeholders should be involved in specifying facility-related services if their needs, including those identified during the preparation of the facility management strategy and in regard to end-users, are to be properly addressed and communicated. A communication plan should be prepared to assist in this task.

Effective communication between the procurer and service providers should be maintained to enable the implementation of a facility management strategy in terms of the broad approach to the procurement of services which is both understood and capable of being acted upon. Clear and regular communication is required to develop relationships.

Options for Service Delivery

The procurer should consider which option for service delivery most closely matches identified needs. The following options might provide an appropriate basis.

- Managing agent: The appointment of a specialist as a representative of the procurer to take responsibility for managing the procurement of one or more service providers.

- Managing contractor: The appointment of an organization to manage all service providers as if they were part of a single contracting body, where the contractor is paid a fee for providing this arrangement (often as a percentage of the value of service contracts).

- Managed budget: A variation on the managing contractor in which responsibility

for management, including payment, of service providers is taken by the contractor within an agreed budget and where the latter is paid a fee related to the resources it consumes in managing the arrangement.

Outsourcing Policy and Decision

The procurer should determine the extent to which, if any, facility-related services are to be provided from within the organization and those services that are to be procured elsewhere. Where both occur, account should be taken of the need to integrate the two sources of service delivery and the resources and costs that might be involved in managing such an arrangement. Consideration should be given to the interfaces between separate services, including any obtained from within the organization, so that end-users experience seamless service delivery.

A review of outsourcing should take place at a minimum of three-yearly intervals or at other times considered beneficial, taking into account the term of contracts. The procurer should recognize its responsibility in addressing statutory obligations and legal requirements and that the engagement of service providers does not absolve it of certain obligations and requirements. The procurer should seek appropriate professional and/or legal advice in this matter.

Facility Management Strategy

The procurer's approach to facility management should be summarized and documented in a facility management strategy. This should include the following:

- Business objectives, main drivers and constraints.
- Split between core and non-core business.
- Geographical location.
- Organization culture.
- Sustainability.
- Corporate social responsibility.
- Scope of services.
- Special service requirements.
- End-users and other stakeholders.

- Access, inclusion and equality objectives and strategies.
- Portfolio and space.
- Existing basis and arrangements for service provision.
- Risks and opportunities.
- Plan and process for procuring and managing services.
- Resources for procuring and managing services and their cost;
- Source of finance or budgets for procuring and managing services; and
- Management of information for planning and controlling services.

Procurement Strategy

General

The procurer should develop a procurement strategy. This procurement strategy should include the following aspects:

- Centralized vs. de-centralized management of service contracts.
- Geographical location of facilities and limits.
- Award of single service vs. multiple service contracts.
- Service providers by specialization and size, and whether they are local, regional or national.

Where the procurer considers that its knowledge of the market is underdeveloped, it should investigate the availability of prospective service providers and the extent to which they might cover the identified scope of facility-related services. The procurer should engage in direct enquiries with service providers and/or the trade associations or other bodies that represent them.

The procurer should determine the extent to which the market locally, regionally or nationally has the capacity to satisfy needs. Account should be taken of the specialization, number and size of service providers able to offer the planned services. Informal enquiries directed to prospective service providers might reveal the extent to which they are in a position to undertake new work, although care should be exercised when making judgments as to their capacity to do so.

Tendering Process

The tendering process covers the following stages, in sequence.

a) RFI or PQQ, covering service provider assessment.

b) RFP, covering tender documentation (i.e. service specifications, SLAs and conditions of contract).

c) Evaluation and commercial/financial close, covering tender assessment and negotiation, pre-contract meeting and contract award.

The procurer should confirm the arrangements for these stages, including overall duration and time needed by prospective service providers to comply with requests. Normally, a period of between two to three weeks should be set aside for service providers to respond to a request for information (RFI). A period of not less than four weeks should be set aside for service providers to respond to a request for proposal (RFP) with the submission of a bona fide tender, although this may be reduced to a minimum period of two weeks where the service is of a minor nature.

Contracts should be awarded on a multi-year basis unless the service is of less than twelve months' duration. For most facility-related services, a contract term of three years is appropriate, with the procurer retaining the option to extend for a further one or two years.

Maintenance Methods

An organization should determine which method or combination of methods best satisfies its operational needs in maintenance. When taking into account asset criticality and monitoring capacity within the facility, the benefit of combining methods should be evaluated. There are a number of methods of maintenance as described below.

Planned Maintenance

Planned Preventive Maintenance allows maintenance activities to be organized and carried out with forethought, control and records to a predetermined plan, based on the results of condition surveys.

Planned shutdown maintenance is normally used for continuous process production facilities, where a detailed plan is produced for all assets for work to be carried out during a total shutdown.

Preventive Maintenance

Condition-based maintenance is based on the results of condition monitoring of plant, equipment, systems and elements to avoid loss of function or failure. Data are collected and analysed and required maintenance is determined from the findings.

Reliability centered maintenance is a systems-based method used to determine maintenance tasks needed to ensure that a facility asset or system continues to function in order to fulfil its purpose as designed in its present operating condition.

Total productive maintenance is a systematic approach to improving maintenance effectiveness, which operates at the tactical level and normally builds on the successful implementation of strategic methods.

Unplanned Maintenance

Corrective maintenance is the maintenance initiated as a result of the observed condition of plant, equipment, systems, elements, before or after a functional failure, can be used to resolve the problem and ensure correct functional performance.

Breakdown maintenance relates to the task of restoring an asset so that it can fulfill its original function after failure. This method might result in high replacement costs over the lifetime of the asset, but has a low initial maintenance resource requirement.

Emergency maintenance results from a sudden, unforeseen occurrence requiring immediate corrective work to be carried out to restore to function and to avoid potentially serious consequences.

Maintenance Management

General

Maintenance management of building is the art of preserving over a long period what has been constructed. Whereas construction stage lasts for a short period, maintenance continues for comparatively very large period during the useful life of building. Inadequate or improper maintenance adversely affects the environment in which people work, thus affecting the overall output. Though the building may be designed to be very durable, it needs maintenance to keep it in good condition.

Maintenance is a continuous process requiring a close watch and taking immediate remedial action. It is interwoven with good quality of housekeeping. It is largely governed by the quality of original construction. The owners, engineers, constructors, occupants and the maintenance agency are all deeply involved in this process and share a responsibility. The prime objective of maintenance is to maintain the perfor-

mance of the building fabric and its services to provide an efficient and acceptable operating environment to its users.

Maintenance in general term can be identified in the following broad categories:

a) Cleaning and servicing — This is largely of preventive type, such as checking the efficacy of rain water gutters and servicing the mechanical and electrical installations. This covers the house keeping also.

b) Rectification and repairs —This is also called periodical maintenance work undertaken by, say, annual contracts and including external replastering, internal finishing etc.

c) Replacements — This covers major repair or restoration such as reproofing or re-building defective building parts.

Factors Affecting Building Maintenance

Maintenance of the buildings is influenced by the following factors:

- Technical Factors — These include age of building, nature of design, material specifications, past standard of maintenance and cost of postponing maintenance.

- Policy — A maintenance policy ensures that value for money expended is obtained in addition to protecting both the asset value and the resource value of the buildings concerned and owners.

- Financial and Economic Factors – The planning and control of finance is an important aspect of maintenance management not only for the control of maintenance but also to demonstrate that the owners are getting value for money and that the maintenance proposals justify the funds requested.

- Environmental — All buildings are subject to the effects of a variety of external factors such as air, wind precipitation, temperature etc. which influence the frequency and scope of maintenance. The fabric of building can be adversely affected as much by the internal environment as by the elements externally. Similar factors of humidity, temperature and pollution should be considered.

- Design Factor - The physical characteristics, the life span and the aesthetic qualities of any building depend on the considerations given at the design stage. All buildings, however well designed and conscientiously built, will require repair and renewal as they get older.

Maintenance Work Programme

Work should take account of the likely maintenance cycle of each building element and be planned logically, with inspections being made at regular intervals. Annual plans should take into account subsequent years' programme to incorporate items and to prevent additional costs. It should be stressed that the design of some buildings can lead to high indirect costs in maintenance contracts and therefore, careful planning can bring financial benefits. Decisions to repair or replace should be taken after due consideration.

- Maintenance work should be carried out at such times as are likely to minimize any adverse effect on output or function.

- Programme should be planned to obviate as far as possible any abortive work. This may arise if upgrading or conversion work is carried out after maintenance work has been completed or if work such as rewiring is carried out after redecoration.

- Any delay in rectifying a defect should be kept to a minimum

- Maintenance work, completed or being carried out should comply with all technical statutory and other legal requirements.

PERFORMANCE AND INFORMATION MANAGEMENT

Performance Management

Performance management involves monitoring, controlling and improving the efficiency and effectiveness of facilities maintenance management and applies to both internal and outsourced arrangements. Various models, methods and tools are available to assist in the measurement of performance and in indicating where improvement is required; examples include, but are not limited to, value management.

Performance management can be used as a means to foster efficient and effective working relationships between the parties of a contract or agreement relating to maintenance and/or its management, with the aim of achieving continual improvement in performance. It is not intended to be used as the basis for penalizing contractors or service providers, but instead to encourage better performance. Requirements for performance management should be formulated as part of the facilities maintenance strategy and policy and communicated to all affected stakeholders.

Inspections

Maintenance should ideally be inspected while it is being undertaken and immediately after completion to ensure that it complies with requirements. Records and

accounts rendered for maintenance work carried out should be checked for completeness and accuracy.

Maintenance is intended to ensure that the facility remains fit for purpose in terms of satisfying organizational goals. This requirement is met, in part, through an effective inspection regime and forward-looking maintenance reporting. The facility should be inspected to determine the quality of the internal environment and the condition and performance of the structure, fabric, engineering installations, fixtures and finishes. Inspection intervals should take into account the properties and anticipated service life of elements/sub elements.

Inspections should be carried out as follows:

- Routine: consultation with occupants and other users of the facility to determine the existence of any maintenance matters that might require action and, where such work has been undertaken, measurement of users' satisfaction with the outcomes;

- General: visual inspections of the main elements carried out on an annual basis that informs an organization's budgets for maintenance programmes and other maintenance;

- Detailed: a full inspection at intervals of not more than five years. An inspection should be carried out by using a checklist made up of facility elements/sub-elements and arranged in way that supports safe working.

A maintenance report should be prepared. Anticipated failures and defects expected to lead to failure should be highlighted in reports. The resulting information should be arranged in three categories: those matters requiring immediate attention, those that could be placed into a maintenance programme and those which could be postponed but which should continue to be monitored and reviewed.

Information Management

Records and documents relating to the maintenance of the facility should be organized, kept up-to-date and stored in a secure environment.

The following general information should be recorded:

- Classification: the facility and its sub-divisions (i.e. rooms and other spaces) should be assigned codes according to type or use to support the management of information and data;

- Obligations under conditions of lease or occupancy (e.g. frequency of repainting);

- Statutory and insurance inspections;
- Estate terrier (records of property holdings with legal status);
- Ownership of and/or maintenance obligations of parties, separating and boundary walls;
- Rights of way, easements and wayleaves (particularly with respect to buried utilities);
- Requirements and restrictions laid down by planning, building regulation control and fire authorities including, in the case of the latter, fire risk assessments.

Records and Documents

General

A facility handbook should be prepared, which can be stored and retrieved electronically, as well as being reproduced on paper wherever necessary. The form of the handbook should be such that content can be easily updated and for versions of it to be controlled. The handbook should include the records relating to the maintenance of the facility and the documents to support the wider needs of the organization in regard to its facilities management.

Records should be broadly classified according to:

- "As built" information, which should have been prepared before the handover of the facility, such as construction details, floor plans and other perspectives showing the location of engineering installations;
- "As subsequently altered", which need to be kept during the operational life of the facility, such as details of defects, maintenance, alterations and redecoration work.

A record should be kept of all reported defects and the measures taken to rectify them. Details of maintenance should also be recorded and cross-referenced to the reported defect. Periodic reviews of records should be made and where there are recurrences of the same defect, the causes should be investigated.

Where a building manual is available, it should be incorporated into the facility handbook. Where no building manual is available, information and data on the operation and maintenance of the facility, including measures to conserve fuel and power, should be incorporated into the facility handbook. The organization should ensure that the scope of a building manual is satisfied by provisions made in the facility handbook.

Where a building manual and/or building user guide has been prepared it/they should be incorporated in the facility handbook.

Drawings

The records of the facility should include as-built and as subsequently altered drawings and contain, as a minimum, the following:

a) A neighborhood plan,

b) The site plan, showing the facility and other structures forming the facility and external engineering installations, e.g. drainage runs and incoming public utilities;

c) General arrangement plans of each floor and the roof to a scale not normally greater than 1:50;

d) Elevations and sections;

e) Foundation plans and details, together with available soil investigation reports;

f) Structural plans and sections, including information relating to design parameters, such as permissible superimposed loadings on floors;

g) Structural details, such as structural steel connections and concrete reinforcement drawings and bending schedules; these are particularly important when prestressed or post-stressed forms of structure have been used;

h) Details of the construction of external wall elements and roofs, including insulation materials and vapour barriers;

i) Materials that might be injurious to health and safety;

j) Location of public health (i.e. waste) systems;

k) Location of essential intake and shut-off of public utilities (water, electricity, gas and telecommunications).

All drawings, including those used in design and construction, should be verified against the as-built facility. Where a discrepancy is found, full details should be recorded and, wherever practicable, the affected drawing(s) should be labeled as subsequently altered.

Specifications and schedules

The records of the facility should include detailed specifications of:

a) All materials incorporated, e.g. name of facing brick, mix of concrete, species and grade of timber;

b) All plant and machinery, including manufacturers' trade literature, manuals and instructions for installation, operation and maintenance;

c) Methods of work used during construction, which are unusual or atypical such as assembly of purpose-made manufactured units.

All specifications and schedules, including those used during construction work, should be verified against the as-built facility.

Mechanical Installations

Records should be kept of the following as installed:

a) The location, including level if buried, of all external connections (e.g. gas and cold water supplies)

b) The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes

c) The location, identity, size and details of all apparatus and control equipment

d) The layout, location and extent of all air ducts showing dampers and other equipment, acoustic silencers, grilles, diffusers or other terminal components.

e) The location and identity of each room or space housing plant, machinery or apparatus.

Drawings should record the following as installed:

1) Detailed general arrangements of boiler houses, machinery spaces, air handling plants, tank rooms and other plant or apparatus, including the location, identity,

2) Isometric or diagrammatic views of boiler houses, plant rooms, tank rooms and similar rooms or spaces housing plant, machinery or apparatus, including valve

3) Comprehensive diagrams that show power wiring and control wiring and/or pneumatic or other control piping, including size, type or conductor or piping used.

Electrical Installations

Records should be kept of the following as installed:

a) Main and sub-main cables, showing origin, route, termination, size and type of each cable. Cables providing supplies to specialist equipment, for example data centre equipment, should be identified separately;

b) Lighting conduits and final sub-circuit cables, showing origin, route, termination and size of each, together with the number and size of cables within each conduit. c) Details of secondary power sources

d) Location and purpose of each emergency lighting fitting,

e) Single and three-phase power conduits and final sub-circuit cables

f) Other miscellaneous equipment, conduits and cables;

g) Lightning conductor air terminals, conductors, earth electrodes and test clamps;

h) Location of earth tapes, earth electrodes and test points other than those

i) Cables providing earth circuits for specialist equipment should be identified separately.

Records should also include, where applicable:

Distribution diagrams or schedules

Schedule of lighting fittings installed stating location, manufacturer and type

Schedule of escape and emergency lighting fittings installed

Records of smoke detectors, sprinklers and fire precautions

Incoming supply details including the type of system, voltage, phases, frequency, rated current and short circuit level, with the details of the supply protection and time of operation as appropriate;

Main switchgear details which, for purpose-made equipment, should include a set of manufacturers' drawings and the site layout;

Transformer, capacitor and power plant details.

Fire Protection

Records should be kept of the following:

a) Description of fire detection and fire alarm system;

b) Details of any fire suppression systems, e.g. sprinkler, inert gas or chemical agent installations;

c) Location and servicing arrangements of all fire alarm and call points;

d) Location and servicing arrangements of all risers, hose reels, extinguishers and any other fire-fighting equipment;

e) Location of all fire compartment walls, doors, floors and screens;

f) Location of all areas of exceptional fire hazard;

g) Fire escape routes;

h) Details of the application of any fire protection treatment

i) Location, details and description of any installation for smoke control or protection of escape routes;

j) Details of any master key system;

k) Names, home addresses and telephone numbers of key holders, which should be kept up-to-date and should be lodged with the fire and police authorities.

Building Management System

Where a BMS or equivalent arrangement exists for monitoring and controlling mechanical, electrical or other engineering installations, the organization should ensure that the requirements for the maintenance of the BMS are fully incorporated into maintenance programmes. In the event of actuator failures or other faults, corrective actions should be initiated with minimal delay.

Manuals, Registers And Inventories

Maintenance Manual

The preparation of a manual tailored to suit each facility can offer significant advantages in terms of providing a clear statement of intentions and required actions.

An organization's procedures for undertaking maintenance should be formalized in a maintenance manual or manuals. The manual may form part of wider documentation covering operational plans and arrangements; where this is the case, all such documentation should be incorporated in the facility handbook. In the event of a change of organization or maintenance advisor, an up-to-date manual and/or facility

handbook should ensure continuity of maintenance. Copies of maintenance manuals should be held by the organization.

The maintenance manual should be prepared in two parts: the first part should be addressed to the organization; and the second part should be addressed to those responsible for inspecting the facility and reporting to and advising the organization.

The first part of the manual should:

a) Recommend intervals between:

- Routine, general and detailed inspections
- Inspection and maintenance of each engineering installation and items of special equipment;
- Maintenance of items which, as recommended by their manufacturers, require regular attention to preserve satisfactory performance, e.g. the lubrication and adjustment of moving parts in component assemblies and systems;
- Other periodic work as experience in use shows to be necessary, e.g. the clearing of gutters, downpipes or surface water gullies;

b) Draw attention to the need to ensure that a facility's provisions for means of escape in the event of fire, i.e. fire resisting self-closing doors and exit hatches, are in satisfactory working order at all times, including those periods during which any maintenance is being undertaken;

c) Draw attention to critical environments, including special arrangements for gaining access for the purpose of inspections or when undertaking maintenance;

d) Specify proprietary maintenance materials, e.g. floor sealers and polishes likely to offer acceptable service and slip resistance;

e) Set out the names, addresses and other contact details of firms responsible for the following:

- Inspecting, reporting and advising on the condition of the building fabric;
- Emergency repairs to the building fabric;
- Servicing and emergency repairs for each engineering installation and items of special equipment.

The second part of the manual should:

- Consist mainly of selected, concise information, abstracted from the facility handbook, and likely to be needed during inspections; this information should be ordered in the sequence in which examination is likely to be carried out;

- Schedule those materials and components that experience shows to be prone to failure and/or to require special attention.

The maintenance manual should be reviewed annually and updated where necessary to reflect changes in legislation as well as current circumstances and arrangements.

Engineering Installations

Information describing the facility's engineering installations should be recorded. Details should include points of entry, or termination, of public utilities.

An organization should stipulate the maintenance requirements for its mechanical and electrical installations and fire protection systems; the tasks to be carried out and their frequency should be included. The following attributes of major components should be taken into account:

a) Current condition;

b) Current utilization or output;

c) Maintenance tasks to be performed;

d) Frequency of maintenance;

e) Estimated cost of maintenance.

Warranties, Repairs And Spare Parts

Details of warranties relating to plant, equipment, components and systems should be recorded and cross-referenced to those operational and maintenance requirements that affect them. Details of repairs should be recorded against the respective item. A list of spare parts should be kept up-to-date. Details should include the following as a minimum:

a) Description of part;

b) Identification number or unique reference for the part;

c) Original manufacturer of part;

d) Contact details of current manufacturer and/or distributor;

e) predicted lifetime of part;

f) Operational parameters affecting lifetime of part;

g) Minimum number of parts to be held in stock (within or near to the facility);

h) Where permissible, details of any alternative part and its source;

i) Availability and minimum delivery period;

j) Warranty period;

k) Estimated cost of part;

l) Transportation and logistical considerations;

m) Details of other parts potentially affected by failure and/or replacement;

n) Specialist equipment or tools required;

o) Specific competence required;

p) Details of special conditions or arrangements when installing.

The details given in a) to p) are, in effect, an inventory that should be kept up-to-date if the organization is to minimize disruption and/or loss of business continuity in the event of a breakdown or failure. An organization should determine its policy on the holding of spare parts.

CONCLUSION

Facilities management encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace. Effective facilities management, combining resources and activities, is vital to the success of any organization. At a corporate level, it contributes to the delivery of strategic and operational objectives. On a day-to day level, effective facilities management provides a safe and efficient working environment, which is essential to the performance of any business – whatever its size and scope.

A well-defined facilities maintenance strategy supports the organization's goals, whereas, a poorly defined or absent strategy could have significant adverse safety

and commercial consequences for an organization. The effectiveness of an organization to fulfil its environmental and social responsibility, commitments and targets is also dependent upon an effective maintenance strategy. Since targets are subject to revision and are progressive, a static maintenance arrangement is unlikely to meet the developing needs of the organization. A review process is particularly important as changes, for example, to health and safety can impact the way in which maintenance is undertaken.

An organization should formulate a facilities maintenance strategy and policy that meets its current and likely future needs. The strategy and policy should be reviewed from time to time to ensure that it continues to be aligned to the organization's core business and primary principles. An organization should ensure that the needs of its stakeholders are identified and the impact of those needs is assessed and taken into account when formulating the strategy and policy. A communication plan to disseminate the strategy and policy, as well as tactical and operational actions, to stakeholders should be prepared by the organization. Details of annual, or more frequent, reviews to check on the alignment between actions and the organization's facilities maintenance strategy should be included in the plan.

BIS STANDARDS

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2. IS : 15813:2002 (ii) Guidelines For Maintenance Management of Building Part 2: Finance
3. IS : 15813:2002 (iii) Guidelines For Maintenance Managementof Building Part 3: Labour

INTERNATIONAL STANDARDS

4. ISO : 55000:2014 – Asset/Facility Management – Overview, Principles And Terminology
5. IS : 55001:2014 – Asset/Facility Management – Management Systems – Requirements
6. IS : 55002 :2014 – asset/facility management –

Management Systems – Guidelines For Application of ISO : 55001

7. BS : 8210: 2012 – Guide To Facility Maintenance Management
8. BS : 8536 : 2011 - Asset/Facility Management, Briefing Code Of Practice
9. BS : 8572:2011 – Guide To Procurement Of Facility, Related Services
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11. BSIPAS : 55:2008 – Publicly Available Specifications For Optional Management of Physical Assets
12. ISNB : 978-1-60983-484-5 – 2015 International Property Maintenance Code
13. IBC – 15 International Buildings Code
14. IFC – 15 International Fire Code
15. IFGC -15 International Fuel Code
16. IMC -15 International Mechanical Code
17. IPC – 15 International Plumbing Code
18. IRC – 15 International Residential Code
19. IZC – 15 International Zoning Code

OTHERS

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Initiatives and Innovations for Maintenance of CPWD Buildings at Delhi during Eighties

K.B. Rajoria
Former E-in-C, Delhi PWD & Past President, IBC

Prologue

The author has explained the importance of maintenance and the care need to be taken in planning, designing, construction and maintenance after constructions of various projects including the preventive maintenance of the infrastructure besides the house keeping in order to enhance the estimated life of the buildings and related structures. This is possible through initiatives and innovations for maintenance of buildings by the professionals incharge and the whole team working under them.

The author, Shri K.B. Rajoira, who superannuated from the post of Engineer-in-Chief, PWD Delhi, has been responsible for maintenance of several important buildings and other related infrastructures in CPWD and PWDs. Through his article, Shri Rajoria speaks of his experiences for efficient maintenance of these structures and explains about the initiatives and innovations for maintenance of Buildings. All the problems whether brought out by the tenants or the staff have to be critically examined and decisions taken promptly in the public interest.

This is good article which gives examples of initiatives taken by executives incharge of all type of buildings, residential or non residential.

-Editor-

Introduction

Experience gained by taking innovative initiatives to bring about change from rituals and systems in practice are worth sharing. Documentation of such initiatives is relevant for inspiring younger generation as also to bring about attitudinal change and developing capability to think beyond. During 1975, Shri V.R. Vaish was the Engineer-in-Chief CPWD and he was a known person for dynamism and to bring about improvements. He created a Circle exclusively for maintenance of all buildings (residential and non residential), except those directly or indirectly connected with VVIPs. Thus Circle VI was created and maintenance of all buildings located in areas south of Railway Track were placed under this circle with G, M and N Divisions. These include Sarojini Nagar, Netaji Nagar, Laxmi Bai Nagar, Kidwai Nagar, Kasturba Nagar etc. Besides Lodhi Colony, Chanakyapuri and colonies in North Delhi including Timarpur were also placed under this circle. Besides, corresponding electrical circle VII was

also created. These circles were placed under Food Zone and not New Delhi Zone- 1 dealing with VVIPs. Shri K. Ramavarman was Chief Engineer Food Zone and I took over as Superintending Engineer Circle VI. It was a great opportunity to work with Shri K. Ramavarman, who was considered as clear headed, bold officer with straight forward approach. His tenure as Chief Technical Examiner was memorable for all engineers of Central PWD. During my first meeting with Shri Ramavarman, he desired that maintenance work should be done as per systems and not by unnecessarily obliging individuals. The first step for understanding maintenance, as explained by him was to become familiar with the work and requirements, by inspection of Enquiry Offices (Service Centers), He wanted me to talk to workmen, verify communication system for attending to maintenance and inspecting a few houses/offices to appreciate effectiveness of existing system. He also directed that any initiative, other than routine one should be discussed with him and he would give suitable directions, if required.

Enquiry Office Complex

For the purpose of maintenance of buildings, the Enquiry Office or Service Center is centre for all activities. Enquiry Office is generally located within the colony to be maintained. Complaints of residents are received at Enquiry office. Assistant Engineers and Junior Engineers have their offices at Enquiry office and deploy workmen for attending to maintenance work. Materials for maintenance are also stored at Enquiry office. Workmen with materials as required are sent to buildings for attending to complaints and report compliances. Thus enquiry offices are nerve centre for maintenance activity. Generally both civil and electrical wings function from same Enquiry office.

All the Enquiry offices of different areas were visited. During visit of Enquiry offices Shri Jain, Shri Gupta and Shri Diwan Executive Engineers of their division, it was noted that most of the Enquiry office buildings were in bad shape on account of poor maintenances and upkeep. Besides, in the compound of Enquiry office, dismantled materials were stored. Most prominent of these materials were broken overhead storage tanks, flushing cisterns and wooden shutters. Besides, for residents who used to visit Enquiry office, there was no proper seating arrangement. Even front desks where Enquiry clerk receive complaints were not proper. Therefore, the first important tasks was to bring Enquiry office complexes in proper shape, which was done in time bound manner. This preliminary initiative improved the image of Enquiry Offices and the residents were happy.

Dismantled flushing cisterns were critically examined. It was noted that most of the flushing cistern were not broken but rendered out of service on account of leakage, which was due to wear and tear at the place where ball was falling on cistern. The cisterns were shown to Shri S.K. Singhal Executive Engineer Mechanical Workshop Division, who agreed to repair by putting some welding ma-

terial on weared surface and then rubbing to even out the surface. The proposal was accepted and 90% of cisterns were made usable by Mechanical Workshop Division at nominal cost. Cisterns were painted and stored at Enquiry offices in reconditioned stage for reuse. After use these Cisterns gave good service. These reconditioned cisterns were shown to Shri Ramavaramn during his visit to an Enquiry Office. He highly appreciated the initiative and wondered as to why anybody else did not do so in the past. There could have been no better appreciation for Engineers working for maintenance.

Dismantled panel wood shutters were inspected at enquiry Offices. These shutters were removed because of some broken members and new shutters were provided in place of these shutters, under Special Repair grant. Close examination of these shutters indicated that 60%-70% members of these shutters were in good condition and could be reused. Reusable wooden members of these shutters were separated and stacked, Broken members which could not be reused were declared surpluses and disposed off. New shutters were made from reusable members and some members from new wood were added wherever required. Most of this work was done by work charged staff of CPWD at Enquiry offices. As per specific requirements, additional carpenters and beldars were employed to give their assistance. Thus what could have been auctioned as unserviceable material at practically no price, was reused. Besides, opportunity for additional work was given to the work charged staff. They were otherwise attending to complaints only and idling for remaining period.

Management of Enquiry Offices for Residential Buildings

As a routine, the Enquiry office received the complaint from residents and was recorded in a Complaint Register. Residents use to visit the Enquiry office and get the complaints recorded in the register. Else they were intimating by phone. At times, Engineer incharge of maintenance used to receive complaints directly. All complaints were given complaint number. At enquiry offices for bigger colonies, separate complaint register were maintened for each Junior Engineer as the colony was divided under different sections for the purpose of attending to complaints. Besides, all JEs used to maintain their separate store for material to be used. Thus colonies to be maintained were divided under JEs who used to work. This was not considered proper. The attendance of complaints also suffered for want to availability of material because there was no policy for procurement of materials. It was also noted that after attending to complaints the permanent staff remained idle for want of adequate work. Thus it was considered desirable to improve management of Enquiry Offices. Steps taken to improve management of Enquiry offices are brought out here.

It was decided that in bigger Enquiry Offices, instead of dividing the colony under different sections, the complaints of whole colony were recorded in one Register

only. All stores were also put under the change of one junior Engineer. JEs were made in charge of building work, plumbing work, carpenter work, etc. Thus JEs were able to see their job more in depth. The procurement of materials also became better as one JE was made incharge of store. This administrative change improved the working of Enquiry Offices for bigger colonies.

On review of complaints register it was noted that a number of complaints remained unattended on account of non availability of materials. It was brought out by Engineers during visits that material purchase cases submitted for approval to higher offices took considerable time. As per the prevailing policy for purchase of materials, cases for approval were submitted to SE after EE exhausted his powers and to C.E. after S.E. exhausted his powers. This approach was considered not proper, Instead it was decided to plan purchases by working out total requirement of the whole year, The ABC Analysis was done for the total demand. The A category materials were put under the planned purchases and B&C category materials were put under priority and crises purchase. Cases for planned purchases were sanctioned by SEs or if required even by CE. The Executive Engineers' power were utilized for priority purchase on account of out of stock articles. Unforeseen repair requirements were termed as crises purchase. A.E/J.E.'s were asked to purchase stores under this system and the availability of store materials improved to a great extent. In turn the efficiency of work improved.

Inspection of job done- After Complaints was attended by worker, it was considered desirable to get these complaints checked by Supervisors and Engineers. This helped in improving the confidence of residents and created a proper confidence amongst work charged staff as complaints attended by them were checked.

Critical Analysis of Complaints and Follow Up Action

Visit to colonies gave insight to the actual state of affairs. Besides, the critical review of complaint register also gave deep insight to the suitability of specifications, short coming of planning, etc. A few examples are given here to explain the importance of such analysis.

Size of drainage pipe- In one particular area these were several complaints regarding chokage of kitchen trap and flow in drainage pipe. Some individuals registered complaints very frequently as such chockages were frequent. On inspection, it was noted that as per contract 2 inch dia pipe was provided for kitchen outlets. Small size pipe was reason for this chokage. So pipes were changed to 4" dia. Thereafter, there were no complaints. Residents were happy with the replacement of pipes.

Breakage of Glass- The consumption of glass required for replacement was very high. At some Enquiry Offices, as much as 5-7% of cost of materials consumed was for glass. Still complaints used to remain unattended. On review it was found that glass was breaking in pockets were children's play ground was around. At these places glass was replaced by plywood. It was also noted that if size of glass panes used were big, the cost of consumption of glass was high, In some Type 2 and type 3 quarters 2 to 3 sqft size glasses were used. It was not proper planning by Architects. Change of window shutters was not possible. So to reduce cost of consumption reinforced glass was used for replacements. This reduced the probability of breakages.

Mumty Shutters-Mumty shutters used to break very often and at times complaint was registered at belated stage when extensive damage was already done. On inspection of these shutters, two main reasons were fund for breakage. Many residents were not locking these shutters and with wind, shutters were becoming loose and breaking. Besides, one side of shutter was exposed to sun and rain. The paint was not lasting for long time and the shutter used to get exposed to severe weather condition. In turn the shutter was breaking. A special drive for repairing, replacing and painting of these shutters was done. For painting exterior finish paint helped to slowdown deterioration. In such situations Engineers acted on proactive manner without waiting for complaints from all affected residents.

Job Standardization in Residential Buildings

Complaints received and special repair requests at different Enquiry offices were reviewed with regard to job to be attended. It was noted that these complaints and requests could be classified under some Standard Jobs. These jobs were further grouped under two categories viz. Major Jobs and Minor Jobs. Jobs for rectification of defects/deficiencies due to constant use or breakage were classified as Minor Jobs. A few examples being chokage of floor traps, replacement of washers in taps etc. To attend to these Minor Jobs, the component to labour is more and the component of material is very less. It is not possible to measure these jobs through items provided in Standard Schedule of Rates. For Major Jobs like replacements etc. the scope of work could be worked out from items provided in Standard Schedule of Rates. For example "Replacement of door shutters", was termed as Major Job. It includes several activities and in turn items of work i.e. removal of old shutters, transportation to Enquiry office, manufacturing of new shutter, transporting to place of work, fixing, applying primer and paint, providing fittings and to ensure that shutter functions properly. A standard unit in terms of a "Major Jobs" is considered better alternative compared to describing the work in terms of Schedule Items, which is good for cost accounting and not for appreciation of the work to be done. After review of work done through departmental labour and special repairs, standard list of Minor and Major jobs were prepared for residential buildings. Thus all work to be done under

maintenance except white washing and painting, was covered under Minor and Major Jobs. The concept helped in physical appreciation of work to be attended for maintenance.

Order of satisfaction for maintenance work was ascertained from representatives of Resident's Associations. By and large they were happy with the attendance of repair work i.e. Minor Jobs through departmental labour. But they were not happy with attendance of 'Major Jobs' by contractors. Residents felt uneasy and uncomfortable with contractor's workers who were strangers. They were of the opinion that all Minor and Major jobs should be attended by departmental labour. Therefore, for satisfaction of Residents, for Major Jobs the contractor's role was kept limited to supply or procurement of shutters, tanks etc. and departmental labour was deployed for fixing. Our observation indicated that on average; for attending to Minor Jobs i.e. day to day complaints, about 75% time of workmen was required. So they were free for remaining 25% time and therefore directed to attend to Major Jobs Wherever ever required additional input of casual or contractor's labour was given, as per job requirement. This approach was appreciated by departmental workers who got opportunity to produce creative work besides day to day maintenance. The total output of workers increased to a great extent. Thus for same expenditure, the output was much higher and also the satisfaction of residents.

Performance Approval- It was considered necessary to judge the efficiency of work done by field units by introducing an index for Performance appraisal. Following details of each sub division were worked out and reviewed every month

A- Expenditure on maintenance during the month including emoluments of work charged staff but excluding expenditure incurred on white washing, painting etc.

B- Assessed market value of work done including all Minor jobs and Major jobs attended.

The Variance Factor for each month would be B-A. The value of variation factor was a giving fairly good idea about proper working of sub division. The plus value would indicate efficient working and proper material management. The minus value would indicate inefficient and uneconomical working. By comparing value of "Variance Factor",. it was possible to compare efficiency of working of different sub divisions. Engineers were encouraged for achieving higher efficiency and more output.

Maintenance of Office Buildings

The maintenance work done by CPWD for a number of office buildings was

inspected and position reviewed with administrative officers in charge of these offices as also CPWD Engineers. We came to conclusion that maintenance of office buildings was generally not good. We also noted that the responsibility for caretaking in these office buildings, was that of department occupying the specific portion of the office building, where-as responsibility of maintenance was with CPWD, There was some gap in understanding the scope of caretaking and maintenance work. Important reasons which could be attributed to poor state of affairs were, inadequate caretaking staff, lack of supervision of caretaking staff, delay in communicating the complaints by offices to CPWD Enquiry office, poor response for maintenance by Enquiry offices, lack of civic sense amongst occupants etc. At times poor maintenance was on account of improper selection of finishing materials and improper planning of buildings. Where, ever different floors of the building or portions of the same floor were occupied by different departments, the problem of maintenance was much more compared to occupancy by single department.

East block I R.K. Puram was occupied by different departments including the office of Circle-VI CPWD (in charge of maintenance). It was decided to undertake caretaking of this block by CPWD and a separate. Junior Engineer was posted to look after this responsibility. The expenditure of caretaking was to be shared by different offices and they nominated their representative to coordinate with CPWD. The Junior Engineer incharge of caretaking was directed to inspect all common areas every day as also get information about requirements of maintenance from different offices on the basis of this information. Jobs required to be attended were recorded for each floor separately. The work to be done by civil and electrical units of Enquiry Offices was communicated to them. The caretaking was attended by the J.E. incharge of caretaking. The position was reviewed daily and civil electrical wing reminded for unattended work. With this system of continues monitoring, the overall condition of cleanliness and orderliness improved to a great extent. The improvements were brought out and were propagated by publishing wallpapers. It was on unique initiative which was appreciated by all concerned

Another important requirement to improve maintenance was to review suitability of existing specifications and planning of services. Two important points worth mentioning are (i) White mosaic flooring was provided in toilets which was difficult to maintain and (ii) The design of staircase nosing was not proper and there were daily breakages. Specifications were improved for better maintenance.

Maintenance of Hospital Complex

The study of hospital complexes was done, after a few years, when Shri A.K. Bhatnagar was Executive engineer incharge for three important hospital complexes i.e. Safdarjung hospital, Dr RML Hospital and Sucheta Kriplani Medical

Collage and Hospital. Maintenance of hospital complexes was responsibility of CPWD where-as caretaking was that of hospital authorities. Hospitals are public buildings and visited by thousands of people. Maintenance and caretaking of hospital complexes are activities undertaken to keep the hospital complexes at acceptable standard of cleanliness, hygiene and safety. The most important requirement for proper upkeep of hospital complexes was to have mutually agreed division of responsibility and effective communication between hospital authorities and CPWD (civil, electrical and horticulture). By and large maintenance work of hospital complexes needed more attention compared to other residential buildings, particularly on account of the fact that these are occupied by patients. Some very important maintenance issues are brought out here.

Seepage in WC blocks of Safdarjung Hospital- Most of the W.Cs remained chocked and on account of this chockage, there was seepage spreading on walls and floors around the shaft. It was found that on account of poor design of waste pipe system, it becomes a chronic problem. These were three WCs in a row at one floor and there were four floors. On inspection of waste pipes, it was noted that a horizontal pipe was provided to connect all the three WCs and this pipe was extended to shaft for connecting to vertical pipe common for all the four floors. Thus there was no free flow of sewage and chockage in any one WC was making all the three WCs unusable. Besides, sunken floor and wall were getting dampened. An alternative design was found by running three separate vertical pipes for all the four WCs. These pipes were connecting one W.C. of each floor. Thus four different stacks were provided. The water proofing of sunken floor was redone and small drainage out let provided in sunken floors. Besides, these stacks were provided on external wall and not inside the shaft. Thus interconnecting horizontal pipes were avoided and vertical pipes were made approachable from outside. Thus the chokage could be attended without any breakage etc. This changed design solved the problem of chokage.

Change in design of door bend cover-The bolts of door-bend cover for waste pipes were of iron and used to get rusted with passage of time. For maintenance work whenever door bend cover was required to be opened these bolts would break. Thus after attending to chokage cover could not be replaced and bends used to remain open. So bends became constant source of leakage. The Quality Circle of Hospital evolved a new design of door bend cover plate which was fixed by using a small bar, attached to the cover by threaded rod and fixed by a nut. This new design of cover made opening and covering of door bend cover convenient. It was much more economical and convenient compared to replacement of door bend.

Conclusion

Issues brought out here with regard to maintenance of residential colonies, office complexes, hospital complexes etc show that there are challenges for Engineers

in attending to maintenance and achieving client satisfaction. Besides, management skills are required to motivate Engineers and improve productivity. It is also observed that by optimizing resources, total output can be increased. The critical examination and analysis of maintenance problems lead to improved design for the existing building. The feedback was also helpful for design of new buildings. Orderliness and economy for maintenance of buildings gives satisfaction of accomplishment. A few examples given in this article will be helpful to engineers to think and find solutions to maintenance problems.

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Conservation of Precious Heritage A Moral Responsibility

Indrani Sarkar
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Prologue

Defence Sector is well known for its organized and systematic working and the same ethos are being carried over in the conservation process for their buildings. Keeping pace with modern trends and latest technologies, the complete process of new development / conservation of these assets is being dealt in a holistic manner

The author has rich experience in the architecture arena dealing with defence structures, old and new. He has very interestingly described the large number of magnificent heritage buildings belonging to defence department, some dating back to more than 200 years old in the country. Assets presently being put to various uses like offices, officers mess, hospital buildings and residential accommodation need to be kept in sound shape to preserve the country's heritage.

-Editor-

Introduction

The concept of cultural heritage has gone through rapid development during the past two centuries. In the 19th and early 20th century many countries in the world had already established legislation and administrative structures for the protection and conservation of cultural heritage, particularly in European countries. However, the situation in the underdeveloped countries or developing countries like India is still very vague and neglected.

India is still largely a traditional society and the conservation of tradition or its elimination is as important issues as defining the nature of development. Therefore, when the conviction is totally defensive in the West, in India 'Conservation' emerged as an alternate strategy for development itself.

A Legacy

The Indian Army has inherited many majestic buildings from our colonial past, each of which is distinct with its own aura and history. Their architecture is unique in design and specially the bungalows and barracks are designed to suit the tropical climate of India. They evoke a sense of nostalgia as a reminisce of an era gone by.

This legacy comes automatically to Indian Army as a bounden duty to preserve these magnificent structures for posterity.

The architecture of these buildings are mainly Victorian, Gothic or Neo-classic and at times with a touch of Islamic Influence. Apart from these, Defence Services have a number of buildings / monuments which are distinct in character of Indian / Indo-persian style, which are the creation of the erstwhile Maharaja's and Nawabs.

Precious Assets

Accurately aware of its moral responsibility, Indian Army has taken various measures to preserve them for posterity in the process of conservation nationwide. There are many forts and heritage buildings which are in use by the Armed Forces all over India and the best part of it, those are not preserved as a museum piece, but also utilized in fruitful manner and well-maintained.

Here is an attempt to present a brief panoramic glimpse of few buildings of historical /architectural importance. It is also a tribute to those many known and unknown who designed and constructed these marvelous architectural pieces. The photographs shown in this paper gives a glimpse of these Heritage Structures.

THE RETREAT, SHIMLA

ITARANA PALACE, ALWAR

FATEGARH FORT, FARRUKKABAD

AHMEDNAGAR FORT

NAVAL DOCK YARD, COLABA, MUMBAI

FORT WALL : INS ANGRAY, MUMBAI

Other than above, there are many more historical buildings scattered all over the country, of old vintage and few of them may be of second world war.

Restoration Efforts

The author would like to make a modest effort to capture also the various efforts of Indian Army / Navy for above, such as :-

- Identification - As a custodian of probably the largest real estate of Government of India in the form of Cantonments and Military Stations, the Indian Army can boast of some of the most invaluable treasures in the country. The architectural heritage that dots the cantonments countrywide includes forts, bungalows, churches, temples, gurdwaras and cemeteries. Army Headquarters has already identified / listed more than 100 nos of buildings precincts / of historical / Architectural importance all over India. Various formation within the Army / Navy are already in the process of taking care for their preservation.

- Preservation of built environment and re-use - It is also to be noted that Armed Forces are not only appreciating these assets, but also try to utilize them conforming their original use as far as possible. Though at times they re-use it for other purpose, however in a suitable manner, for e.g. a Church is used as a library, a barrack is used as an office, a residential quarter as an Officers' Mess and so on.

- Preservation of antique elements - such as, stained glass windows, ornamental grills, antique furniture, brass / marble plaques etc are also preserved with due care. Quiet a few old drawings / maps made by British are also preserved till date as an archival documents in the custody of Military Engineer Services.

- Framing of policies – Engineer-in-Chiefs Branch of Army HQ, being an apex body for maintenance of all buildings under defence services, a pan India con-

servation policies/guidelines has been framed for buildings of historical importance being used by Armed Forces.

- Heritage Committee - A Heritage Committee was set up in 2001 at Eastern Command, within the department under the chairmanship of Chief Engineer Eastern Command to look after the various issues related to conservation . A proposal is also underway to form similar committee in other commands to monitor the conservation activity locally.

- Heritage Walk - There are few conscious efforts also by Navy for preservation of heritage buildings under their custody, for e.g. Western Naval Command has taken already few measure for the heritage assets in their possession, such as Naval Dock Yard. They introduced a 'heritage walk' in 2001 within the Naval Dockyard at Colaba and preserved, the ruins of Fort Wall, INS Angray.

- Harmonious Architecture -The awareness has also generated amongst MES architects to design in conformity with the environment and to develop a harmonious architecture in the historical environment. Few humble attempts by them within the restricted govt policies are praiseworthy. Some of them are as follows:-

- Office Accommodation for Provost unit at Fort William Complex by CE Kolkata Zone

- Naval Academy at Ezimala, Kochi by CE(N) Kochi Zone

- Auditorium at Jaipur by CE Jaipur Zone

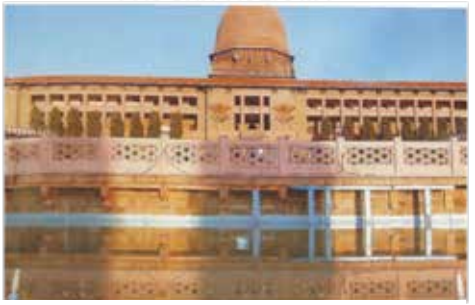
Harmonious Architecture by Military Engineer Services

OFFICER'S MESS, TEZPUR

AUDITORIUM JAIPUR

PRO UNIT KOLKATA

GYMNASIUM KOLKATA



NATIONAL DEFENCE ACADEMY PUNE

OFFICE ACCN DELHI

OFFICER'S MESS, DELHI

NAVAL ACADEMY KOCHI

Case Study – Kolkata

The Central Public Works Department, was established on 1858 as an only Civil Construction Agency of Govt. of India. Therefore, it is presumed that most of the construction activities between 1757–1858 were mostly entrusted to Military Engineers Department of the British Army in India, during that time.

Fort William

There was an Old Fort William which stood once upon a time at Strand Road beside the River Hooghly, where G.P.O. building is presently located at B.B.D.Bag. The same was conquered by Nawab Siraj-ud –daullah and at a later date when Lord Clive defeated Siraj at the battle of Plassey, the British regained its possession.

However, Fort William of today is the new Fort, which Clive planned to create a better defensive fort than the old one. The village Govindapore was selected as a site and the plan was originally traced out by the master hand of Clive ,which was ultimately handed over to Capt. John Brohier to execute. Brohier commenced the work in Oct 1757. At the end of 1776, Col Henry Watson took the charge , By 1781, the fortification was over. Fort William is by default the epicenter for the growth of today's Kolkata as a metropolis. Since Independence, Fort William was under occupation of Indian Army.

Fort William, situated at the bank of River Hooghly, is an irregular octagon in form, with four gates towards the land and two towards the River Hooghly. It is surrounded by a dry ditch (Moat) which was originally designed as a water-barrier as a defensive measure for the fort. Inside the core area, there are few barracks to accommodate troops which are the examples of Military Architecture of 18th Century. The buildings are designed in such a way, that it never poses an imposing appearance externally. Simple architecture, but well planned on the climatic considerations. Most of the buildings still exist in its original form. The first Governor's house was constructed inside the Fort, before the present Raj Bhavan was built, which is now being used as OR's Institute. Another important building i.e. Kitchener's house was constructed, for the residence of the then army commander-in-chief now used as an officers' Mess. Two unique examples of early engineering are also still existing: -

- Lock gate - To fill the moat with water from the nearby Hooghly river during high tide. However it is in disuse now, as the water level of the Hooghly river has gone down since long.

- Ball tower - An early example of time-signaling in the 18th century, which was in a functioning mode even after Independence. However now it is preserved as a heritage structure only.

Calcutta Maidan, a part of Fort William, is actually planned as a vast open buffer zone between the city and the Fort, as a defensive measure for the Fort. British Govt gave it a Blue Zone status since 1921, where no permanent construction can come up, which was again corroborated by the Govt of India after Independence. It is a boon in disguise for the citizen of Calcutta, as this is the only lung space in the heart of the city, to breathe fresh air and use as a playfield/recreational park for the citizens of Kolkata, though under the control of Army This is the most significant contribution by Armed Forces to maintain it as a vast open green space.

KOLKATA MAIDAN

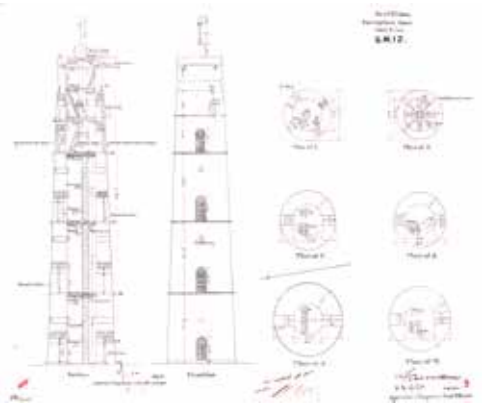
Significant Restoration Work Inside Fort William

KITCHENER HOUSE, KOLKATA

DALHOUSIE BARRACK, KOLKATA

ST PETERS ANGLICAN CHURCH

INTERIOR OF CHURCH AFTER RESTORATION



SEMAPHOR TOWER : ARCHIVAL DRAWING

INTERIOR OF KITCHENER'S HOUSE AFTER RESTORATION : THE LOUNGE & VERANDAH

Other Magnificent Buildings Outside Fort William Maintained by Military Engineers

ORDINANCE FACTORY BOARD OFFICE

HQ BENGAL AREA OFFICE

Contribution of Military Engrs. (1757-1858) for Precious Heritage of Kolkata

Apart from Fort William, Table 1 gives a few noteworthy works (though not in custody of Indian Army now) in respect of architecture and infrastructure development, which are a great contribution for the development of the city of Kolkata and the citizens of Kolkata may like to owe to the engineering fraternity for the same.

Table -1: Other Heritage Structures of Kolkata

Building	Year of Construction	Engineer in Charge
Town Hall	1813	Col John Garstin, Bengal Engineers
Asiatic Society	1808	Capt Lock, Bengal Engineers

Raj Bhavan	1803	Capt Charles Wyatt, Bengal Engineers
ST John's Church	1787	Lt James Agg
St Paul's Cathedral	1847	Maj W.N. Forbes, Bengal Engineers
Princep Ghat	1841	Capt W. Fitzgerald
Gwalior Monument	1847	Col H. Goodwyn, Bengal Engineers
Eden Garden	1841	Capt W.Fitzgerald
Red Road / Park Street	1781	Col Henry Watson
Kidderpore Dock	1780/1807	Col Watson and Kyd brothers
Tolly's Nullah	1776	Maj W.Tolly

RAJ BHAVAN

TOWN HALL

ST PAUL'S CATHEDRAL

ASIATIC SOCIETY

PRINCEP GHAT

Conclusion

It is important to stress that, public awareness is an important issue in the field of conservation. We are proud to say, that Indian Armed Forces consciously are taking responsibility for preservation of assets under their custody and actively supports the meaningful restoration.

Heritage buildings should be acknowledged as a resource, not a burden. It is definitely possible to create an environment where conservation can be a part of life and a blended architecture with old and new be developed to retain the heritage character of a particular place. The aim of the architects of Military Engineer Services is to achieve this goal within the restricted govt. policies. It may please be noted, Government Dept has to function, unlike the private developers, keeping the economic criteria in mind. Reasons being, once the Govt policies are framed, it will have a far reaching effect and will be applicable to nationwide assets which are enormous in volume as well. Though the Archeological Survey of India is the chief organization to look after the heritage buildings/ precincts of Govt of India, but the approach and the attitude with the similar motto of Indian Armed forces is equally praise worthy in the process of restoration of the assets under their custody.

Maintenance of Buildings - An Essential Aspect

Rakesh Misra
Former Director General, CPWD

Prologue

While lot of emphasis is given on creation of assets, the maintenance aspects are mostly neglected, at initial stages of planning and execution as well as at later stage of resource allocation on maintenance. This results in early deterioration of buildings, roads and bridges etc. Studies in many countries like United States, U.K., Australia and Singapore have revealed that the majority of buildings and/or component failures are a result of making wrong choices of materials or components for different parts of the building and poor workmanship/specifications. Therefore, all these aspects need to be thought properly by giving due considerations.

Shri Misra, the author who has retired as Director General, CPWD, and was responsible for the policy making in the field of construction and maintenance of the buildings and other infrastructure. Through this article, he has put forth his views for maintenance of buildings and the care to be taken during various stages like planning, design, construction and maintenance including house keeping to ensure safety of the occupants besides preserving them for the designed life of structure.

-Editor-

Introduction

Indian economy is passing through a fast growth regime with major investment committed to creation of basic infrastructure in roads, buildings, ports,metros, airports, power plants and manufacturing. These are assets created at huge costs. However, to ensure that these assets continue to perform their stated functions efficiently for their stated life span, it is necessary that they are maintained effectively. Effective maintenance not only ensures better revenues throughout the life and reduction in cost of replacement but also helps in reducing energy consumption , in manufacturing as well as running the installations, thus helping sustainable development.

However it is common observation that while lot of emphasis is being given on creation of assets, the maintenance aspects are mostly neglected, at initial stages of planning and execution as well as at later stage of resource allocation and emphasis on maintenance. This has resulted in buildings deteriorating at half their life span and roads and bridges coming apart even before they are completed. We have often seen

old toilets rotting due to lack of maintenance, while we go on adding new toilets at the same places in the name of one or the other scheme.

All this can change only when we see both construction and maintenance as part and parcel of total infrastructure development plan (two sides of the same coin) and not as different distant parts. While we know that the quality and performance of buildings is dependent on the effectiveness of its design and sustained maintenance, traditionally, these tasks are treated as separate entities. And, most importantly, without using life cycle costing for decision making on designs, buildings lack thorough documentation to reveal the real costs during the life of the building. Designers focus on the construction cost of a building, but typically do not really take into account the subsequent owning and operating costs, especially maintenance. We have to provide for both, right at the planning and execution stage, both in terms of budget as well as in terms of design and execution.

Building studies in many countries like United States, U.K., Australia and Singapore etc. have revealed that the majority of building and/or component failures are a result of making wrong choices of materials or components for different parts of the building and poor workmanship/specifications. This is the main cause of poor performance, high costs and premature failures. We can see examples of this in India all around us, whether it is extreme and harsh climatic conditions of Delhi and around or more temperate climatic conditions of the coastal areas. Concrete structures constructed during 1960s and 1970s started crumbling within 20 to 25 years of construction due to poor quality of concrete components, steel and water used as well as poor specifications in terms of durability parameters and this has cost us a fortune in terms of maintenance, repair and rehabilitation. Even brick masonry buildings constructed with poor specifications for flooring and other finishing items in the name of low cost housing during Janta regime have proved to be too costly in the ultimate run requiring too frequent repairs and replacements of their components.

Therefore it is important to consider each of the following aspects at initial planning stage itself:

- The adequacy of the design and the suitability of the materials specified.
- The required standard of workmanship in the initial construction and subsequent maintenance operations.
- Provisions in the design to cater for present and anticipated future needs.

Building Maintenance

Building maintenance basically consists of a set of actions ,technical and administrative,which combine together to ensure that the elements of a building continue to

perform their required functions to an acceptable standard at least upto their full life expectancy. Anticipating and identifying problems likely to arise during the lifetime of a building and addressing the same timely are the most important aspects of building maintenance. The important of maintenance are:-

Objectives

- To extend the useful life of the buildings and prevent premature capital outlay for replacement.

- To provide a safe, secure and efficient working and living environment and to avoid deterioration of physical assets.

- To maximize the aesthetic and economic values of a building as well as to ensure the health and safety of the occupants.

  The benefits are both short term as well as long term and can be reflected in terms of physical, financial or human resources as well as in terms of environmental cost.

Good maintenance helps preserve the physical characteristics of a building and its services which in turn results in:

- Fewer breakdowns and lower maintenance costs,

- Higher productivity, less wastage of materials,

- Less energy consumption in running and maintenance as well as manufacture of replacements and

- Improved revenue generation due to less downtime

The improved condition of the buildings not only improves workers efficiency and increases turnover but also improves customer relation and public image.

Considering Maintenance at Planning

As mentioned earlier, maintenance should be considered an integral part of planning and design of any building project from start to finish. Many buildings are rendered useless not due to outside forces such as weathering factors like heavy rains, snow or drought but due to insufficient/improper design during the design stage,poor execution and bad housekeeping, inadequate maintenance and neglect during its full operation. The word design used here encompasses the entire gamut of thought process which goes into conceptualization of the building and includes architectural and structural design, specifications for various materials used and services provided.

Maintenance Factors at Design Stage

- The concept of “ease of maintenance” has to play as important a role in design parameters as others like structural safety, durability and comfort etc. Designing for ease of maintenance can prolong the building lifespan, reduce frequency of breakdowns and therefore reduce maintenance costs and increase revenues.

- Design and maintenance issues require a practical approach, an attitude for problem solving and “learning from experience” to produce a comprehensive approach to improve building performance and reducing life cycle cost. It is essential to have communication between design engineers and maintenance engineers as well as building users or owners so that designers are fully aware of the maintenance-related problems frequently reported by building owners.

- Main problems that are currently being faced are caused by building design deficiencies, poor construction quality and poor performance of building which is directly related to functional layout, choice of building material and equipment.

- Durability and serviceability of the structures being designed and implemented must be given top priority at design stage. The design should ensure, by means of the appropriate choice of structural forms, details and materials that the structure and building shall remain in a serviceable condition over its life.

- Easy access for inspection and maintenance of all the elements of the structure is very important.

- Ingress of moisture into various components of building is the single most problematic issue concerning maintenance. Such ingress occurs from walls, openings, roofs and toilets. Therefore design of these components, choice of materials and quality of construction plays a major role throughout the life of the building. Most of maintenance problems arise due to poor quality of brickwork and concrete giving way to seepages / leakages and spalling. A properly designed and constructed concrete building should be immune to such attacks.

- It is also important to design and lay service lines which are not only strong, durable and leak proof but also clearly demarcated for easy accessibility and laid without much entanglement with each other as well as with the main structure.

- Another reason is settlement of ground and swelling of soils. A well designed building with full understanding of soil conditions beneath it should be able to resist all such negative forces and not require frequent repair or retrofitting.

Maintenance after Construction

Planned Maintenance

Every physical infrastructure or building, once constructed, becomes an asset and it must be protected through a well-planned and appropriately funded planned maintenance. The starting point for implementing an asset-based maintenance program is to understand two important concepts.

First, the goal of maintenance is to prevent,or at least reduce, the degradation or deterioration of the quality of service provided by each building component over its design service life.

Second, each building and the individual components that make-up that building, has a finite service life. At the end of that life, replacement or major renovation is required since, in the long run, it is less expensive to replace or renovate than to continue to make repairs that become increasingly frequent and costly.

Thus, planned maintenance has two essential elements i.e.

a. Preventive maintenance

b. Planned replacement or major renovation of building components. Planned replacement or major renovation is the step taken when a component reaches the end of its design service life.

Preventive maintenance ensures that building components actually achieve their service life and consists of:

Routine maintenance, which consists of specific procedures that are performed on a regular schedule. These procedures are designed to detect, preclude, or mitigate degradation of a facility system (or its components). The goal of routine, scheduled maintenance is to minimize each component's degradation and thus maintain, or even extend the useful life of the component. Routine maintenance can further be sub-divided into:-

- Annual Maintenance e.g. painting, polishing, periodic scheduled servicing of equipment etc. which are predetermined and can be planned for in advance in terms of estimates, provision of funds and drawing up of contracts.

- Day to day or casual maintenance operations which are required to address everyday breakages and breakdowns of minor nature which may be pertaining to plumbing and other fixtures and fittings in civil, electrical and mechanical works. These form an important part of preventive maintenance because, if left unattended, these very minor defects grow into major problems requiring vaca-

tion of premises for major renovation, repair and replacements. These operations can also be planned for in advance on the basis of past statistics of nature of complaints received and action can be taken to draw running contracts to attend to them promptly as and when complaints are received.

Predictive maintenance or planned replacement uses routine inspection and evaluation, testing and analysis to augment routine, scheduled maintenance procedures by detecting the onset of component degradation and to address problems as they are identified. This helps in minimising casual or day to day complaints as well as emergencies and eliminates any significant deterioration in the physical state of the component. Scientifically estimating the remaining life of various components and planning for their phased replacement is as important an aspect of maintenance as day to day and annual maintenance.

In both the cases regular inspection at pre-determined periodicity, keen and honest observation/reporting and advance action planning plays most crucial role.

Feedback

Apart from regular inspections by the concerned officials responsible for maintenance, obtaining and monitoring redressal of user feedback plays a major role in efficient maintenance. This aspect assumes special and utmost importance in case of large government establishments because slow or insufficient response from officials responsible for maintenance is the main cause of dis-satisfaction amongst the user public. Officials are either indifferent or unable to attend to their real duties in field due to other activities and complaints are either ignored and keep piling up or these are addressed poorly. Feedback for public utilities like government housing, roads, parks, streetlights and toilets etc. can be easily obtained if contact details (Telephone numbers, email addresses etc.) of concerned officials/departments are prominently displayed at appropriate places and feedback is encouraged. Lack of such information being readily available is the main cause of disinterest, dis-satisfaction and frustration in the mind of the public at large.However this will be successful only if feedback is utilized properly and redressal is monitored in a systemic manner for delivery of quick results, so that user public also realizes the value of it's feedback.

Emergency Maintenance

Even though the goal of planned maintenance is to anticipate and address all of the maintenance requirements for each building component, however breakdowns do occur unexpectedly at times despite best intentions and efforts. There could be numerous factors responsible for this, both internal and external. This requires taking up maintenance and repair work that has not been planned in advance. Unplanned maintenance requirements may crop up due to sudden failures due to natural causes or due to built up stresses in some neglected areas which are detected at very late

stage by a building occupant/user, by the maintenance staff while performing routine preventive maintenance procedures, or by predictive maintenance tests and evaluations. Such works may have to be taken up immediately for the necessary unplanned, but needed, maintenance or repair.

It is therefore impossible to plan for all required maintenance activities in advance. It has been observed in various studies that unplanned maintenance activities could consume resources to the extent of about 20 - 30% of total expenditure on maintenance. It is therefore necessary that provision of funds for such unplanned and emergent works be kept in the annual budget for maintenance. This aspect also brings to the fore the fact that, if expenditure on unplanned/ emergent maintenance activities starts consuming more than 25% of the available maintenancere sources, it goes to show that resources available to provide the required level of planned maintenance are inadequate. It could also show that sufficient attention has not been given to planned maintenance in the past years.

Housekeeping

Although it is not a part of building maintenance activity, yet housekeeping plays a crucial role not only in projecting the appearance of a buildings and it's surroundings as, well maintained, but also it's long term serviceability. Garbage, horticultural waste and accumulated soil/dust, if not removed regularly, only results in choking of lines and their deterioration with time. We have all seen choking of rain water pipes due to not cleaning the terraces, which results in leakages/ seepages and damages to the structure and shortening of it's life. Similarly trees growing out of crevices in the concrete/brick structure, if not removed regularly in infant stage itself, cause maximum damage to structures as well as services and finish of the building. It is also true that even a well maintained building, if not kept neat and clean, gives it a shabby and neglected look.

Co-ordinated Approach

Another important aspect in maintenance of buildings is adoption of an integrated and well coordinated approach amongst various disciplines i.e. civil, electrical, mechanical, horticultural and housekeeping etc. In fact a multi-disciplinary team at all levels is a must for proper redressal of maintenance complaints. Whether it is planned maintenance or unplanned/ emergency maintenance, a fractured approach will defeat the very purpose of the efforts i.e. ensuring full life serviceability of all components and use of building with minimum breakdown time.

This is a common problem encountered in maintenance of government buildings and facilities. One arm does not know what the other one is doing and they keep on doing their bit without waiting for the other. This not only results in increasing the cost of maintenance, but also inconvenience to user and more downtime resulting in loss

of revenue. The solution to this problem lies in awarding comprehensive maintenance contracts which include all disciplines. The contracting agency employs multi-disciplinary trained workers and supervisors, who treat the problems as a whole, with least cost and time. This has been tried in some areas in CPWD and found to deliver much better results.

Conclusion

Buildings have a significant direct and indirect impact on the environment. They not only consume vast amount of energy and raw materials for their construction, they also generate waste and potentially harmful atmospheric emissions during their entire lifetime. The idea of green buildings has only recently caught the attention of builders and the government in India. However the emphasis has so far been on use of materials consuming least energy in their manufacture including recycled materials and use of energy efficient equipment apart from location and orientation of the buildings. Importance of efficient maintenance as a tool for sustainable building construction and accounting for use of “ease of maintenance” as one of the guiding principle in design and construction of buildings is yet to be recognised as an important factor in declaring a building a “green building”.

When a building is designed for maximum “ease of maintenance” and minimum life cycle cost (both in terms of money spent as well as in terms of energy consumed), it automatically conforms to sustainability standards. And when the building is maintained efficiently, it not only reduces cost of running and maintenance of installations and ,of course their replacements, it also helps us save huge amount of energy and it’s carbon footprints in terms of efficient use of scarce materials and other resources as a result of reduction in manufacturing of replacements. This not only applies to various components of the buildings, but also to building as a whole.

Therefore what is required is a wholesome “sustainable” approach to building design and construction fully accounting for operation and maintenance to achieve durability and longevity with least cost to exchequer as well as environment. This will help us to meet the goals and functions of the facility or infrastructure being planned while supporting an increased commitment to environmental outlook and conservation.

Durability of the Built Environment and Environmental Characterization

Svein Haagenrud

The built environment is in a really bad State. For many years society has been aware of that, and has been fighting against environmental degradation of the cultural heritage, which traditionally is defined as buildings and situations of historic value. However, it is not only this cultural heritage which is exposed to environmental degradation and at nsk. Also, the newer built environment is under attack in just the same way. It has now become clear that after the "build and let decay" age during the last 30 years, i.e. the damage to building materials and constructions generally has become an enormous economic, cultural and environmental problem, not only in Europe, but in most developed nations as well.

The building stock and infrastructure in each country constitute more than 50 % of each country's real capital. The yearly maintenance costs amount to billions and billions of ECU per year, and should be considerably increased as Europe's building activity shifts from new-building to maintaining and care-taking of the existing. The German market alone is estimated to 2,000 billion DM towards the year 2000. An increased effort in this area also has the potential of creating millions of new jobs for Europe.

The degrading built environment also constitutes a major environmental problem in the context of sustainable development. The wasteful consumption of energy and materials linked to the degrading built environment has to be resolved.

There are a whole set of reasons for this bad State of the built environment, ranging from the market-closed society of public administration and conservators/ scientists in the cultural heritage area, to the lack of recognition of the importance of service life and maintenance of the more modern buildings. Main barriers for a proper care- taking and maintenance of the built environment are:

- No total life cycle concept exists for buildings.
- Lack of main contractor responsibility, sub-contracting dilutes responsibility, and hinders major developments.
- Poor workmanship and inadequate quality control dominates.
- The very fragmented R&D in this area, resultmg in duplication of basic research, low technology and little application and market orientation.

- Lack of Standards and regulations.

- Lack of communication between material scientists and designers, engineers and contractors.

The EUREKA umbrella EUROCARE deals with all these problems. EUROCARE started out in 1986. As a EUREKA Umbrella it aims at facilitating and promotmg market oriented EUREKA projects, which should counter-act the degradation of Europe's built environment, including the cultural heritage and within a sustainable development context. The long term Strategie goal of these projects is to increase the service life of the built environment and decrease the yearly life cycle cost for its conservation, restoration and maintenance.

18 of the EUREKA countries and CEC are now members of the EUROCARE umbrella, comprising a network of more than 350 organisations and a project portfolio of more than 40 EUREKA projects.

To facilitate and promote EUREKA projects, the EUROCARE umbrella has important tasks, such as:

- Serving as a market developer and integrator of R&D

- Offering supportive measures in standardization and funding

- Monitoring of project portfolio

- Work to increase Synergy and interaction with CEC.

Important achievements have been reached in all these areas. as for example on integrating R&D:

To safeguard our built environment, action is urgently needed. In principle there are two possibilities - and both should be pursued in parallel. First, society should try to improve the environment surrounding the materials, and secondary better products, processes, infrastructures, methods and Standards should be pursued.

The second issue is EUROCARE's main concern. while the first is being pursued by the environmental research area via cost-benefit analysis for material corrosion.

Knowledge about the exposure environment and its relationship with the degradation of various building materials (dose-response and damage functions) is very much needed both in the environmental research area as a basis for policy decisions on abatement strategies, and as well in the building and construction sector as a basis for proper maintenance and service life planning.

Environmental cost benefit analysis of building materials degradation

Environmental cost benefit analysis for various themes. such as health, forest, materials. are needed as basis for policy decisions on abatement strategies. A building inventory, MOBAK (Kucera et al., 1993), gave ground for detailed analysis in Stockholm, Sarpsborg and Prague. An extrapolation of this model for Europe showed a benefit of about 10 billion dollars per year in savings by implementation of the 2nd sulphur protocol (Cowell and ApSimon, 1994).

Long-term research in the environmental area has substantially improved the basis for methods and data for proper corrosion mappmg and cost assessment:

- Dose-response and damage functions have been established via the UN /ECE / ICP exposure program and the MOBAK building inventory

- Knowledge about the environmental degradation factors exist on the European level via the European Monitoring Environmental Program and UN/ECE/ICP Programme, on the regional and local level via national surveillance programs and the "Urban air" project (EEA, 1993).

- For many reasons air dispersion models play an increasingly important role in characterizing the atmospheric environment. This is the case also as concerns exposure to the built environment. However, for maintenance planning of each specific building/object knowledge about the micro environment is of decisive importance.

- Data should be made available on user friendly geographically Information Systems (GIS), which collect, integrate and present data in a very useful way. The integrated environmental surveillance and information System, ENSIS, was developed and demonstrated for the Winter Olympic Games in Lillehammer. Since then, ENSIS is under further development and implementation in major Norwegian cities and abroad. ENSIS contains a number of different applications and tools for air and water quality (Haagenrud et al., 1994). Based on the needs and requirements of the user the ARCView GIS based ENSIS concept can be used to establish a tailor-made application for any user need for environmental information. In that context the new ENSIS Corrosion module has been developed.

- In the UN/ECE/ICP dose-response functions for a ränge of materials and mapping procedures based on "Critical/acceptable load" concept have been developed. By using these functions and procedures together with the available air quality data and dispersion models, the corrosion can be modelled and mapped via the ENSIS Corrosion module.

Service life and maintenance planning of built environment

For economic and environmental reasons there is a great need for a more durable built environment. An international Standard on design life of buildings is currentiy in the process of being elaborated within ISO/TC59/SC3/WG9. This group was set from the joint initiative for standardization by the EUREKA umbrella project EUROCARE, and CIB/RILEM, towards CEC and CEN in 1991, and based upon the generic RILEM Recommendation for prediction of Service life. In Europe the entry into force of the Construction Products Directive (CPD) also creates an urgent and increased need for Standards addressing the issue of durability. For industry to respond to the Standards and requirements, a lot of data and knowledge needs to be compiled or generated.

As shown above, the data could be supplied or provided for through extensive co-operation with meteorological and environmental research organizations.

Mapping of the corrosion rates can easily be transformed into maps for Service life and maintenance intervals if the Performance requirement is defined for the material in question. It could then serve as a tool for maintenance planning for individual users etc. In this respect the question of transformation and Validation of these dose-response functions to the micro environment on the building surface has to be addressed. Some Classification Systems for materials exist, such as Scheffer's index for degradation of wood and the ISO 9223-26 Classification of atmospheric corrosivity for metals. These concepts are powerful tools in assessing environmental aggressivity towards building materials. Their application, however, is and will be dependent on the availability of data and user friendly Systems for its use.

Conclusions

Users of materials Performance data can achieve all the needed environmental data by collaboration with the environmental research area. Such a collaboration should also have the mutual benefit of establishing much more sound cost benefit data for the degradation and maintenance of Europe's built environment. This is a very much needed documentation that should serve as basis for a more comprehensive market-oriented and strengthening effort on the maintaining of Europe's built environment.

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Urban Communication – Survival in the City

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Prologue

Mahatma Gandhi said during even modern times the village should be developed an ideal identity for human settlement. Elvin Toffler in his book, while mentioning the dream of Mahatma Gandhi, expressed his view of making such dream a reality, on account of back-up by modern technologies of transport and communication. Mobile phone and internet are same dimensions of new technology. Still, it remains a dream

In our country, it for urban settlements, the population is increasing on account of birth and migration to cities. A number of cities are approaching to become metropolis and metropolis are moving towards status of megapolis. In turn, urban miseries are multiplying many fold. Still there is no solution. There are many difficulties and constrains. Whether it is possible to think of and/or plan urban renewal to make life comfortable. It will be interesting to know, thoughts and propositions of thinkers and experts regarding survival in the city. This book extract will add to our thinking, for 1 urban renewal initiatives.

Abstract

When societies are young, they are flexible, fluid, not paralyzed by a rigid specialization and willing to being anything. Thus maturities of societies, which continue with passage of time narrows down potentialities for change and reduces adoptability. For an over-renewing society, the appropriate image is a total garden, a balanced aquarium and other ecological system. Some things are being born, other things are flourishing, still other things are dying –but the system lives on.

For continuous renewal, an organization is needed which should view the whole as a system in need of continuing innovation. Most vital requirement of renewal is that there has to be system by which able people are nurtured and moved into positions where they can make their contribution.

It is absolutely necessary that those involved with renewal which include policy makers and political leadership, should get out in the field and know people involved by personal contact, i.e., they have to ring door bells to know factuals. Thus for this activity, experts need to be developed.

A city is meant for human development and it consists of five elements, (i) Nature, (ii) Man, (iii) Society, (iv) Skills and (v) Networks. A city functions in five different ways. These are, (i) economic, (ii) sociological, (iii) political, (iv) technological and/or (v) cultural phenomenon. The combination of elements and functions can create a number of combinations.

Cities consist of units of different sizes; form human bubble containing man's body to room, house, neighbourhood, city, metropolis, megapolis and even beyond – to cover upto whole earth. The man in the centre of a system of spheres defined by his body, senses (touch, smell, hear, sight and speak), mind and soul.

The city of the present has become extra human in dimension – nobody can and will walk from one end to the other. In turn, it has become inhuman in formation of many of its parts. Thus failure of the city to serve the man leads to a need for its re-examination. In fact a city for maximum human development must guarantee everybody, the best possible development under conditions of freedom and safety. The human system must be able to grow within the urban system and at the right pace and in right direction.

Impacts of environment on human development are (i) it should protect man physically from adverse exposures to his physical environment, i.e., nature, shells and the network, (ii) it should protect man socially by facilitating quality and quantity of human contacts (iii) the environment can and should provide opportunities for a gradual increase in freedom.

People feel lonely if left alone in space and, therefore, tend to come closer to form organized society. The goal of the city is to bring the people close enough to get benefit from their contacts, as also to form proper structure. It is imperative that we develop a system which will help us to comprehend the relationship of people to the space.

More than 50% of earth's population is less than 20 years of age. Man prefers to work in spaces covered by horizontal ceiling.

. Study of history of cities show that we cannot establish their final destination or population size. In fact, ideal city to have 2km x 2Km size and maximum average walking distance not to exceed 10 minutes, population should rarely exceeds of 50,000 people. Thus, it should be easy to operate and manage.

To define units of space used by man at every age, a study was conducted. There are about 101 phases in life of 100 years old person.

(i) 1st Phase - Prenatal Phase – It is limited to a part of body of mother.

(ii) 2nd Phase – (First Year of life) – 80% of time in room and 20% in rest of home, including garden.

(iii) 3rd Phase (Second Year of Life) –Room other rooms and garden.

(iv) 5th and 6th Phase – He discovers neighbourhood and something about operation of society by going to local shop.

(v) 11th Phase – More to wider areas including going to school in independent manner.

(vi) 16th Phase – Lot of time spent in community unit.

(vii) 21st Phase – More time in Larger Units

(viii) 41st Phase –Move outward, by mechanical dependent and independent units. His natural movement decreases.

(ix) 61st Phase – Kinetic field continues to be far out reaching the limit of earth.

(x) 81st Phase – Retreated back to smaller unit. Generally does not walk out and is not involved in profession. Man's kinetic fields have shunk.

(xi) 101st Phase – man goes to smaller unit covered by flower.

If we place the distance between people in settlements of average densities on logarithmic scale, we note that, with a room, the distance may be of the order of 3 meters, in a dwelling units 4-5 meters. In a neighborhood 6 meters, to a town 8, 10 or 15 meters or more (according to size). If we spread whole population evenly over the earth the distance between two persons is around 400 meters. We must work out how large should be distance, to develop man properly.

Annexure A

Comments of Readers on Inaugural Issue of IBC Journal

(i) Comments of Shri Sudhir Krishna, Chairman, BIS Committee on Smart City Standard & Former Secretary (Urban Development), Government of India

"I am delighted to receive the Inaugural Issue of the IBC Journal, released in September 2015. The content and get up are both of very high quality. The journal is sure to become a very useful source of knowledge and information to its readers. I compliment you, your editorial and support teams and the contributors/ authors for achieving this major milestone and wish a very long and successful future for the journal."

(ii) Comments of Shri M.K. Agarwal, Former President, Indian Roads Congress & Engineer-in-Chief (Retd.), Haryana PWD (B&R) "

I have before me two recent IBC publication, viz.

- Built Environment – Vol. Issue 2
- IBC Journal – Vol I, Inaugural Issue

I have gone through them and I must say that I enjoyed reading them. I would like to congratulate you on their beautiful format and elegant printing, and more than that, their contents. The sweep of Built Environment is quite large and encompasses bridges and highway, too. It keeps one informed about the emerging building scenario and innovative technologies on the construction front.

You and your team seem to have worked not just hard but with dedication, and under inspired leadership. I hope you will keep up the standard, and not let it slump or flag with time, as unfortunately often happens.

Most of such publications remain on one's desk for a few days, then for some weeks move to the shelf, and ultimately land up with the raddiwala. But I am tempted to say that these IBC publication are (and hopefully would be) for keeps.

The IBC is fortunate to have the Founding President Mr. O.P. Goel around. After planting the sapling of the Institution, he seems to be constantly at pains to ensure that it receives due nourishment and develops healthy and tall. In these efforts, as everybody can see, he has abundantly succeeded.

(iii) Comments of Dr. Shailesh Kumar Agrawal, Executive Director, BMTPC, New Delhi

"We are in receipt of your IBC Journal Vol.1, Inaugural Issue. The Journal has some very good articles on built environment and has come out very well. The entire IBC editorial team needs to be complemented for bringing out the journal. We certainly hope that in future also these kinds of valuable documents will be published by IBC. We wish them all success in their future endeavour."

(iv) Comments of Shri V. K. Agarwal, Former Chairman Railway Board & Ex-Officio Principal Secretary, Govt. of India.

"I was very happy to receive the copy of the Inaugural Issue of IBC Journal (Sept. 2015) which focuses on Built Environment. You and your editorial team have done a commendable job in not only selecting a focus area (Built Environment), so very relevant today, but also in contacting eminent authors who are not only 'Specialists' but also have an experiential profile covering a wide range of areas i.e. people with T-shaped profiles. In this intimately interconnected, interrelated & interdependent technological era only such persons can suggest holistic solutions to problems / issues.

One can find that the issues of Sustainable development, Climate change, Inclusive growth, and Job creation, which are staring at us, have ably been covered in a series of articles by the eminent authors. The Journal has articles highlighting Urban Housing and Mobility, Building Materials and Technologies for Sustainable Environment, Skill Development so very relevant for Job Creation, and Dispute Resolution, to name a few.

To my mind, Articles in this Journal will be extremely useful not only to the practising Engineers but also for the Planners and the Society / Nature at large.

I compliment you, your editorial team and the learned authors for their efforts and wish that the future issues of IBC Journal also continue to enlighten us on selected relevant issues / areas in the same manner."