JUNE 2018

VIEWPOINT

OFFICIAL QUARTERLY MAGAZINE OF CEAI

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Asset Management

CONSULTING ENGINEERS ASSOCIATION OF INDIA

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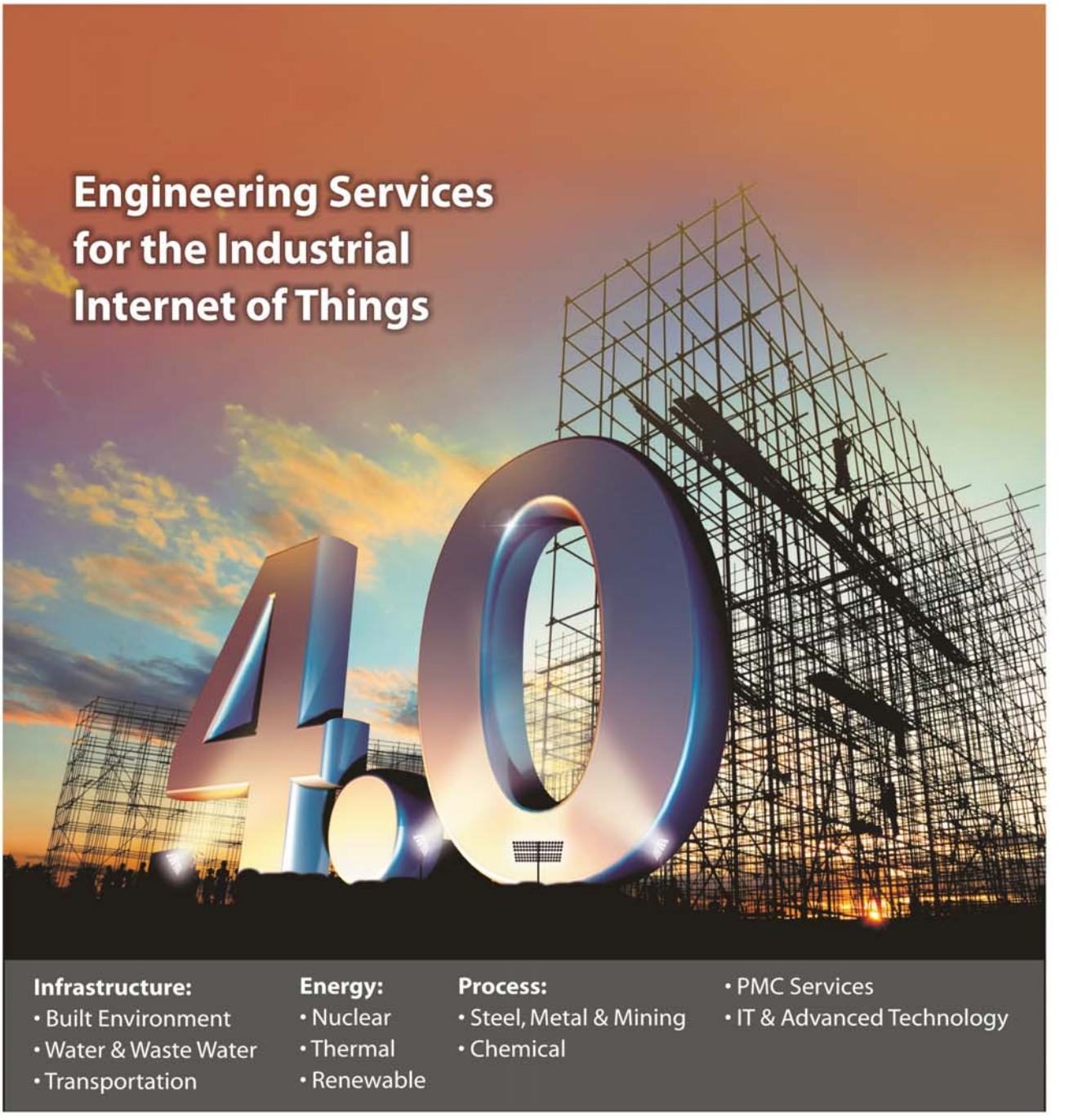

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MESSAGE FROM CHIEF EDITOR

Dear Fellow Consulting Engineers,

Assets, assets, assets! Our lives revolve around multiple assets starting from our own physical body and mind. So long as we look after our body – clean and refuel it day in and day out and also retain a balanced frame of mind they both let us live peacefully and enjoy our life. The moment either one is stricken we lose our equanimity. The same applies to the assets that we inherit and/ or create be they financial, physical (stationary or moveable), environmental, relationship, etc.

This issue of View Point is inseparably linked to the previous issue whose theme was *"Environment & Climate Change"*. Prior to that the seminar on *"Managing Physical Assets to Deliver Business Outcomes Cost Effectively"* held in October 2017 had for the first time in India brought about an awareness regarding the need for proper management of the physical assets. This requires an appreciation and understanding that the full life cycle cost of the asset needs to be considered right at the beginning and keep that in view in all decisions that affect the assets and *inter alia* linked to the whole gamut of conceptualization, planning, design, detailing, construction, fabrication, erection, installation, testing & commissioning, operating and maintaining, repairing, modifying, replacing and decommissioning/ disposal—of the assets. Operation and maintenance of assets in a constrained budget environment require a prioritization scheme. Risk analysis is a part of the process. The risk and what if exercise need to be done at each step and decision taken keeping all the factors in mind especially those relating to safety, security of life and property not only within the asset per se but also the adjoining ones which could be affected. Change in usage of the facility in the future could also be a factor if the Owner's are uncertain if they would own and retain the facility for its intended design life.

Countries are learning the hard way and at great costs accompanied by hardships that any asset cannot be just made and left to its fate or else it becomes a liability and risks lives. They have realized that the asset needs to be looked after continuously and repairs carried out for it to perform as intended for its design life. That latter is an aspect that needs to be incorporated into the codes and standards. The owners, advisors, consultants, contractors, manufacturers, vendors, operators and maintainers – all need to be responsible for the preplanned upkeep of the asset. Thus the allocation of responsibilities and funds needs to be done up front and not deferred. Maintenance inter alia includes the replacement, after the design life, of a particular component or set of components of the asset is over. As mentioned earlier an asset, regardless of whether it's tangible or intangible, financial or non-financial, would perform better and contribute to improving operating results, service performance and ultimately

improve the satisfaction of the users with planned management over its life cycle. Simultaneously it would spare the people of the country the burden of funding for rebuilding the public asset.

As for countries, so also for organizations, especially those with multiple assets. They also require an efficient asset management strategy. The concepts and principals of asset management are not limited to organizations per se but can be equally be extended to cities, regions and even to individuals.

The spate of fires in high rises in the country especially Mumbai and even those abroad highlight as to how little though is given to safety of lives and property. Maximising space utilization and providing appurtenances for beautification or even usage for a legitimate purpose which become obstructions later on can be no excuse for doing so. Safety and security must be paramount and non negotiable.

The International Standards Organization (ISO) has brought out the 55000 family of standards in 2014. They give guidance on asset management best practices. The standards are a collaborative effort of 36 countries, including India. They focus on helping to develop a proactive lifecycle asset management system. It thus supports optimization of assets and reduces the overall cost of ownership while helping to meet the necessary performance and safety requirements.

The National Building Code of India 2016 has also incorporated 'Asset and Facility Management' in Volume 2, Part 12 which gives a much needed impetus to proper planning, design, construction and maintenance of buildings. NBC 2016 becomes mandatory in states that have stipulated its adoption. They must thus necessarily adopt asset management.

Asset Management has been made easier with the ubiquitous use of sensors and automation, both of which have made data gathering simpler and in many cases continuous. However, that data needs to be systematically analysed and decisions taken. That is where Data Analytics comes in to help chart the course of actions to be taken. The algorithms behind all these must be carefully built and be robust. They also must be upgraded at regular intervals based on the experience gained.

The papers included make this an interesting issue to read. Let's take a cue and ensure that we as engineers abide by the life cycle benefits and design to meet all safety and security requirements while meeting the functional requirements for which the asset is built.

Happy Reading and Learning

A P Mull

VALUE ADDITION OF ASSETS THROUGH EFFICIENT AFM

V Suresh
President, Good Governance India Foundation
Vice Chairman, National Building Code of India
Chairman, IGBC Policy and Advocacy
Former CMD HUDCO
Former President Indian Building Congress, NAREDCO

1. CONTEXT

1.1. With demographic explosion and rapid urbanizations, India is witnessing a quantum jump in growth of cities, towns and the built environment from just around 100 crores in 2001, it will be crossing 140 crores by 2021, and over 50% of the growth in the last decades is in urban areas. India's urban populations will double from 28 crores in 2001 to 56 crores by 2021. Over 70% of India's GDP comes from economic development from cities as "Growth Engines".

India's built environment (buildings and related infrastructure), which is over 30 billion sq.ft. will see a major quantum jump with construction of additional 50 billion sq.ft. in the next two decades.

The launch programmes such as of 100 Smart Cites, 500 AMRUT Cities, Housing for All by 2022, Swachh Bharat Mission has created additional impacts in building construction sector.

With the generational historic age of the built environment standing from centuries to decades the life of the built environment is also getting affected due to obsolescence, decay, lack of upkeep and maintenance care for structural, non-structural items, finishing and building and plumbing services installations. With every monsoon and vagaries of weather, buildings are collapsing and life of buildings and people living and working in these spaces are affected.

Due to large scale new construction taking place all across the country there has been increased output of the construction industry in terms of buildings and built environment. There is a growing awareness of the need to manage the condition of the nation's building stock more efficiently.

To realize full potential of assets/ facilities, it is imperative that application of new technology and efficient use of data and resources is made. Positive impact on safety and business continuity that a well planned maintenance strategy can make also needs to be appreciated.

There has been significant growth in the requirement of building maintenance in view of an increased output of the construction industry in terms of buildings and built environment. This has been primarily due to large scale new construction taking place all across the country. While there is a need for proper maintenance of the existing building assets, there is a growing awareness of the need to manage the condition of the nation's building stock more efficiently. Paralleling these developments has been the increased application of new technology, permitting more efficient use of data and resources. Notwithstanding this, it is still the case that much maintenance activities take place in a context that do not create a fully integrated approach to managing asset/ facility performance and, thus, the full potential of many assets/ facilities is never wholly realized. The likely adverse impact on safety and business continuity due to lack of a well planned maintenance strategy is also not fully appreciated as yet.

Poor detailed design affects building performance, and hence impacts maintenance cost and consequent effects are well known. There is need to look into this aspect and explore design-maintenance relationship. Many of the problems encountered in buildings stem from the development phase, where a failure to establish user requirements in sufficient detail results in the poor performance of the completed building. At the hand-over stage also there may be serious shortcomings, and more careful consideration need to be given to providing the client with a proper building model to facilitate the effective management of the property. None of these crucial developments can take place without a major shift in client attitudes, and professions working with the built environment.

1.2. The National Building Code of India 2016 has brought in many innovative provisions to address these concerns. Approach to Sustainable built environment creation through New Part 11, highlights the need for a life cycle care approach from cradle to grave and recognising the Capital Costs (CAPEX) and Operating and Maintenance Costs (OPEX) as part of life cycle costing for buildings and services during the service life.

More importantly the New Part 12 on Assets and Facility Management covers the whole gamut.

This Part covers provisions relating to management of building assets and associated facilities and deals with issues relating to maintenance of all types of facilities and fixed assets such as buildings and building services. However, assets other than physical assets and the maintenance of bulk services required for towns and cities are not covered in this Part.

2. NBC 2016 AND APPROACH TO ASSET AND FACILITIES MANAGEMENT

2.1 The contents of Part 12 Asset and Facility Management in National Building Code of India 2016 is the first major National effort to provide a guiding and regulatory framework on this important facets of post completion/ occupation stages of buildings and facilities and have a rational scientific, management overview on keeping buildings and facilities, fit, safe, operational and performing. It also helps to extend the life of the buildings and facilities.

2.2 The Contents of NBC 2016 Part 12 on Asset and Facility Management covers the following:

1 Scope
2 Terminology
3 General Aspects of Asset and Facility Management
4 Organizational Structure of an Asset & Facility Management System
5 Methodology
6 Resource Requirement for Asset/ Facility Management
7 Procurement of Facility Related Services
8 Classification of Asset/Facility Management
9 Building Maintenance –Methods and Management
10 Building Fabric Maintenance
11 Maintenance of Plumbing and Drainage Systems
12 Maintenance of Heating, Ventilation & Air Conditioning (HVAC) System
13 Maintenance of Electrical Installations
14 Operation and Maintenance of Lifts and Escalators
15 Maintenance of Fire Fighting Systems
16 Roads and Pathways Management and Upkeep

17 Health and Safety Requirements
18 Maintenance of Landscaping and Horticulture Works
19 Housekeeping
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Annex E Guidelines for Maintenance of Electrical Equipment
Annex F Format for Preventive Maintenance Profile of Lifts
Annex G Typical Checklists for Maintenance of Lifts
Annex H Typical Check List for Landscape Areas
Annex J Typical Template for Housekeeping of Hotels

2.3. **Strategic Approach**

a) Asset Management:

The physical assets represent only one of the five broad categories of asset types that have to be managed holistically in order to achieve the organizational strategic plan. The other categories are human assets, information assets, financial assets and intangible assets (reputation, morale, intellectual property, goodwill, etc). The scope of this Part is limited to maintenance of physical assets.

Asset management is the process by which an owner maximizes the value of a property or portfolio of properties from acquisition to dispossession within the objectives defined by the owner.

Asset management utilizes strategic planning practices including investment analysis, operation analysis and the positioning of a property in the market place in accordance with market trends.

b) Facility and its Management

Facility is something that is built for a specific purpose and which is used by end users for predetermined purposes. Facilities management is the integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities as well as enhances its ability to successfully control the building environment that houses people (employees, clients, visitors). Facilities management encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace. It is also known as a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process, and technology.

c) Overview of Asset/Facility Management

Asset/ Facility management is a multidisciplinary approach for designing, planning and managing in an integrated and coordinated way all non-core support services necessary for an effective and efficient execution

of the organization's core activities. It involves systematic and coordinated process of planning, operating, maintaining, upgrading and replacing assets cost effectively with minimum risk and at the desired level of customer service at the lowest life cycle cost for the purpose of achieving its organizational strategic plan. It can be used to help assure that utility services are provided in a sustainable, cost-effective way to assist and help to improve the quality of life of people.

Asset/ Facility Management is not an accounting exercise or a substitute for quality management. It is for everyone working in an organization that owns or operates assets. This includes those working in procurement, finance, personnel, service, planning, design, operations, administration, leadership, marketing and sales. It is neither a project management system nor just about maintenance.

It is devoted to the coordination of space, infrastructure, people, and organization, often associated with the administration of office blocks, public arenas, schools, sporting complexes, convention centers, shopping complexes, hospitals, hotels, etc. Facilities management practice is applicable for all class of assets, that is, retail, residential, commercial, industrial, warehousing, hospitality, etc.

2.4. **Core Competencies for AFM**

If correctly implemented, facility management can deliver safe, productive, humane, and cost effective environments in different spheres of people's living, commercial activities and working. This practice also enhances the skills of people within the facilities management sector, creates career opportunities, and enables new working styles which is important in this technologically driven world. All these benefits will not only enhance the organization's image and brand name but also make the infrastructures across class of assets a safe, healthy, and productive place.

Asset/facility management includes the integration of the planning and management of a wide range of services both 'hard' (for example, building fabric and building services) and 'soft' (for example, catering, cleaning, security, and mailroom), the management of an increasingly broad range of tangible assets, support services as well as people skills.

The identified core competencies of the asset/ facility management are:

a) Communication - Communication plans and processes for both internal and external stakeholders;
b) Emergency preparedness and Business Continuity - Emergency and risk management plans and procedures;
c) Environmental stewardship and Sustainability - Sustainable management of built and natural environments;
d) Finance and Business - Strategic plans, budgets, financial analyses, procurement;
e) Human factors - Healthful and safe environment, security, facility management employee development;
f) Leadership and Strategy - Strategic planning, organization, staff and leadership organization;
g) Operations and Maintenance - Building operations and maintenance, occupant services;
h) Project Management - Overseeing and management of all projects and related contracts; and
i) Quality - Best practices, process improvements, audits and measurements;

The asset/ facility management can be done either in-house or by engaging outside agency.

Asset management and facility management have overlapping aspects, hence they are therefore dealt with in one Part of the NBC 2016 and accordingly, in most cases the term 'asset/ facility' has been used while in some other cases, the two terms have been used interchangeably.

2.5. Importance and Benefits of AFM

Asset/ facility management is important because it can help organizations to:

a) reduce the total costs of operating their assets;
b) reduce the capital costs of investing in the asset base;
c) improve the operating performance of their assets (reduce failure rates, increase availability, etc) and ensure continued serviceability during life of the asset;
d) reduce the potential health impacts of operating the assets;
e) reduce the safety risks of operating the assets;
f) minimize adverse environmental impact of operating the assets;
g) maintain and improve the reputation of the organization;
h) improve the regulatory performance of the organization;
i) reduce legal risks associated with operating assets;
j) gives better return on investment (important from financers point of view), enhanced life of asset, ensures continued safety; and
k) it ensures that the asset continues to meet the standards which were set during design stage – the strategy for managing the asset/ facility should be efficient and cost-effective in terms that are quantifiable.

3. AFM TEAM

3.1 The Role and Responsibilities of the AFM team to deal with multidisciplinary functions are identified with scope of work to be carried out, competence of skilled personnel at various levels, the importance of Facility Manager and functions are delineated.

Outsourcing

Certain items under the facility manager may have been outsourced. Facility Manager has to supervise those items with effective monitoring in order to ensure that the concerned agencies are discharging their responsibilities properly and performance is as planned, which should be supported by necessary documentation. The control of risks which cannot be transferred to outside agencies should be maintained with the Facility Manager.

3.2 Methodology

During the planning of the asset/facility management system, the resources required for the activities planned should be determined. These resources may be grouped broadly in the following two categories:

a) In-house; and
b) Outsourced.

The costs of activities required for asset/ facility management should also be grouped under above two categories.

In-house Activities

Following aspects should be kept in view while planning the activities required for asset/ facility management as in-house activities:

a) Cost to be incurred on salary and establishment expenses of regular staff will be more or less fixed depending upon the number of staff in various categories and the infrastructure required for them by

way of office accommodation, tools and plants, equipment, etc. This expenditure will not vary much unless the number of staff or the quantum of equipment is varied depending on the work load.

b) Generally, the quantum of works to be carried out is decided keeping in view, in addition to technical requirement, the availability of funds. Cost incurred on works will depend on the actual quantum of work carried out and is, therefore, variable.

Outsourced Activities

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 outsourced. Where both occur, account should be taken of the need to integrate the two sources of service delivery and the resources and costs that may 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.

The advantage of managing activities with in-house resources is that the organization has direct control over the operations. However, when activities are outsourced, such direct control is not automatic. The organization should assess the associated risks and should ensure that outsourced processes and activities are controlled.

This can be taken care by adopting a proper organised procurement process of asset and Facility Management Services. The Role and Responsibilities as well as accountabilities need to be clearly identified with the processes of identifying the right teams and with contractual and financial framework.

4. CLASSIFICATION OF ASSET / FACILITY MANAGEMENT SERVICES.

4.1 Typically asset/ facility management includes the integration of the planning and management of a wide range of services which can be split into two areas of 'Hard' Services and 'Soft' Services.

i) Hard Services

- Building fabric maintenance;
- Building services maintenance:
  - Plumbing and drainage;
  - Air Conditioning, heating and mechanical ventilation (HVAC) services;
  - Electrical installations;
  - Lifts and escalators;
  - Fire fighting-detection and suppression, and
- Roads and pathways

ii) Soft Services

- Environment, Health and Safety;
- Landscaping and Horticulture waste management;
- Housekeeping;
- Pest control;
- Security management;
- Solid waste management;

The common areas in a building and built environment should comply with the provisions.

4.2. **Aspects Influencing Building Maintenance Influence of Design**

a) Due attention to maintenance requirements from the planning stage.
b) Involvement of maintenance agency from the design stage itself.
c) Correct choice of materials, specifications, construction techniques & quality
d) Attention to services and testing of lines, effective supervision
e) Life cycle cost, type of finish, fire and life
f) Safety requirements
g) Detailing of components
h) Accessibility for maintenance purposes.
i) Environmental factors – external and internal, and
j) Future requirements of owner

5. MAINTENANCE METHODS

5.1. An organization should determine which method or combination of methods best satisfies its operational needs in maintenance in accordance with its facilities maintenance strategy and policy. Each method should be assessed in terms of the extent to which it satisfies (or does not satisfy) the criteria defined as part of the facilities maintenance strategy. 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; these can be grouped into two broad categories (see Fig.1):

Planned Maintenance, which includes Planned Preventive Maintenance and Shutdown Maintenance. Preventive Maintenance further includes Condition-based Maintenance, Reliability Centred Maintenance (RCM) and Total Productive Maintenance (TPM); and

Unplanned Maintenance, which includes Corrective Maintenance, Breakdown Maintenance and Emergency Maintenance.

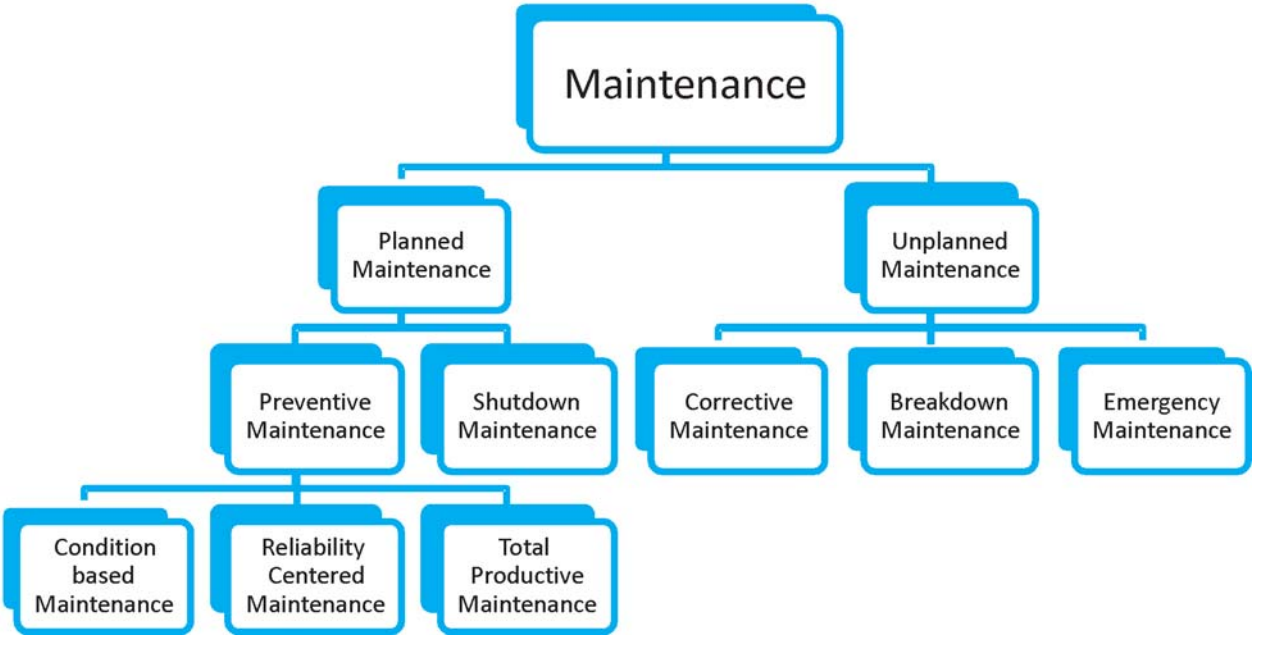

Fig. 1 MAINTENANCE METHODS

5.2. **Responsibility of Owners/ Occupiers**

- Vacant structures and land
- Sanitation
- Sidewalks and driveways
- Weeds
- Exhaust vents
- Accessory structures
- Rubbish and Garbage
- Exterior and Interior Structure

Responsibility Matrix

- Single owner
- Occupant
- Multiple occupancy

Common Area Maintenance

- Maintenance of common areas in any building, group of buildings, should be responsibility of all those who share and use the common areas.
- Funds to carry out this function by levying a Common Area Maintenance (CAM) charge on all the users.

Other Aspects Covered

- Prevention of Cracks, Repairs, Retrofitting and Seismic Strengthening of Buildings
- Maintenance of plumbing and drainage
- Storm water,
- Grey water,
- Black water, runoff, and
- Evaporation and leaks.

6. PERIODICITY

6.1 A major part of expenditure on asset/ facility management is incurred on maintenance - usually subdivided as follows:

- Maintenance for day to day services,
- Annual repairs,
- Special repairs,

6.2. **Maintenance Norms**

Plinth area maintenance rates, that is annual financial yardstick established for building maintenance on plinth area basis for civil, electrical/ mechanical works may be taken as per existing provisions in works departments at central or state level or any other prevalent rates. Special considerations may be taken into account for hilly areas, coastal areas or other areas with severe aggressive climate.

7. FACILITIES AND SERVICES

7.1. **Operation and Maintenance of Sewage Treatment Plant (STP)**

More and more campuses are now being served by STPs for treatment of waste water and reusing it for various purposes. Maintenance of STPs and their operation is an essential activity for proper functioning of

facilities where such plants are provided. The methods of checking operational aspects of the STPs are given in Annex D. Adequate exhaust and ventilation system are to be provided for operator comfort, health, and hygiene

7.2. **Maintenance of HVAC Systems**

Continuous monitoring of plant through a Building Maintenance System (BMS) and continuously seek refinement of the programmed logic, till the user is satisfied.

Periodicity/ Frequency of servicing: Optimum frequency of carrying out servicing to be determined.

A regular record of all maintenance and service operations shall be maintained and periodically reviewed.

7.3. **Maintenance of Electrical Installations**

It covers HV panels, HV switches, transformers, LV panels, floor panels, earthing, internal electrical distribution systems, light fixtures/ switches/ MCBs, lightning arrestors, street lighting systems, façade lighting, and transformers.

1. Maintenance of UPS/ Inverter
2. Maintenance of Battery
3. Emergency Lighting Procedures for maintenance of emergency lighting fixtures

Planning of Electrical Maintenance Work

- Routine maintenance
- Post fault maintenance

List of authorized person should be displayed on HV, LV, and Lift Machine Room because of likelihood of lots of hazards in these areas. Proper signage should be displayed to discourage unauthorized personnel in these areas.

Maintenance of Electrical Services

- Lock Out and Tag Out (LOTO) processes
- Maintenance of UPS/ Inverter
- Maintenance of Battery

Appropriate gas detectors can be installed in battery rooms to detect and warn about build-up of harmful gasses. These detectors should be regularly monitored and inspected to ensure proper functioning

Additional Electrical Services maintenance

- Standard operating procedures for maintenance of lead acid battery
- Earth Pits and Earthing Installations
- DG Set and its Auxiliary Operation
- Emergency Lighting

7.4. **Operation and Maintenance of Lifts and Escalators**

Guarantee and Servicing - a comprehensive maintenance contract with the lift/ escalator manufacturer ensure that lifts are not overloaded or misused **Statutory Examinations**

Service Contract (Annual Maintenance Contract)

- Comprehensive contract

- Non-comprehensive contract
- Manufacturer's Responsibilities
- Deployment of manpower
- Statutory Approvals and Compliances
- Automatic Rescue Device (ARD) operation - This should be provided in accordance with Part 8 'Building Services', Section 5 'Lifts, Escalators and Moving Walks: 5A Lifts' of the Code.
- In Door Safety (Sensor) Operation
- Man Entrapments Rescue Operation
- Rescue Operation Procedure, and
- Maintenance schedule laid down

7.5. **Maintenance of Fire Fighting Systems**

- Deploy adequate number of trained people to man the systems and also ensure adequate budgetary support.
- All fire exits and staircases are to be kept free from any form of obstruction to allow easy egress of occupants'.
- Smoke extraction fans, fire dampers in HVAC systems should be periodically (at least a fortnightly check is desirable) run and tested.
- Hold regular mock fire fighting drills to make people aware of the systems installed, the location of nearest exits, etc.
- Regular maintenance of fire extinguishers.
- Maintain log book for recording details, including causes of all the alarms.
- Proper functioning of the fire pumps. Regular maintenance of these pumps.
- Periodic check of all Fire installations such as Internal fire hydrants, Hose reels, External fire hydrants, etc.

7.6. **Roads and Pathways Maintenance and Upkeep**

Roads to be well planned and foot paths/ pavements provided should be at a standard height (usually 150 mm) above the road surface.

External Services

Storm water drains, -Proper survey, and outlets for the rain water should be ensured.

Ease of Movement - foot paths/ walkways are easily approachable and are user-friendly especially to elderly people and persons with physical disabilities.

7.7. **Maintenance of Landscaping and Horticulture works**

- Care of Planted Area
- Shrubs and vines
- Groundcover
- Weed control
- Mulch and/or rock layer
- Lawns
- Irrigation – Water Application and Scheduling Irrigation system scheduled maintenance Chemicals, Pesticides and Herbicides

8. OTHER SIGNIFICANT FEATURES

8.1. House Keeping

Methodology and Processes to be adopted

- All local laws and regulations are to be abided by, and the required protocols of cleaning for all areas of the building and cleaning schedules for building are implemented.
- Periodicity of the activities can be classified into: daily, weekly, monthly, or annually.
- Safe Chemicals only to be used.
- Non-conformance to Service Level Agreement (SLA) may be classified as High, Medium, and/ or Low.
- Facility management team to set benchmarks for measuring performance and non-compliance

8.2. Pest and Rodents Control

Integrated pest control management encompasses prevention, monitoring, and control techniques with larger goal of suppressing pests by application of least toxic measures

- Prevention techniques
- Elimination of ingress points
- Monitoring techniques
- Control techniques

8.3. Security Services

Methodology and Processes

- Categories of physical security measures used to protect buildings
- Crime Prevention Through Environmental Design (CPTED);
- Physical barriers and site hardening;
- Physical entry and access control;
- Security lighting;
- Intrusion detection systems;
- Video surveillance;
- Security personnel; and
- Security policies and procedures

8.4. Solid Waste Management Planning

- Waste Prevention Strategy
- Recycling and Reuse
- Treatment and Disposal

Guiding principle for solid waste management:

- Minimize waste generation;
- Reuse and recycling of waste;
- Waste segregation; and
- Waste disposal

8.5. Construction and Demolition Waste Management

Responsibility of the Waste Generator

a) Waste generator responsible for collection, segregation of concrete, soil and other such materials and storage of construction and demolition waste generated.

b) The generator should ensure that other wastes do not get mixed with this waste and it is stored and disposed separately. This waste should be segregated as specified

9. BUILDING MANAGEMENT SYSTEMS (BMS)

BMS can control the following key operations:

a) HVAC Systems, which include air handling units, fan coil units, chillers, pumps and boilers;
b) Lifts (normally used to gather information about location/ movement of lifts);
c) All equipment having variable frequency drives (VFD);
d) Lighting systems
e) Water Supply Systems including boilers, water treatment plants, water supply pumps, etc;
f) Sewage Treatment Plant (STP), Effluent Treatment Plants (ETP);
g) Medical and other gas supply system;
h) Access Control System;
i) Ventilation System
j) Fire Alarm & Suppression, Fire Fighting Systems (Sprinklers, Hydrants)

BMS will have a very larger impact with green buildings becoming popular since it helps to continuously monitor 24x7 all the facilities/ services on their operational parameters. ***What gets measured gets managed.***

10. 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

Facility Handbook

- A compilation of records of the asset/ facility, which can be stored and retrieved electronically, as well as reproduced on paper,
- Easy to update contents,
- Contents to be detailed enough,
- History,
- Drawings, and
- Specifications & Schedules

Asset Register, O &M MANUALS

Asset Register is an important document and should be maintained for each asset and kept updated. To record any modifications/ alterations done during life time of the asset/ facility. An organization should include other information and data as might be necessary in the form of a register of its assets/ facility.

Operating and Maintenance Manuals

- Should be prepared as reference documents even for existing installations where no such information exists.
- To be reviewed and updated annually.

11. CHECK LISTS

In order that the activities of inspection/ maintenance of assets may be carried out systematically in a comprehensive manner, certain check lists/ proforma may be made available. While these may vary from asset to asset and organization to organization, a few examples of the activities to be covered are given below:

To ensure systematic inspection/ maintenance of assets, pre-determined check lists/ proforma may be used. These may vary from asset to asset and organization to organization.

ANNEX A: Common Causes for Maintenance Problems
ANNEX B: Format for Inspection Report
ANNEX C: Typical Norms for Employment of Workmen for Day to Day Maintenance of Buildings
ANNEX D: Methods of Operational Checks for STP
ANNEX E: Guidelines for Maintenance of Electrical Equipment
ANNEX F: Format for Preventive Maintenance Profile of Lifts
ANNEX G: Typical Checklists for Maintenance of Lifts
ANNEX H: Typical Check List for Landscape Areas
ANNEX J: Typical Template for Housekeeping of Hotels

12. CONCLUSION

12.1 Asset and facility management both perform corresponding management functions such as:

- Strategic Planning
- Risk Management
- Service Management
- Financial Planning and Control
- Performance Management
- Quality Management
- Change Management
- Project Management
- Energy Management
- Outsourcing
- Benchmarking, etc.

12.2 Asset/ Facility management is a multidisciplinary approach for designing, planning and managing in an integrated and coordinated way all non-core support services necessary for an effective and efficient execution of the organization's core activities.

It aims at minimum risk, desired level of customer service, lowest life cycle cost and improved quality of life of people while achieving its organizational strategic plan.

12.3 **Organizational Structure of an Asset and Facility Management**

- Assess number of persons required at field level and supervisory levels for each discipline.
- Select personnel with adequate and relevant expertise in each of the concerned disciplines at various levels.
- Make personnel at various levels aware of their roles and responsibilities.
- Put Information communication system in place to ensure activities specified for asset/ facility management have been duly carried out at all levels.

13. ACKNOWLEDGEMENT

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ASSET MANAGEMENT IN ENGINEERING WORKS

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1. Introduction

Asset Management in Engineering works is the integrated, multidisciplinary set of strategies in sustaining public infrastructure assets such as public health systems- water sources, water extraction, conveyance and treatment systems, waste water collection treatment and disposal systems, waste collection and disposal systems; transportation systems -roads, highways, bridges, railways, airports and ports; irrigation, power plants, dams, power transmission and distribution, communication systems, fire detection and fighting equipment, etc.. Generally, the focuses is on the later stages of a facility's life cycle after construction specifically maintenance, rehabilitation, and replacement. Asset Management specifically uses multiple tools to organize and implement these strategies with the fundamental goal to preserve and extend the service life of long-term infrastructure assets which are vital underlying components in maintaining the quality of life in society and efficiency in the economy.

The poor conditions and shortcomings in the performance of the physical infrastructures have increasingly been in the news and it has been advocated that appropriate financing, planning, operating and maintaining of these multi-domain, complex and interdependent systems be done. It is widely recognised that infrastructure concerns are not only due to a shortage of investment but also to a lack of fundamental knowledge and metrics for describing the valuation, condition and performance of these systems.

2. Historical Study of Asset Management

In a retrospective approach to assessing the sustainability of the Grand Canal of China, Tseng et al. explored a methodology to assess the sustainability of China's Grand Canal through use of historic-geographic data compiled and analysed into an historical sustainability index. In the another paper titled, 'Algorithms for bottom-up maintenance optimisation for heterogeneous infrastructure systems', Yeo et al. developed a bottom-up method for optimising infrastructure maintenance where the infrastructure is heterogeneous and composed of multiple sub-systems. In a criticality-based approach to bridge performance data collection and monitoring, Bush et al. combined risk and critical approaches to prioritise data within knowledge management of bridge infrastructure. Van der Velde et al. presented a European case study of asset management focusing on the interchange between asset owner, asset manager and service provider, for achieving a preferred market outcome in, 'A holistic approach to asset management in the Netherlands'.

In a US-based case study of bridge management, 'Designing bridge maintenance on the network and project levels', Yanev and Richards used a data-based approach to demonstrate the importance of preventive maintenance on the life cycle costs of bridges within short and long-term maintenance timeframes and within the context of reducing preservation and reconstruction costs.

The first published use of the term **asset management** to refer to physical assets is not known for sure. The earliest adopter known for certain is Dr. Penny Burns in 1984. The New Zealand Infrastructure Asset Management Manual published in 1996 is an early use of the specific term infrastructure asset management. The term "asset management" was first used in a document published in 1983 by the United States Department of Transportation, Federal Highway Administration entitled: Transportation Resource Management Strategies for Elected Officials of Rural Municipalities and Counties. That document consisted of seven chapters of resource management strategies for each of two types of transportation infrastructure - roads & bridges and public transportation. Each of these two parts of the document focused on the following seven categories: Planning, Prioritization, Contracting Out, Innovative Finance, Human Resource Management, Asset Management, and Performance Measurement & Reporting.

3. Present Status

After decades of capital investment in infrastructure the need to sustain such infrastructure experiences mounting challenges. The current duress includes tight state and local budgets, deferral of needed maintenance funding, and political pressures to cut public spending. Today, shrinking appropriations, progressively aging capital stock, and parochial statuses and interest groups have inhibited flexible procurement strategies. Besides, with the rise of design firms, professional societies, licensures, construction and industry associations, and related specialties, the management of the infrastructure system has dramatically altered. As a result, the life cycle of a facility, including Planning, Design, Construction, Operations, Maintenance, Upgrading, and Replacement, has become bifurcated between agencies and firms where Design and Construction becomes contracted separately from Operations and Maintenance. The push for more dual-track strategies and not segmented ones such as Design-Build and Build-Operate-Transfer helps in maintaining public facilities. Yet, over time, the government apparatus focused more on start-up capital expenses for constructing public assets without focused monies on maintenance.

The situation of asset management of engineering works in India is in a very bad state. The main thrust by Governments is only on Capital expenditure leaving behind the priorities of asset management.

Indeed, it is now recognised that decisions involving infrastructure planning, financing and investment may lead to many unintended consequences over different time-scales. While the need for a systemic and transparent approach to infrastructure decision-making is recognised, and even the term 'asset management' borrowed from economics and finance to describe such an approach, there are still major challenges to be faced before a set of universal principles could be formulated for applying asset management. Asset management is a complex paradigm, requiring stakeholder consensus on the values, policies, strategies and tactics related to infrastructure services, performance metrics and associated management risks trade-offs. No single discipline and certainly no one sub-discipline is equipped to address these problems single-handedly. Knowledge from a multidisciplinary group of engineers, scientists and stakeholder representatives from academia, government and industry are needed to develop consensus definitions and principles for infrastructure asset management.

4. Processes Involved

The basic premise of infrastructure asset management is to intervene at strategic points in an asset's designed life

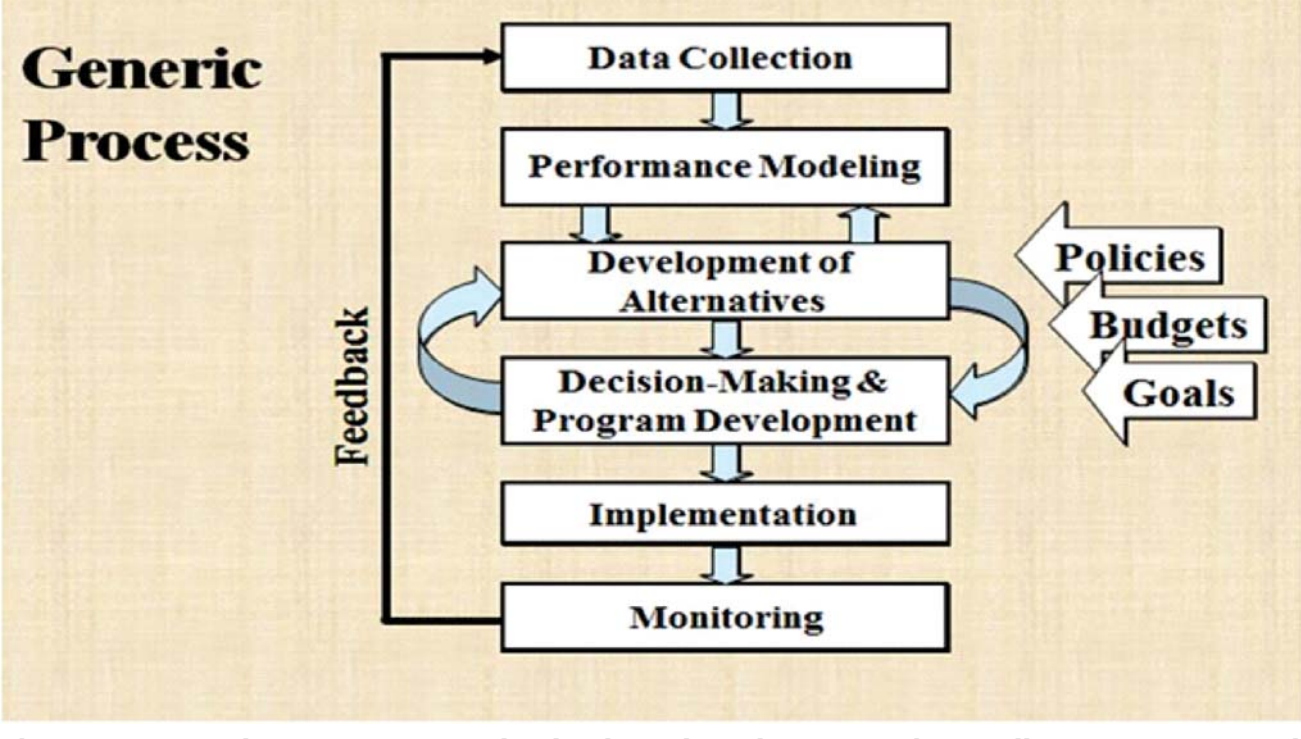
cycle to also extend it where appropriate, and thereby maintain its uesfulness. Typically, a long-life-cycle asset requires multiple intervention points including a combination of repair and maintenance activities and even overall rehabilitation. Costs decrease with planned maintenance rather than unplanned maintenance. Yet, excessive planned maintenance increases costs. Thus, a balance between the two must be recognized. While each improvement raises an asset's condition curve, each rehabilitation resets an asset's condition curve, and complete replacement returns condition curve to new level or upgraded level. Therefore, strategically timing these interventions would aid in extending an asset's life cycle. A simple working definition of asset management would be: first, assess what you have; then, assess what condition it is in; and lastly, assess the financial burden to maintain it at a targeted condition.

Essential processes for asset management for engineering works include the following:

(a) Maintaining a systematic record of individual assets (an inventory)—e.g., acquisition cost, original service life, remaining useful life, physical condition, repair and maintenance consistency.

(b) Developing a defined program for sustaining the aggregate body of assets through planned maintenance, repair, and replacement.

(c) Implementing and managing information systems in support of these systems, which would inter alia include a comprehensive and continuously updated data base linked to a Geographic Information System.



These processes and activities are interrelated and interdependent aspects that usually cross organizational boundaries including finance, engineering, and operations. Hence, asset management is a comprehensive approach in handling an immense portfolio of public and private capital stock. As example, in 2009, the IBM Maximo software was adopted to manage the maintenance of rolling stock and facilities for three railway systems: the Long Island Rail Road, San Francisco BART system, Washington Metrorail. Also, recently, wireless sensors, totaling 663, have been installed on South Korea's Jindo Bridge to detect structural cracks and corrosion. Though

in a testing phase among three universities in South Korea, United States and Japan, the use of wireless technology may lend itself to future, cost-efficient asset management.

In 2014 ISO published an international management system standard for asset management. The ISO 55000 series provides terminology, requirements and guidance for implementing, maintaining and improving an effective asset management system.

5. (a) Comprehensive Infrastructure Asset Management

Organisational readiness relies on the systems and processes put in place to achieve strategic, tactical, operational, and maintenance excellence. Risks associated with performance goals, aging infrastructure, and the environment must furthermore be managed in order to ensure sustainable service delivery. The following key variables are of common concern in a complex infrastructure asset management landscape:

- Aging infrastructure
- Rapid growth of demand
- Geographic expansion
- Unplanned outages from overloaded infrastructure (limited redundancy)
- Constrained capital investment for refurbishment
- Higher maintenance costs compounded by poor preventative practices
- Unavailability of resources to optimise responses to crises

As a result, traditional asset management activities need to evolve into a comprehensive, standards-driven management approach across all facets of an organisation.

(b) Current Practices

National Building Code of India 2016 (NBC-2016) - SP 7; 2016, Volume -2 – Part 12 covers Asset and Facility Management. All asset and facility management services in permanent or temporary buildings, including mechanical, electrical and plumbing services relating to building, maintenance of landscaped areas are covered. It also includes all operations/efforts required to ensure that the asset/ facility continues to meet the requirements which were set for it during design stage. The maintenance of bulk service required for towns and cities are not covered in this part.

The present practice in for roads and highways is laying overlays such as surface dressing. Overlays at defined periods on highways are not being implemented. Similarly in buildings, treatment period has been assigned for different items in a building. Unfortunately, in view of scarcity of financial resources, the condition of assets go from bad to worse resulting in reconstruction or rehabilitation/ retrofitting of assets at a much higher cost apart from creating a lot of inconvenience to asset users.

(c) A Technology-Driven Systems Approach

For instance, the Integrated Quality Management System (IMQS) utilises an end-to-end value led approach that looks at the core industry needs from a people, process and system view. All these elements are critical in changing an organisation into a top performer.

The approach takes cognisance of the notion that technology is an enabler or catalyst as opposed to the complete solution.

IMQS recognises five levers of change:

- Industry best practice process
- Change management and organisational design
- World class benchmarking and continuous review
- Business strategy and technology alignment
- Value-driven systems that are fit for purpose

The previous BSI's Publicly Available Specification (PAS) 55 and now ISO 55000, helps organisations apply structured, good practice-based disciplines to their asset management capabilities. The IMQS systems approach aims to leverage 'fit for purpose' software solutions integrated to enable all aspects of the organisation and ensure Optimised asset utilization, Uptime, Reliability and Overall performance.

This approach provides a truly integrated view of the full asset life-cycle management process - from planning through to asset creation and ultimate disposal. With the strategic deployment of technological solutions, smarter systems can be constructed that assist in ensuring every resource is correctly and optimally utilised to reach strategic objectives.

(d) The Business Relevance

Investment forecasting is crucial when analysing and determining criticality and project optimisation of physical asset needs. Given the diversity and large amount of data involved (master planning, replacement prioritisation, IDP), this endeavour requires due diligence. By applying the principles of this methodology, organisations should be able to improve Opex and Capex assignment with a view on long-term sustainability.

The IMQS integrated platform allows multiple data sources to be interrogated to determine the probable, technical, and operational risks versus the benefits of such a capital investment. Together with strategic future planning, this analysis improves the organisation's ability to prioritise portfolio items and projects. The organisation is ultimately able to effectively use available resources to improve return on assets.

6. Importance of GIS/ GPS Referencing

Public asset management expands the definition of Enterprise Asset Management (EAM) by incorporating the management of all things which are of value to a municipal jurisdiction and its citizen's expectations. Public Asset Management is the term that considers the importance that public assets affect other public assets and work activities which are important sources of revenue for municipal governments and has various points of citizen interaction. The versatility and functionality of a GIS system allow for the control and management of all assets and land-focused activities. All public assets are interconnected and share proximity, and this connectivity is possible through the use of GIS. GIS-centric public asset management standardizes data and allows interoperability, providing users the capability to reuse, coordinate, and share information in an efficient and effective manner.

Among the GISs in use for infrastructure management in the USA are GE Small world and ESRI. An ESRI GIS platform combined with the overall public asset management umbrella of both physical *hard* assets and *soft* assets helps remove the traditional silos of structured municipal functions which serves the citizens. While the hard assets are the typical physical assets or infrastructure assets, the soft assets of a municipality includes permits, license, code enforcement, right-of-ways and other land-focused work activities.

7. Financial Options

(a) A recent article in Governing magazine, in USA, gives another good reason why investing in asset management can be beneficial. In this article, Justin Marlowe discusses the benefit of using the modified approach for calculating the value of infrastructure required in annual GASB (Government Accounting & Standard Board) reports of USA. Under GASB standards, governments can either subtract a standard portion of their infrastructure's value each year to account for depreciation (the traditional approach), or they can regularly assess the condition of the infrastructure, invest in maintenance to keep it in good condition, and then report the amount of money they have invested in maintenance (the modified approach). Using the modified approach, the assets don't have to depreciate in value like they would in the traditional approach. Investors appear to prefer trading from governments that use the modified approach "Governments that use the modified method trade at much narrower price ranges compared to bonds from governments that depreciate. In other words, when a government uses the modified approach, investors are much more likely to agree on how to price its bonds. For governments, this can ultimately translate into lower bond interest rates." (excerpted from "Selling Your Sewer's Story – Financial statements can make the best case for public works investors")

Very few governments at the state and local level actually use the modified approach, so with a lower supply, the demand for such investments would likely be stronger yet.

(b) **Adrenne Vicari, P.E. [http://www.hrg-inc.com/portfolio-item/Adrienne-m-vicari-p-e/],** is the financial services practice area leader at Herbert, Rowland & Grubic, Inc., a civil engineering firm that serves local governments and authorities in Pennsylvania, Ohio, and West Virginia. Ms. Vicari has assisted numerous municipalities and water and sewer authorities with the creation of asset management programs that have created increased value and lowered costs for clients.

It enables an Authority to better understand and manage the relationship **BETWEEN COST AND PERFORMANCE**

Benefit Value = Performance / Cost of Service Delivery

Where: Performance = Σ level of service; condition, availability, safety, etc.

8. The Way Forward

(a) In unpredictable management environments, access to and interrogation of information are integral. Quality information is turned into the intelligence that informs critical decision-making.

The IMQS system establishes a solid planning baseline that informs the long term quantification of asset needs and impacts. It opens up the possibility to project future costs and options to offset future asset failures. It offers a comprehensive view of the entire infrastructure asset landscape. With an improved understanding of maintenance frequency or the analysis of the probability and consequence of the likely failure modes, more reliable upgrade and renewal plans can, for example, be determined.

(b) There is a need to closely monitor the condition of assets so as to treat them at an optimum stage and prolong its life.

(c) Innovative options for financing to manage all the assets in a healthy state are the need of the hour. Reducing salary expenditure, innovative models of earning revenue for different services and enforcement of collection of taxes and charges of services need to be implemented meticulously.

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Sustainability and Competitive Advantage

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In an ever increasingly challenging global economy, businesses are more focused than ever on conceptualising and implementing strategies to help their enterprises sustain a competitive advantage. More and more firms are now considering how the assets they own and occupy impact the challenge to achieve a competitive advantage. Detailed consideration of the firm's management of built environment assets should become a keystone principal in an overall competitive advantage sustainability plan.

Built environment assets impact the health, well-being and productivity of the people who occupy them as well as the environmental stability of our planet. Additionally, built environment assets affect the firm's bottom line due to their operating costs - costs that can vary greatly depending on the quality of the design and construction of the asset as well as the quality of the facilities management, occupant education and their feedback post-occupancy.

There are many compelling reasons to consider built environment asset management. According to Felix Oberholzer-Gee of the Harvard Business School, climate change has now become a threat to long-term competitive advantage. Whether this is from reputational risk to not managing the carbon footprint of assets, excessive operational costs, or from direct system impacts due to extreme weather events that destroy markets, energy intensity in business must be given proper attention for risk management purposes. Often hidden within the built environment assets that firms occupy are opportunities for enhancing the bottom line and longevity of success. Tapping these opportunities, however, requires more than green-building rating initiatives. Deep diving into an integrated management system inspired by the framework of a detailed CEO sponsored Energy Management Plan is the first step.

For achievement of the desired triple bottom line impact, the saying "the devil is in the details" is very appropriate when implementing an Energy Management Plan. Best practice and return on investment in energy management come from a cycle of continuous improvement that starts during design and construction and is continued during operations. Historically Energy Management Plans have been focused on how to operate buildings once constructed. It is recommended that the CEO's Energy Management Plan should consider design and construction activities of new buildings and all major renovations of assets in addition to addressing operations.

Ideally, the high-performance attributes of any building in a firm's built environment asset portfolio are established at the start of the design concept, carefully developed through detailed design and then protected throughout construction. This is traditionally how a green building is developed. However, the design and construction of a green building is not enough to ensure sustainability. For example, a CEO may believe that if all new construction or major renovations of buildings that the firm own or lease space in are built in compliance with a third-party green building rating system (such as LEED, BREEAM, GREENSTAR) or are meeting energy efficiency design codes, that adequate diligence has been applied. He or she may assume that the green building rating will guarantee energy efficient and cost optimized operations, healthy occupants and avoidance of the reputational and commercial risk of being burdened with a building that could someday be labeled a stranded asset. However, unless an adequate quality assurance function has been put in place both within the design and construction

process as well as during operations, the green building rated assets may fail to perform sustainably regarding their energy use, water use and the indoor environmental quality that end-users experience.

Such failure to perform in green-rated built environment asset is called “a performance gap”. The CEO’s Energy Management Plan can assist in avoiding a performance gap by encompassing strategies for every phase of the building’s lifecycle and therefore act as the catalyst for quality assurance in the asset.

Why the Performance Gap?

There can be many contributing factors that cause a performance gap in a green building. The following points detail some prime suspects that can reduce the performance of a built environment asset.

- **An accurate basis of design is lacking**

The potential likelihood of a performance gap may start early during the design of the building, where there may not be enough detailed engagement between the building developer and the designer about what the buildings end-use will realistically be. For example, plug loads are a significant area of energy use in buildings and rarely considered in great specificity by a design team- unless an owner goes into focused detail within the owner’s project requirements to illuminate them of this fact. Codes do not require an owner to disclose this information. Plug loads can cause a building to have a performance gap in operations.

An Energy Management Plan can help avoid costly omissions by requiring that on all new build or major renovations of build assets that the basis of the design includes what the key operational priorities of the building are. In this way the reality of the use of the building-such as plug loads- will be understood by the design team and this can be reflected in the project sustainability criteria.

- **Value engineering destroys sustainable performance value**

As the design progresses toward construction, value engineering exercises may take place that unwittingly “devalue” some of the synergistic systems in a green building that in their integrated state produce high performance, but when a piece of the system is substituted with a cheaper alternative, the efficiency of the system is marginalised. Value engineering is intentioned to be an exercise to provide better value by redesigning without exceeding a cost; or, to reduce the cost of a solution by re-engineering without moving away from key project performance requirements. Sustainability Principal Ioannis Spanos, KEO notes, “unfortunately Clients frequently see VE as the last-moment-solution to reduce project costs, and proper consideration is not given to performance.”

Building Physicist Michael Aghabi, KEO concurs, “VE exercises sometimes take place very late in the design stage, and can have large implications on the performance of a building. I worked on a hospital design project, where the owner decided to change the mechanical plant system from a high-performance water-cooled chiller system with VSD pumps to an inefficient air-cooled chiller system with constant speed pumps. The energy penalty for such a change, as shown by our energy models, was greater than 30%.”

On paper, this change might have produced a cost saving from a capital investment point of view. However, over the life of the building, this was likely not a strategic decision.

The CEO’s Energy Management Plan should require that life cycle cost analysis is incorporated into the budgeting, design, engineering, and approval process of all new buildings and major renovations. Value engineering activities should be conducted by professionals who understand green building performance strategies and be tasked to ensure that value engineering doesn’t devalue sustainability.

- **Facilities management isn't involved in the Integrated Design Process**

Another possible contributing factor to an eventual performance gap within the design phase activities is not including any senior representative from the facilities management department as part of the integrated design process to collaborate with the design and engineering team. A candid discussion about an organisation's practices related to facilities management in their portfolio of buildings or prior history of leasing or ownership of a single building is invaluable. If a firm is not able to maintain any permanent facilities management staff, for example, and relies entirely on contracted facilities management support, system choices for energy optimisation may need to be different than for an organisation that can keep a Director of Engineering or Facilities Management on the payroll. "Smart building" applications, when not maintained correctly by skilled professionals, can have a negative impact on the buildings electricity budget and contribute to higher energy intensity.

The CEO's Energy Management Plan should require the inclusion of either the firm's facilities management professionals or facilities management consultants into the design of all new buildings and major renovations.

- **Marginal construction practices**

Also noted for reducing built environment asset performance, can be the improper construction of a properly designed green building. If the design and engineering team uses best endeavours to create a building that is fit for the end user only to have the contractor alter the design that is constructed, negative performance impacts can occur. Delivering a green building to achieve its high-performance attributes requires constant supervision of the contractor's team, ideally by a specialist sustainability site engineer or a third-party sustainability specialist contracted directly to the owner. Frequently by the time a building arrives at the construction phase, an owner is already looking to reduce budgets on professional service costs. They may see the additional cost of a sustainability specialist as something that is no longer needed. They or their third-party project managers may say "the building was designed to be green so why do we still need those specialists during construction?" If the green design isn't constructed to embody the sustainable attributes that were part of the design, performance gap can result.

As part of squeezed budgets, inadequate testing may be conducted during construction to prove that the built asset's envelope is constructed correctly. Senior Commissioning Manager Michael Campbell, KEO notes that having thermographic tests for air leakage is critical to delivering high performance. Although this testing does add some modest soft costs to a project, it is also insurance for correct performance. Campbell points out that the most efficient mechanical systems will underperform if the envelope isn't sound.

The most impactful Energy Management Plans will include budgetary provisions for specialists to conduct witnessing and testing during construction of the asset as well as during operations. The skills of an independent commissioning authority for comprehensive commissioning of the building needs to be part of the construction process, and after occupancy, monitoring-based commissioning is critical to maintaining performance during the operations of the asset.

- **Lack of monitoring and feedback after occupancy**

Say that a developer does all the right things to have an optimised green building during the design and construction phases but then never does follow up activities/ studies on performance success or failure after the building is operational. Activities such as occupant education, monitoring and feedback following occupancy are also critical for the highest performance of the built environment asset and should be articulated in the CEO's Energy Management Plan. Sustainability Manager Shakir Ismail, KEO notes that influencing better occupant behaviour is key to helping bridge the performance gap and can have significant value for the asset owner/ occupier. In addition to Ismail's own experience improving existing building performance, he points to the abundance of peer-

reviewed literature and case studies which confirm that stimulating better occupant behavior can yield anywhere from 40-60% improvement in energy performance for office buildings when strategies such as community-based social marketing models are employed together with active systems (like occupant feedback systems).

There are numerous resources available on the web for samples and templates of Energy Management Plans focused on operational activities for built environment assets. A firm can begin their journey toward the creation of a customised CEO sponsored Energy Management Plan by nominating an internal champion and having them familiarise themselves with these resources and associated case studies. Then the expertise of a skilled green building consultant with additional experience in energy auditing and commissioning can be sought out. Through iterative communication with the consultant and internal stakeholders, a plan should be created which will be a live document, covering typically a three to five-year period. Like any plan, the Energy Management Plan only provides value if the plan, act, do check cycle is robustly adhered to with document revisions incorporated and implemented each year.

Public-Private Partnership in Public Utilities through Privatization:

Some of the methods are:

Management Contracts: Management contracts are also a method of privatization through PPP. The key issues in success or failure are whether performance is related to the contract terms and whether managers have true autonomy in hiring and firing. Management contracts privatize management, leaving ownership in the hand of the state. The results of management contracts have shown remarkable improvement in productivity and profitability in some countries. This method is also less controversial since ownership continues to remain in the hands of the state.

Lease Contract: Lease contracts are of different types, varying mainly by who is responsible for financing the project. Under straight forward leasing (sometimes called afterimage) the contractor or lessees pays the public owner a fee for the right to operate a public facility and bears the financial risks of its operation. This method is widely used in power, ports, urban transport, waste disposal and industry. Of late, this method has been in vogue in state run transport, water and electricity departments in India and Bangladesh.

Concession: Concession is also termed as build operate transfer (BOT) and build operate own (BOO). This involves longer contractor responsibility than leases. They also last longer normally within 15 to 30 years. Water supply, waste disposal, toll roads and ports are among the common areas of usage. Lease and concession are same in the resonance but different in practice on the basis of the time factor. If government is really looking for a change in responsibility but at the same time also trying to retain the ownership then all these methods are easy to work with. Lease contracts are very popular in developing country because it cannot provide any great political obstacle on the way of privatization. Government can stop anybody if it does not generate any positive move. India and Bangladesh both are practicing the method of concession in various public utilities.

Contracting out: This is a process whereby government hires, under contract, a private firm to perform, over a defined period of time, some specific service that might otherwise be provided by public employees using government equipment and facilities. According to Attiat and Hartly (1991), contracting out is identical with outsourcing or subcontracting. This method is widespread in public sector service provision. It is an extremely diverse form of privatization, especially common for municipal service, and is widespread in the United States. This method is creating right buzz even in a country like India.

(Source: Excerpted from paper on 'Public-Private Partnership in India's Urban Water Public Utilities: A Case of Sonia Vihar Water Project' by Nalin Bharti & G. Ganesh)

VALUATION FOR ASSET MANAGEMENT IN INDIA

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INTRODUCTION

Valuing assets provides accurate and timely information for better understanding of how to capture the enduring value in any class of assets to not only maximise profit, but also increase revenues and thus provide a much needed breathing room on balance sheets, which if not incorporated may lead to confusion, missed opportunities and increase the risk of failure. The general belief of a common man is that the value of an asset or a property can be easily worked out by multiplying Area of premises with prevalent Market Rate in the locality: AREA x RATE = VALUE of the asset/ property. However, this is not the actual scenario as there are innumerable known and unknown forces operating in the Real Estate Market which includes Demand and Supply aspect, Paying Capacity aspect, Builders and Mafia links, Imprudent Purchasers paying fancy prices, Dual interest rates in market, Black Money aspect, Unauthorized constructions, Second hand concept, Leasehold properties, etc. Valuation by the simple formula (Market Approach) is only one of the methods of valuation. In a number of cases this formula will not work. If the asset or premises is tenanted, licensed or leased, this formula will not work. Even for factories, schools, bungalows, and shopping mall also this formula will not work. A Valuer will be required to adopt other Valuation Methods to estimate the correct value of these types of assets/ properties. An asset may be tangible assets or intangible assets. Tangible assets contain various subclasses like Current Assets and Fixed Assets in which Current Assets include inventory, but fixed assets include such items as buildings and equipment. Intangible assets are nonphysical resources and rights which include goodwill, copyrights, trademarks, patents and computer programs, and financial assets like items as accounts receivable, bonds and stocks. There is no end to intricacies in field of valuation of Real Assets and the subject of Valuation of Assets *per se* is so large that a whole book can be written on it. However, this paper aims to bring out some of the Valuation aspects and issues involving financial aspects Asset Management of physical assets.

BRIEF DISCUSSION

As early as in July 1948, Justice Viscount Simon of the House of Lord, Great Britain held that "*Even if asset is difficult to value, none the less it is of a money value. Hence the best possible valuation must we made. Mathematical certainty is not demanded nor indeed is it possible*." During past several years the situation has not changed. Valuing asset has still remained very difficult. Unfortunately clients and Banks have started expecting mathematical precision in valuation of Real Estate. Any asset/ property must have four basic qualities **Utility – Scarcity –Demand – Transferability,** to have a value. If the property has no use or no utility, no one would want it and hence there would be no demand and no value. The next quality required for value of the commodity/ asset is that the property has to be scarce in supply. Air, Sunlight and River water are available in abundance hence of no value but when they are supplied through electric fans, electricity or municipal tap they are scarce and hence carry value. Similarly transferability is an essential quality to have value. If ownership of a property is not transferable, no Bank would advance any loan to the borrower against non transferable security.

Need for Awareness

Valuing assets depends on several aspects such as (a) Fundamentals & Principles of Valuation, (b) Market Forces like Demand and Supply and black money aspect, (c) Time Factor, (d) Purpose of Valuation, and (e) Selection of Appropriate Method. Physical Asset Valuation (from the financial perspective) is not Physical LAND & BUILDING but the RIGHTS of the owner in Land in Buildings. The fundamental Principal of Valuation is that ***"Full Right Full Value – Less Right Less Value – No Right No Value".*** Value changes with legal rights held by the owner in a property. Changes in holding pattern in the property would change the value of the property. A plot may have a value of Rs. 50 lacs when it is freehold, i.e. 100% rights are held by the owner but as soon as the said owner leases the plot to a lessee on agreed ground rent, the value of his ownership rights would get reduced to say Rs. 45 lacs (Leasehold). An Owner's rights under Transfer of Property Act are given alongside.

Under **Transfer of Property Act**, an owner holds the following rights:

- Right to Use and Enjoy the Property Permanently,
- Right to Rent, Lease, Transfer or Assign the Property,
- Right to Possession and Occupation,
- Right to Alienate or Destroy the Property (building can be destroyed),
- Right to Gift or Will or create Life Interest for anyone, and
- Right to Develop or Permit Development of Property.

All these are called the **Bundle of Rights**.

If an owner retains some rights and parts with some other rights, the value of the property changes. A very senior and experienced Valuer once raised a question about the share of Lessor's Right and Share of Lessee's right in total value of a leasehold land. He further said Courts have given different rulings such as 50:50 share, 60:40 and 30:70 share in total value of land for Lessor's and the Lessee's interests in the land respectively and hence the question. The correct answer to this query would be that the provisions or terms of lease deed would decide share or value of right of Lessor and Lessee's interest in the land. Moreover, the value of an asset/ property would change depending upon the type of value required. An Ownership flat can have five different values on the same day. Book Value (as entered in Balance Sheet) = Rs. 10 lacs; Fair Market Value (as demanded by Banks) = Rs. 60 lacs; Distress Sale Value (required for auction) = Rs. 48 lacs; Statutory Value (as governed by legislation for compulsory acquisitions) = Rs.2 lacs; Special Value (value typically applied to business valuation for a specific investor) = Rs. 69 lacs. The maximum value is realized when the land uses are compatible with VAASTU along with a reasonable degree of architectural harmony present in an asset. The condition of the structure and so also that of the services - electrical, mechanical, instrumentation, plumbing, fire, communication and others would need to be accessed and valued.

Valuation also depends on overall economic condition of the country and Real Estate Market trends with Brokers' information, whether it is Boom period or Slump period along with the number of Documents registered every month at registers office indicating increasing or decreasing sales (this information is now available on internet for some of the states in India). If the stock market is collapsing, investors would be tempted to invest in Real Estate and prices would rise in the Real Estate Market. Valuer must also keep a track on black money force operating in Real Estate Market. In some areas (like Udaipur, Surat, etc.) it may be as high as 80% cash payment (Black Money) , where as in some other areas it may be as low as only 30% or less cash payment in the transaction. Time factor is very vital for valuation. The value changes depending upon date of valuation. For Capital Gain Tax, the value is required as on 1-4-1981 or subsequent date if the purchase is later than April 1981.

Valuer has to find out market trend during the said period. For Bank Mortgage, the Current Market Value is required. It should be remembered that the present value may not be same when the account turns to be NPA after a period of time say 3 or 5 years. All sale transactions taking place in Real Estate Market are not indicative of the Fair Market price. The market is flooded with sales taking place due to different reasons and aspirations of buyers or sellers. Sale price may be Distress Value as seller had to sell property for daughter's marriage. Sale price could be Special Value which is higher than the F.M.V. because purchaser was determined to purchase the flat at any cost due to his desire to stay close to his brother having flat in said building. There are many imprudent and reckless purchasers in the market. They pay fancy prices for different reasons. In Smart Cities where many redevelopment projects are going on, a builder would buy over one flat in 40 or 50 years old building , by paying even 100 % extra price than its real worth. In one case builder paid Rs. 125 Lacs to acquire occupancy right of the sitting tenant of the flat, in an old building, against possession of the premises, even without the permission and consent of the landlord for the transfer of the tenancy rights. This new trend and the latest technique of the builders is known as "*Anchoring The Property*". Once the builder is in possession of even a single flat in the building, he can easily pressurize other occupants/ tenants/ landlord for the redevelopment project in his favor. The sale price in the document could be Speculative Value by the investor/ purchaser who thought that prices in locality would rise by 50% in next year. Price could be Prestige Value as flat purchased was next to flat of celebrity like Amitabh Bachhan or Sharukh Khan. A Valuer has to therefore make proper enquiry before relying even on documented sale transactions. A value of property changes with the purpose of the asset/ property. For e.g. a residential bungalow could have four different values on same day, Sale Purpose=Rs. 510 lacs, Insurance Purpose=Rs. 50 lacs, Taxation Purpose=Rs. 5 lacs, and for Auction Purpose = Rs. 450 lacs. Besides these a concept called Super Built-up Area (S.B.A.) has cropped up over and above the Carpet Area (as defined in Flat Ownership Act). Builders have misused it by arbitrary loading the carpet area into their favor. In case of shops some builders charge loading factor as high as 100% of the actual carpet area. In 1981, in case of K.P. Varghese, the Supreme Court held *"It is well known fact that the determination of fair market value of a capital asset is generally a matter of estimate based to some extent on guess work and despite the utmost bona fides, the estimate of Fair Market Value is bound to vary from individual to individual. The postulate underlying sub section (2) of the act is that the difference between one honest valuation and another may range up to 15%."*

Valuation Approaches

There are three basic approaches available for valuation of any physical asset, namely:

(a) Income Approach Rental Method, Profit Method, Discounted Cash Flow Technique,

(b) Cost Approach Land and Building Method, and

(c) Market Approach Sales Comparison Method, Development Method.

Depending upon the facts and circumstances in each case, the Valuer adopts most appropriate method of valuation. Normally, rented properties are valued by Income Approach. Bungalows and factories are valued by Cost Approach. Ownership flats, offices, shops are valued by Market Approach. There are no hard & fast rules or watertight compartments in selection of any one of these three Methods but averaging two values is totally wrong and not acceptable to court. It should be borne in kind that for Bank Mortgage purpose, the Asset/ Property has to be valued on the concept of "Value in Exchange" or "HABU (Highest & Best Use)" while "As is where is basis" for advancing loans to running units or awarding compensation in LARAR Act or while estimating value of profit making companies on "Going concern" concept in case of mergers and acquisitions. Valuers may rely on and take Brokers information (Intrinsic Value) as basis while preparing Valuation Report for sale and purchase advice to the client or for Bank's Fair Market Value (F.M.V.). While preparing valuation

report for Land acquisition cases and for valuation reports for property disputes which are in court, the Valuer could exclusively rely on the Agreement Values only and not on Intrinsic value. Many Valuers prefer to follow Stamp Duty Rates (also called Circle Rates or Guide Lines Rates or Ready Reckoner rates or District Land Committee Rates or Land Registration Rates downloaded from respective State Government websites) fixed by the State Government, as the basis for the purpose of estimating Market Value. It is a common experience of Valuers that in some locality these rates are fixed lower than the actual rate in the Real Estate Market whereas in some others locality they are fixed higher. Obviously these rates are not reliable and cannot be adopted as a basis. Even the Courts have said so.

Last but not the least, Valuation of properties affected by Coastal Regulation Zone (CRZ) is very difficult as there are restrictions on development on plots falling within 500 meters distance from the High Tide Line. Valuation of properties falling inside a Special Economic Zone (SEZ) also pose a problem in valuation because Plots/ Buildings can be given only on Lease and that too only to export oriented units approved by the Central Government. Development of Large size Township Projects in a city calls for NOC or Environment Clearance from Centre. Valuers must know Environment Impact Assessment Norms and also the likely penalty by the National Green Tribunal for any default, prior to estimating the value of a running Township Project.

In 1979, in case of V.C. Ramchandran, Karnataka H.C. held "*If there is more than one valuation of same property, the one which is reasonable and nearer to correct market value, alone should be accepted*". Selection and application of most appropriate method of valuation in a given case alone is not sufficient. Proper weightage should be given in valuation for all the factors. It is seen that some market forces do exist in a market and that they affect the value of the property but are never considered in a proper manner while estimating the value of the property. The following aspects are required to be considered by a Valuer.

(1) Income Approach: Duel yield rates are prevalent in the Market due to the Indian Legal system. On some properties the expected yield rate is 3% to 5% where as for some other properties it is 8% to 10%. This is perhaps unique in the whole world. Properties given on Leave & License are governed by provisions of the Indian Easement Act. Rent can be increased after licensed period. Investors call it "*Appreciating Asset*" and hence are happy with low return of 3% to 5%. Properties given on Rent are governed by provisions of the Rent Control Act. The Rent is frozen and cannot be increased. Investors call it "*Depreciating Asset*" and hence expect high return of 8% to 10%;

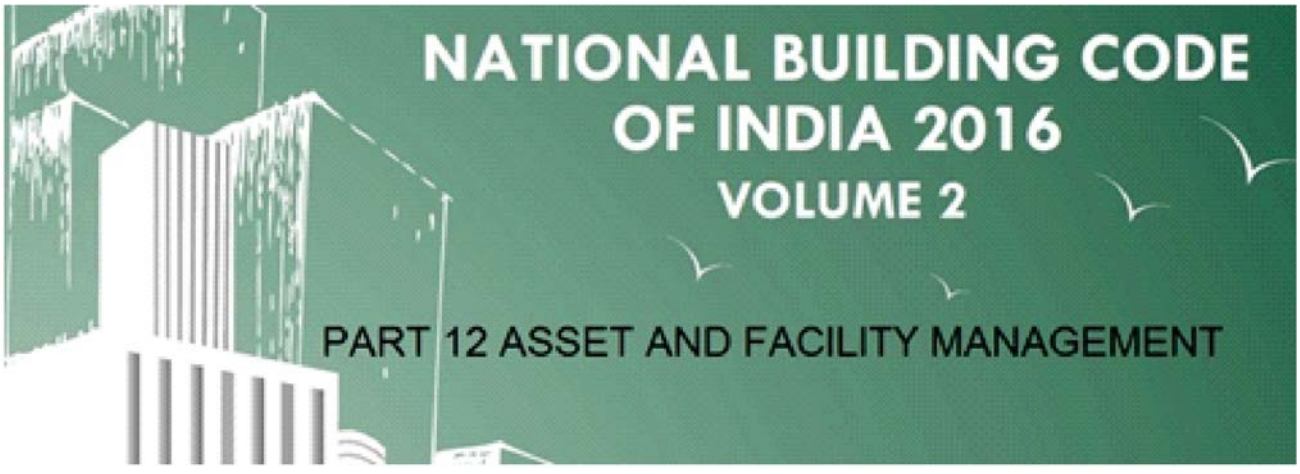
(2) Cost Approach: Demand/ Supply factor on building component. International Valuation Standard Council (IVSC) is of the view that the cost approach is market based (due to the Land component) and it does not consider demand and supply aspect of the market. IVSC therefore recommends this approach to valuation for non marketable properties like Church, Temple, Museum, etc. Though IVS norms prohibits use of Cost Approach for bungalows and factories, yet in India, 60% of Bank Valuations are done by applying Cost Approach i.e. Land and Building method of valuation; and

(3) Market Approach: Second hand concept operating in Market. Second hand factor is wrongly mixed up and clubbed by Valuers with Depreciation aspect or Age Factor or Obsolescence Factor.

Asset Management under National Building Code of India-2016 & SARFAESI Act

The Operation and Maintenance of a physical asset is known as Asset Management or Estate Management, not to be confused with Project Management or Construction Management.

Asset Management has recently been introduced in Part 12 of the National Building Code of India 2016 which calls for continuous maintenance and performance assessment of the built environment with the sole aim that



maintaining assets yield value unless or otherwise they turn into Non Performing Assets (NPA) i.e. ceases to generate income for Banks. Gross NPAs of Indian Banks have risen from Rs.1.4 lakh crores in March 2012 to Rs.7.9 lakh crores in March, 2017 after staying below the Rs.1 lakh crores mark between FY2006-FY2011. Prior to the 1990s, the banks had a really hard time recovering the bad loans due to NPAs because the borrower would often file a frivolous case in the Civil Court and the proceedings could go on for years. So the Government of India (GOI), to curb this menace, started the Debt Recovery Tribunals (DRTs) in 1993. Then the borrower had to go to the DRT and could not approach the Civil Courts. This gave temporary relief to the banks but as the DRTs got clogged with excessive cases it was unable to work efficiently and ended up being a failure. In 2002, GOI came up with the *SARFAESI (*Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002*) Act* to crack down on the defaulters.

The Government had approved a Bill to amend the *SARFAESI Act*- The Enforcement of Security Interest and Recovery of Debts Laws (Amendment) Bill, 2011. By these amendments the Banks and Asset Reconstruction Companies (ARCs) which was constituted specially for this purpose would be allowed to convert any part of the debt of the defaulting company into equity. The amendments also allow banks to bid for any immovable property they have put out for auction themselves, if they do not receive any bids during the auction. In such a scenario, banks would be able to adjust the debt with the amount paid for this property. This enables the bank to secure the asset in part fulfillment of the defaulted loan. Banks can then sell this property to a new bidder at a later date to clear off the debt completely.

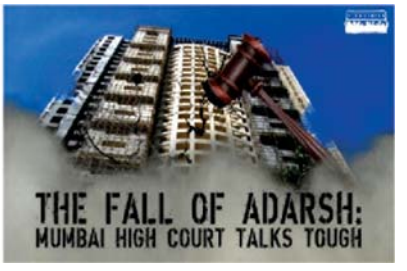
Case Histories

Bankers/ Courts invite Valuers to suggest Reserve Price of property to be auctioned through REVALUATION under S*ARFAESI Act* but whose frequency is mentioned in Para 31 of IndAS16 stating that "*Revaluation shall be made with sufficient regularity to ensure that…"* which is in line with Part 12 of NBC 2016. Most Valuers recommend 15% to 25% deduction on Fair Market Value for forced sale value of the property. There is hardly any authentic public data on this issue. As an example: Vijay Mallya's King Fisher House near Mumbai Airport (17,000 sqft built up Office premises) was put up for Auction in March 2016 by a Consortium of 14 banks headed by the State Bank of India. The Reserve Price was fixed at Rs. 150 crores in March 2016. There was not a single Bid. In August 2016 the Reserve Price was reduced to Rs. 135 crores. Even then there was not a single Bid. In December 2016 the Reserve Price was further reduced to Rs. 115 crores. Still there was no Bid. For the fourth auction on 6-3-2017 the Reserve Price was reduced and fixed at Rs. 103.50 crores. Yet again there was no bid. The bid to sell Vijay Mallya's Kingfisher House failed again in May.2017, despite lenders cutting the reserve price to Rs. 93.50 crores by 38%. On the contrary, the 45 acres plot at Gorakhpur owned by the Sahara

Group was put up for Auction by Supreme Court on 14-7-2015. As per the advice of the experts the Reserve Price was fixed by the Supreme Court at Rs. 64 crores. In open competitive bidding held in the Court room of the Supreme Court itself, the price went up to Rs. 150 crores. The Real worth of the property was reported at Rs. 190 crores.

Auction Notice under SARFAESI Act, of Vijay Mallya's King Fisher House

Supreme Court turns into auction room in Sahara Assets sale



Fall of Adarsh Housing Society

These examples indicate the sheer magnitude of the problem faced by expert Valuers to know the real worth of the property put up for auction. Valuers were not able to gauge the actual Fair Market Value of the property in open Real Estate Market and perhaps also of the behavior of the bidders in the Auction proceedings. All that resulted in recommending an unrealistic Reserve Price in both the cases. It's public knowledge as to what price and how the flats of ADARSH Society, Mumbai, were sold and to whom. It is also confounding that no one knew the real owner of the land on which the Society's tower was constructed. The Navy and the Defense Department state that land belongs to them whereas the Government of Maharashtra countered and said that the land belonged to the State Government. Hence the question that arises: Who is to verify and certify the ownership of the land? Whether Valuer is supposed to ask the borrower (Owner of flat) about the ownership of land or not? Is this not a great technical hazard for the Valuer, because, if the borrower has no rights in land, the security offered by the borrower has NIL value?

CONCLUSION & RECOMMENDATION

India had earlier not developed any educational system in the field of valuation. Till 1994 there was not a single university offering a course in valuation. The Sardar Patel University in Gujarat was the first to start, in 1994, a full-fledged 2 years Post-Graduate course in Valuation of Real Estate as well as Valuation of Plant and Machinery and awarded the degree of M.Val. The Shivaji University in Maharashtra then started a similar course but in the Distant Learning Mode. The Annamalai University has recently started M.Sc. (RE) and (PM) course in valuation under distance learning but none of these are UGC approved. In such a large country where at least 100,000 academically qualified Valuers are required, there are today hardly 40,000 practising Valuers albeit untrained and less than 3000 trained academically qualified Valuers. Besides, there are no good books available by Indian authors on the subject of valuation from which a new entrant could learn and understand Valuation in Indian markets. What are available are copies of foreign books and foreign system which do not work well in India.

In our country there is no Act to regulate the valuation profession whereas in countries like Gambia, Ghana, Nigeria, Kenya, Zimbabwe. Zambia, Sri Lanka, Singapore, Malaysia, Australia, New Zealand, etc. the profession is regulated by an Act which requires that in order to practise valuation one must possess an academic degree and experience in valuation. Since there is no Act to regulate the valuation profession in India - the registration granted u/s 34AB of the Wealth Tax Act, 1957 (WTA) is practically valid for all purposes and for basic disciplines like civil, mechanical, electrical engineering and architecture till today.

The Central Government has recently come out with following enactments and amendments to existing laws concerning Valuation of Real Estate.

(i) Land Acquisition, Rehabilitation & Resettlement Act of 2013 (LARAR Act),

(ii) Prevention of Money Laundering (Amendment) Act 2012 (Applicable w.e.f. 3-1-2013),

(iii) The Companies Act 2013 and Draft Companies Rules 2017,

(iv) Real Estate (Regulation & Development) Act of 2016 (RERA Act w.e.f. 1-5-2017),

(v) Insolvency & Bankruptcy Code 2016,

(vi) Demonetisation effected in entire country on 8-11-2016, and

(vii) Prohibition of Benami Property Transaction Act 1988 (Amended in 2015 and made effective from 31-10-2016).

The Ministry of Corporate Affairs has recently finalised the rules for Registration as Valuers for various categories of assets including immovable property and plant and machinery to be adopted by Insolvency and Bankruptcy Board of India (IBBI). The IBBI will conduct the examinations in Valuation of all the practising Valuers having degrees in engineering and architecture.

India also does not have its own Valuation standards; hence SEBI has appointed the Institute of Chartered Accountants of India (ICAI) to frame Indian Valuation Standards for Real Estate and Plant and Machineries.

The Banking sector is the third authority that has also come out with new policies & standards for Valuation of Real Estate. The Indian Bank Association from 2008 to 2011 worked for framing policy and standards for Real Estate Valuation. A Handbook on Policy and Standard was published in February 2011. Subsequently in August 2014 the Reserve Bank of India directed the IBA to frame a policy for Valuers Empanelment. The IBA formed a Working Group on 26-9-2014 to frame the policy for empanelment procedure for Valuers of Banks. The said Committee issued its final report on the empanelment of Valuers on 18-11-2015.

Last but not the least a lot of research work is being undertaken in world in almost every field but in valuation we hardly find any basic research being undertaken by anyone. This mindset needs to change. We keep hearing about Smart Man, Smart Materials, Smart Mobile, Smart and Intelligent Buildings and even Smart Cities.

When are we going to have SMART VALUERS?

"Multibillion worth valuation business is waiting to be tapped in India in the years to come. If we do not rise today to upgrade ourselves a time will come when the whole profession will be swept up by multinational companies."

Kirit Budhbhatti, Principal, Government Registered Valuers and Member of Arca Laudis International Network of Valuers as told to Business Economics, dated Jan 2, 2018.

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Skyscraper Fire Protection, an Asset Management Strategy

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Insight

Consulting engineering practice considers four categories of viz. (1) Financial Asset Management, (2) Infrastructure Asset Management, (3) Enterprise Asset Management, and (4) Public Asset Management.

This paper eals with Infrastructure Asset Management in relation to tangible assets of "Skyscrapers" based on the three pillars of competency of management, engineering, and information required for the level of service to be provided in a cost-effective manner within the entire lifecycle of the built asset. Asset Management is necessary in order to achieve the greatest return through the process of monitoring and maintaining the facilities systems, with the objective of providing the best possible service to the users in all dimensions.

Building Skyscrapers is the most trending business strategically around the world. The built environment can be used for different functions or a combination of them which could inter alia include residential, offices, hotels and other commercial applications with basements for services and parking.

A typical skyscraper's components are the structural system, the exterior walls - a combination of masonry, curtain glass wall, and metal cladding. The building would be provided with centralized air conditioning system connected to an independent chilled water plant or to a District Cooling Plant, **Fire Protection and Safety Engineering** (designed to withstand an incidence of fire with the help of building safety plan, ACMV, fire alarm and detection, firefighting systems), Plumbing and Sanitary Systems, Electrical Systems comprising Lighting, Power, Grounding, Instrumentation & Control, and Information Technology & Telecommunication systems, People and material moving systems including the loading and unloading of goods for storage and distribution from loading bay within the basement of the building, Waste collection and removal/ disposal systems.

Skyscrapers are like virtual small cities in themselves and where all facets of Asset management need to be. The discussion is further limited to Fire Protection Systems of a Skyscraper.

Understanding Asset Management for a Skyscraper's Fire Protection

Fire Protection of a skyscraper is an essential part of Asset Management. **Fire Safety Design** is mandatory by the Authority Having Jurisdiction (AHJ) so as to provide in the building features and services with regards to life safety and protection of property. These regulations are mainly based on protecting properties and people's lives

through design requirements based on the codes and standards of practices, which is mostly provided by the NFPAs (National Fire Protection Association), and the required maintenance in ensuring the fire resistance of the building to be to the rating stipulated and the fire detection and suppression system's performance secure the building in case of a fire.

The practice of fire protection revolves around decision-making in deciding how to best meet the code requirements or the client's visions and objectives, in case they are more stringent. The principal tools of decision-making are information - whether in the form of statistics or investigative findings and analysis through calculations or modeling, and the application of codes and design techniques for the building's application.

The design of Life Safety and Property Protection systems for a skyscraper building are a multi-disciplinary effort involving the Architect and the Engineers from different disciplines - Structural, HVAC, Electrical, Information Technology, Plumbing, People & Material Movers, and Fire Protection. The team has to identify and define the location and details of fire stairs that are shown in the drawings and areas of the refuge as well as the fire rating of the shafts and internal separation of spaces in the building, etc. which need to be put down on the architectural drawings by the Architect. The Structural Engineer needs to specify the fire retardant material for the protection of the structural system. The other elements of the life safety and property protection systems comprise the fire management systems designed by the HVAC, Electrical, Fire Protection, Instrumentation & Control, and the Information Technology engineers.

Each area in the building design is govern by the local building code that applies according to the Authority Having Jurisdiction and the regulations required for the skyscraper building that is being designed and constructed with reference to National Fire Protection Association (NFPA) and Society of Fire Protection Engineers (SFPE) Codes and Standards. These standards are applicable to all facets of a Skyscraper Building Design, specifically including those areas of concern with the mechanical and electrical design trades, which would be the Fire Detection and Alarm System, Fire Fighting System, Smoke & Heat Exhaust, Pressurisation and Ventilation Management Systems.

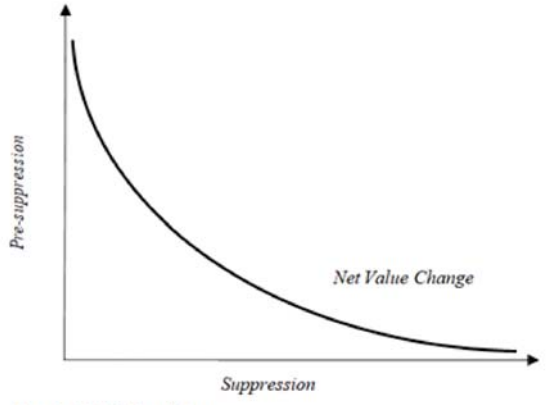
Skyscrapers Fire System Economic Analysis and Assessment

The economic variables of Fire Protection Engineering Systems relative to costs and benefits must be weighed. The material and labour costs involved in installations and additional system maintenance, testing and modification are important economic considerations related to the systems. Other factors to be also considered are the moral, legal, and economic consequences stemming from human fatalities and injuries and property damage within and around the building itself.

The economic analysis of the efficiency of fire management is generally evaluated by the **Cost plus Net Value Change concept** (**C+NVC**), *(González-Cabán; 2007)*. This approach estimates all the costs and benefits related to fire management measures. The model is derived by adding pre-suppression costs to the costs of fire suppression and the net value of the change in resources outputs that result from the fires, and it may differ between the benefits and the damage to the building resource. The pre-suppression costs represent the expenditure on fire management (e.g. purchase of

fire protection system resources for the building requirement). Suppression costs are fire fighting expenditures when fire occurs.

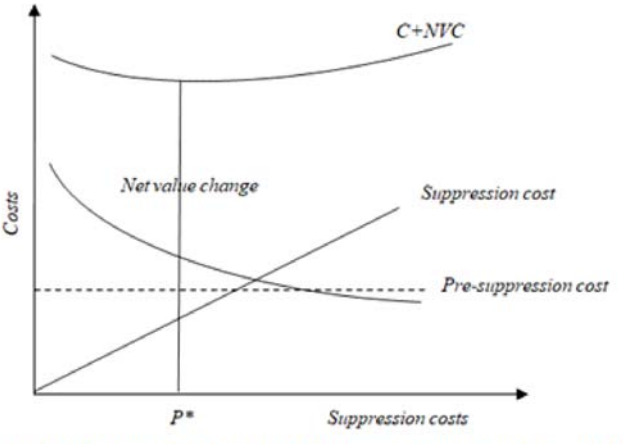
In the C+NVC model pre-suppression and suppression expenditures are considered as independent inputs, related through the Net Value Change (NVC) function *(Donovan and Rideout 2003)*. But, the independence of pre-suppression and suppression expenditures means that one input does not determine the level of the other. However, nowadays cost-efficient and effective type of fire protection systems which are available and being installed viz. the Wet Pipe Sprinkler System for protecting the skyscrapers structures before or when a fire occurs. By this system, the pre-suppression may affect the optimal level of suppression through the NVC function as shown in Graph 1 below.



Graph 1 NVC Level Curve.

In this graph, the slope of the NVC level curve is equal to the negative of the ratio of the marginal contributions of suppression and pre-suppression in reducing damage. But, it should be noted, that pre-suppression can be substituted by suppression in the case that NVC is held constant. Thus, both inputs are allowed to vary independently, but remain related through the NVC function. However, the C+NVC model is to find the most efficient management levels and enable selection of an efficient management level, where the intent is to either minimize the costs and the net value change, or to maximize the social benefits.

Analyzing the economics of fire protection system involves many factors which should be taken into consideration in the skyscraper's asset management. The factors being discussed are about the effect of the system in protecting properties and lives. The actual cost implication of all these factors, for example, given that the pre-suppression expenses are at an optimal level (Graph 2), the most efficient level of fire programmed is the point where the summation of costs and the net value change is minimized (i.e. P* in Graph 2). In the model, the cost part (C) is obtained by the estimation of the programmed costs (pre-suppression and suppression activities); while the net value change (NVC) sums all the changes in the quantity/quality of resources outputs that result from the fire multiplied by the unit value of the output.



Graph 2 Illustration of the C+NVC Model (source; Donovan and Rideout 2003)

Furthermore, the objective of the evaluation of economic efficiency of fire management measures is to help identify the most efficient programmed level for skyscrapers asset management. However, the analysis is derived from Risk Analysis, which refers to a systematic examination of risk measures in terms of deaths, injuries, property damage and business interruptions. Risk Analysis examines whether the reduction or freedom from these risks are adequate enough to justify the cost of the system; it is an analysis of cost versus risk reduction benefits in which the risk portion is measured explicitly.

There are three methods by which risk can be handled:

1) Assuming all the risk,
2) Buying insurance policies to transfer the risk, and
3) Installing fire protection system to reduce the risk in the building skyscrapers as it was designed and the way the system is installed.

The building owners may handle risks through a combination of these methods. Nevertheless, in most cases, the building owners prefer buying insurance policies in order to transfer the risk as it is. When there is a transfer of risk, the insurance company impose fire protection system requirement for the building asset management depending on the severity and possible occurrence of fire as a condition of obtaining an insurance policy. However, the local code requirement, with respect to fire, takes precedence over all requirements and considerations. The escape routes are also part of the fire safety plan for the occupants and normally designed as per NFPA 101. The building owner may consider buying both fire and business interruption insurance policy as part of an Asset Management policy.

The most common approach to Risk Analysis is the Cost-Benefit Analysis, a technique in which all the benefits of risk reduction are translated into monetary equivalents. This technique permits a proposed installation of fire protection system to be assessed in terms of its net benefits or costs. The benefits mean the saved losses from a fire and the cost means the initial installation and the operating costs of the system being designed and installed. There are two major type of losses associated with the destruction of property from fire:

1. Direct losses include damage to plant & equipment, the building and its contents. The cost of personal injuries and death resulting from fire and consequent explosions are also part of a direct loss. Depending on the property owner's degree of liability, these losses can exceed the cost of all other direct losses.

2. Indirect losses include loss of profit caused by interruption of business, cost of temporary location, temporary or permanent loss of customers, and the loss of a skilled employee who takes another job during the lay-off.

Determination of the expected losses with or without fire protection is usually made on judgment basis. It requires a lot of assumptions and statistical data based on fire scenarios. The most difficult step is assessing the cost of lives and injuries of persons. For property damage, the loss faced by the building owner may be mediated by insurance. In that case, it would be necessary to estimate the likely reduction in out of pocket, uninsured damage plus insurance premium, rather than likely reduction in total direct damage achievable. Another consideration in the evaluation is whether to include an adjustment for indirect loss such items as business interruption and permanent or temporary loss of customers. These losses can be very large in individual cases, but in the aggregate, they tend to be in the order of magnitude smaller than the direct losses. Determination of such indirect losses depends on the nature of business of the building owner. Likewise, the owner may transfer some of the risks to the insurance company and assume some of the risks. The cost-benefit analysis produces time streams of costs and risk reduction benefits - that is, year by year estimate of cost and reductions in fire death, injuries, property damage and indirect losses.

To give an idea how the economic cost of fires compare, for non-residential buildings as an example. According to the Fire Research (Berl, 2011), the fire services cost amounted to $656.3 Million which was estimated less than 0.5% of total Gross Domestic Product of Australia, Canada, the United Kingdom, United States, and New Zealand in year 2011. However, overall, 86% of the cost was not associated with the direct losses caused by the fire. The amount of $656.3 Million includes - $273M for Fire Protection Systems (41.59%), $151.7M for Fire Service Levy (23.11%), $124M Net Fire Insurance (18.89%), $93.2M for Fire Damage (14.22%), and $14.4M for Human Factors (2.19%).

As per the National Fire Protection Association (NFPA) high-rise skyscrapers buildings have lower percentages of fires with flame damage beyond room of origin. The impact of providing fire protection systems and allied features for different usage of buildings is shown in the table.

Usage	Incidence of Fires in High-rise Buildings	Incidence of Fires in Shorter Buildings
Apartments	6%	10%
Hotels	6%	10%
Institutional	5%	8%
Offices	14%	21%

Moreover, the important concern in economic evaluation of fire management efficiency and estimation of cost in terms of asset management is the proper consideration of skyscrapers building's built environmental properties, lives and services that may be damaged (or enhanced) as a consequence of fire, and thus, fire system protection is an essential aspect to be considered in valuing an asset management system.

Skyscrapers Fire Risk Management Plan

In line with Risk Management especially for Skyscrapers buildings, Fire Protection Systems have represented a significant capital investment to secure building asset management in making sure that they are fully operational to perform when needed. NFPA has identified and explained these systems through NFPA 13 using an Automatic Fire Sprinkler Systems, which are obviously an effect on reducing damage from fire and smoke as well as the potential for injury or death to building occupants.

However, when the Fire Protection Systems are out of service due to a planned or emergency repair, human error, or might even be through a malicious act, a fire could grow unchecked, which might result in substantial property loss or personal injury. Moreover, these have been carefully studied by all experts with the application of fire protection impairment program that can be used to manage and facilitate these kinds of situations in the Skyscrapers buildings in order to reduce the possible threat to property and personnel. Accordingly, the program has accomplished through limiting the time and scope of unavailable fire protection, controlling hazards, establishing alternate fire detection and alarm activation methods, providing substitute fire suppression systems, and ensuring that response to a fire, should one occur during the impairment, be swift and appropriate.

The importance of planned impairment in the Skyscrapers buildings when a fire protection system is out of service due to work, such as maintenance, scheduled repairs, or new construction must be fully understood in a planned and systematic manner. An alternative way to reduce the potential for loss, has to be scheduled with the maintenance and repair work so that only a part of the system would be impaired during the repair or maintenance work, and thus securing the building.

It must be borne in mind that an impairment management program for Fire Protection Systems includes all aspects of fire protection including: (1) Fire sprinkler systems, (2) Fire pumps, (3) Water supplies, including public and private water systems and underground supply piping, (4) Fire alarm systems, (5) Smoke and fire detection systems, (6) Life safety systems, such as evacuation alarms and voice notification systems, (7) Special extinguishing systems, such as carbon dioxide, foam, water mist, and chemical extinguishing systems, and (8) Fire hydrants, fire department connections, and standpipe and hose systems.

The overall Skyscrapers Risk Management Plan has to be outlined with the policies, procedures, standards, codes and guidelines within the jurisdiction requirements that would apply to the construction, operation and

network management, whereby, it would provide an overview of the risk management strategies in relation to key stakeholders in securing the building asset management.

Conclusion

To compare future and present costs and benefits, it is necessary to decide what the future costs and benefits are worth in the present in taking care of the Asset Management for the building skyscraper's owners.

In today's modern world, Asset Management for skyscrapers is a key part of the financial services in the industry, which acts as a central means of capital flows from those who wish to invest in those who require investment that includes the management of funds bought by the institutions or individuals and the running of mandates for investor accounts.

The attractiveness of such investments is based on the prevailing bank interest rate. Most fire risk-reducing strategies involve greater costs than benefits in the near years and greater benefits than costs in the later years; this makes the interest rate of a critical factor in the overall assessment of whether the benefits justify the costs.

However, in the evaluation whether the prescribed burning provides sufficient benefits to justify the costs is a challenging part. The evaluation process may require integration of information of many different types such as asset values, the frequencies of different weather conditions, the frequencies of fires, the consequences of fires of different severities, the relationship between weather conditions and fire consequence, the costs of fire suppression, the costs of prescribed burning, the frequency of escapes from prescribed burns, and the effects of prescribed burning on the number of fire incidents, the spread of fires, fire severity and suppression costs that may be involved in the skyscrapers building's built environment.

The management of fire risks is a fundamental responsibility of every skyscraper building's occupant that might be either for residential or offices application, whereas the primary Occupational Safety and Health requirement is an essential aspect that needs to be established. As is known to all, a serious fire could destroy a business and the whole buildings asset but as per occurrences around the world, they also result in deaths of many innocent people. An effective fire management is a staged process and has been spelt out in in the NFPAs Codes and Standards. The stages are logical and small steps can effectively reduce the risks. Thereby, a close cooperation between workers, employers, and governments is an essential part of successful prevention and control of fire at the workplace in securing the overall building asset management.

The fact that throughout the development and innovations through experimental of fire/ life safety codes and standards by scientists and experts from around the world, coupled with adoption of NFPA Code and Standards and proper application of these codes and standards by the design professionals and the enforcement by the local Authority Having Jurisdiction could lead to far safer and secure high-rise skyscrapers buildings and that would benefit the owners.

To conclude, there are still many issues to overcome, but overall, the importance of asset management within the skyscrapers building's built environment is **to provide an efficient and appropriate fire system protection**, that is likely to be the most beneficial to the asset owners in the aspect of asset management, to the building's occupants and the adjoining premises.

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Asset Management

Broadly defined, Asset Management refers to any system that monitors and maintains things of value to an entity or group. It may apply to both tangible assets (such as buildings) and to intangible assets (such as human capital, intellectual property, goodwill and/or financial assets). Asset management is a systematic process of developing, operating, maintaining, upgrading, and disposing of assets cost-effective.

The term is most commonly used in the financial sector to describe people and companies who manage investments on behalf of others. Those include, for example, investment managers that manage the assets of a pension fund.

Alternative views of asset management in the engineering environment are: the practice of managing assets to achieve the greatest return (particularly useful for productive assets such as plant and equipment), and the process of monitoring and maintaining facilities systems, with the objective of providing the best possible service to users in all dimensions-appropriate for public infrastructure assets.

(Source: Wikipedia)

Asset Integrity Management in Process Industries: A Holistic Approach

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Introduction

Asset Integrity Management (AIM) as a domain has gained importance in recent years in the process industries in general and the Hydrocarbon sector in particular. As an area of specialization, AIM seeks to integrate a number of different tools and techniques for designing, operating and maintaining the critical assets in process industries in the most optimum way. The impact of operating a plant in an unfit and unsafe manner and the consequent economic setback of an unforeseen shutdown or catastrophic failure are driving the Owner-Operators of such facilities to focus more and more on a structured, periodic assessment of the health of their assets.

AIM: Not an Option but an Imperative

The entire Hydrocarbon value chain (Upstream, Midstream and Downstream) is characterized by several challenges that make this sector an ideal area of application for AIM. Some of the critical attributes of this sector are:

- High strategic and geo-political significance,
- Stringent operating conditions,
- Aggressive fluids to be processed,
- Adverse environmental conditions,
- Safety-critical installations,
- Prohibitive cost of unplanned shut-downs, and
- Operating life of 25-30 years with High Reliability

The industry is constantly searching for better design, engineering and technological solutions to mitigate the huge risks associated with this sector.

In today's scenario, the fallout of not having a properly designed AIM framework in place can be detrimental for any process industry. If plant and machinery are not in good health as demanded by the application, the first casualty is the product quality. The plant would produce output that is not in conformity with designed specifications (popularly called as "Off-Spec operation"). The economic loss arising out of this is substantial. The second major disadvantage comes from unplanned shutdowns when damaged, degraded or worn-out machinery are forced to run beyond their capability. A single day's outage of a refinery or power plant can easily result in a revenue loss of several crores of rupees for the Owner-Operator.

However, the most disastrous event arising out of the absence of proper integrity management strategy is a catastrophic failure. A large-scale industrial accident like the Bhopal Gas Tragedy involving the Union Carbide plant can lead to safety and environment related calamity of unimaginable proportions. Apart from the human cost and societal impact of such events across the boundary of time and geography, such disasters can wipe out the brand value of a company – thus ruining a business.

The Three Elements: A, I & M

In the context of process industry, one has to deal with a large variety of plant, machinery, hardware and other infrastructure which can be collectively termed as **"Assets".** These include:

- All plant and machinery,
- Offshore structures and pipelines,
- Onshore structures, buildings and pipelines,
- Transportation equipment,
- Power generation and transmission systems,
- Telecommunication system,
- Control and automation systems, and so on.

"Integrity" could be defined as the ability of the Assets to safely perform their intended functions under prescribed conditions over specified period of time.

"Management" could be defined as strategies and activities to ensure, through proactive planning and execution, that the Integrity of these Assets is not compromised. Management will also involve implementing prompt remedial measures wherever lack of Integrity of the Assets is envisaged.

Evolution of Maintenance Strategies

Figure-1 illustrates how the plant maintenance philosophy in the industry has developed over the years. There are distinct types of plant maintenance approaches, such as:

- Break-down Maintenance - for non-critical assets and systems with redundancies,
- Time-scheduled (Preventive) Maintenance – for continuously operating facilities such as Process Plants and Power Plants,

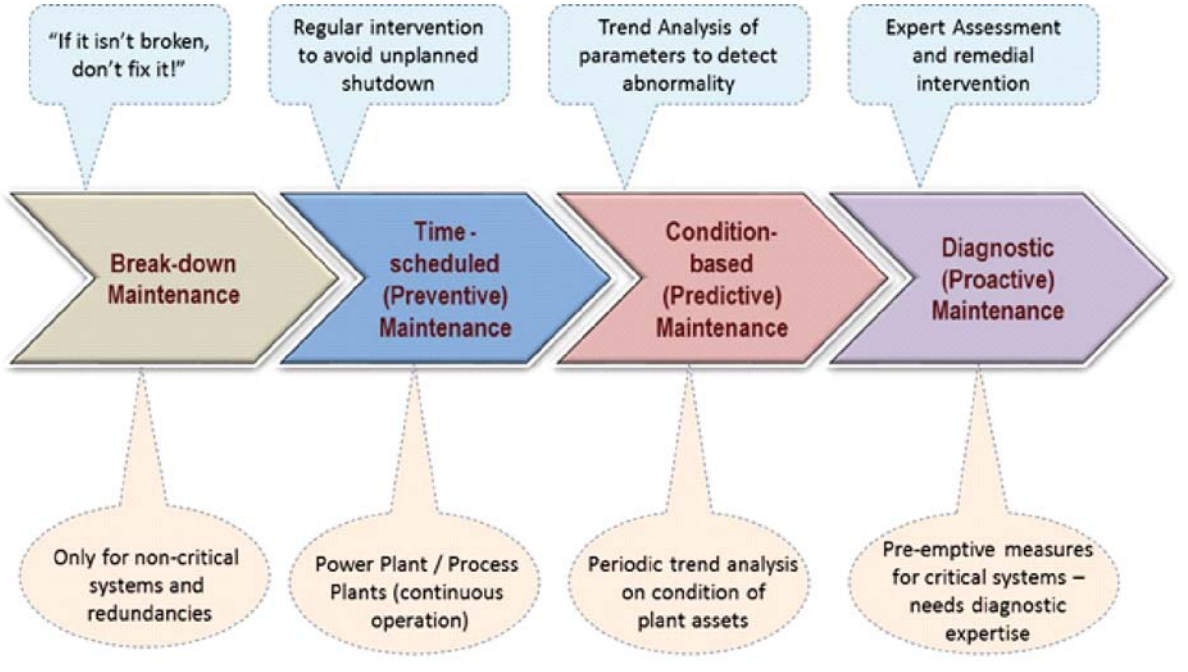

Figure-1: Evolution of Plant Maintenance Philosophy

- Condition Based (Preventive) Maintenance – predictive trend analysis of operating parameters to decide on operation/ maintenance actions, and
- Diagnostic (Proactive) Maintenance – pre-emptive measures for critical systems, based on diagnostic expertise.

Most of the industries today operate with a mix of Time-scheduled and Condition-based maintenance philosophies. Though all industries would prefer to graduate to the Proactive Diagnostic approach for obvious benefits, it could be quite expensive and the expertise required to drive such initiatives could be scarce.

Failure Pattern of Assets: The Bathtub Curve

Any asset has a distinct pattern of failure, from the inception of its service life till the end of its useful life. Figure-2 illustrates the typical failure pattern, popularly known as the Bathtub Curve due to its shape. It shows three distinct patterns of failure:

- Sudden initial failure of a new asset due to inherent defects ("Infant Mortality" phase),
- Relatively constant failure rate during the useful life of the asset (mostly attributable to random causes), and
- Wear-out failure due to aging effect and wear and tear of the assets over time.

The failure rate tends to decrease after the newly installed asset stabilizes in operation while the wear and tear damages start growing towards the end of useful operating life. Superimposing the three phases, one gets the bath-tub shaped overall failure pattern. The goal of any AIM strategy should be to identify the signs of incipient damage as early as possible, so that unforeseen and catastrophic failures could be prevented.

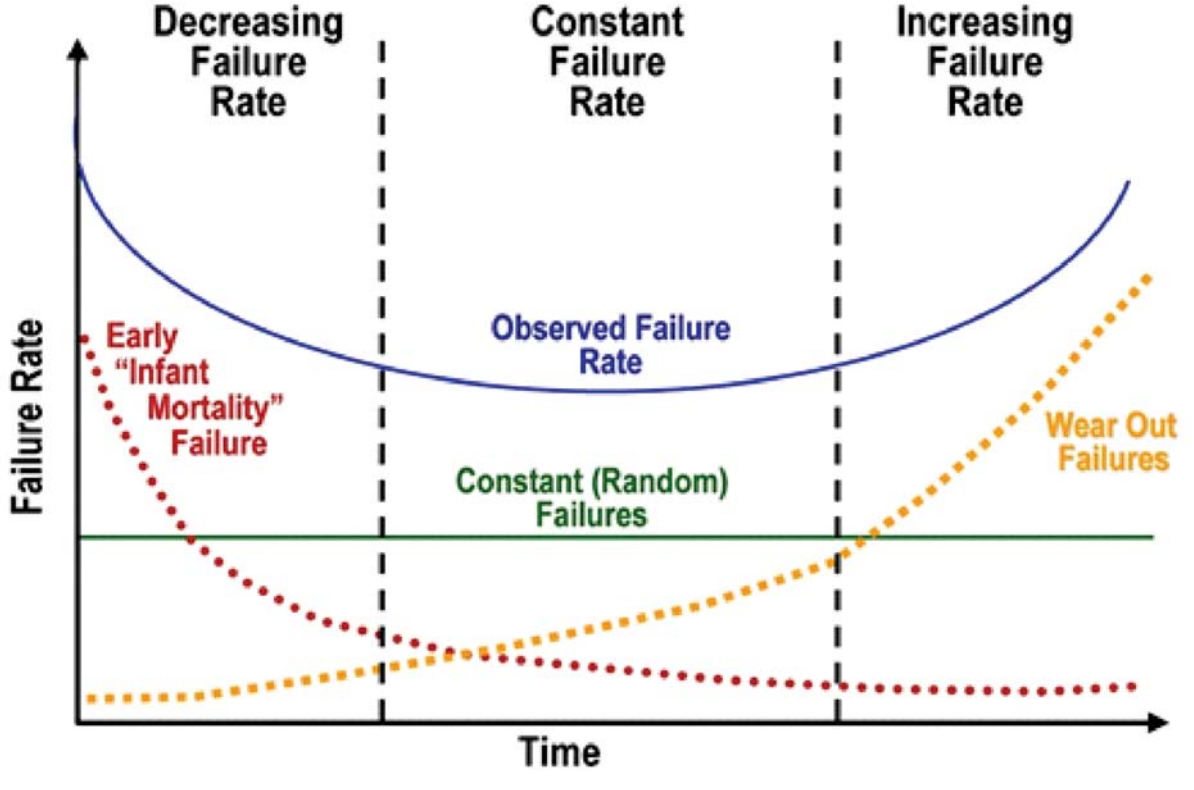

Figure-2: Asset Failure Pattern (Bathtub Curve)

AIM: Implementation & Asset Lifecycle

Traditionally, plant operators ran their machinery with need-based maintenance intervention and would worry about long-term health of assets only towards the end of useful operating life (as highlighted in the figure), when equipment break-downs would become frequent. However, today the prohibitive cost of unforeseen shutdowns and risk of possible safety and environmental impacts on business have effectively ruled out such laid-back approach.

Figure-3 shows the key stages in Asset Lifecycle. While earlier approach would be to focus on asset health in an advanced stage of the Operation & Maintenance (O&M) phase, a properly designed AIM strategy must necessarily consider the issue of long-term integrity and life of asset right from the design/ engineering phase through to the operating phase. One needs to keep in mind that proactive engineering solutions at the Design stage (involving Conceptualization, Basic Design, Front End Engineering as well as Detailed Engineering)) and proper process/ quality control in the Manufacturing phase will go a long way to ensure long-term integrity of critical assets.

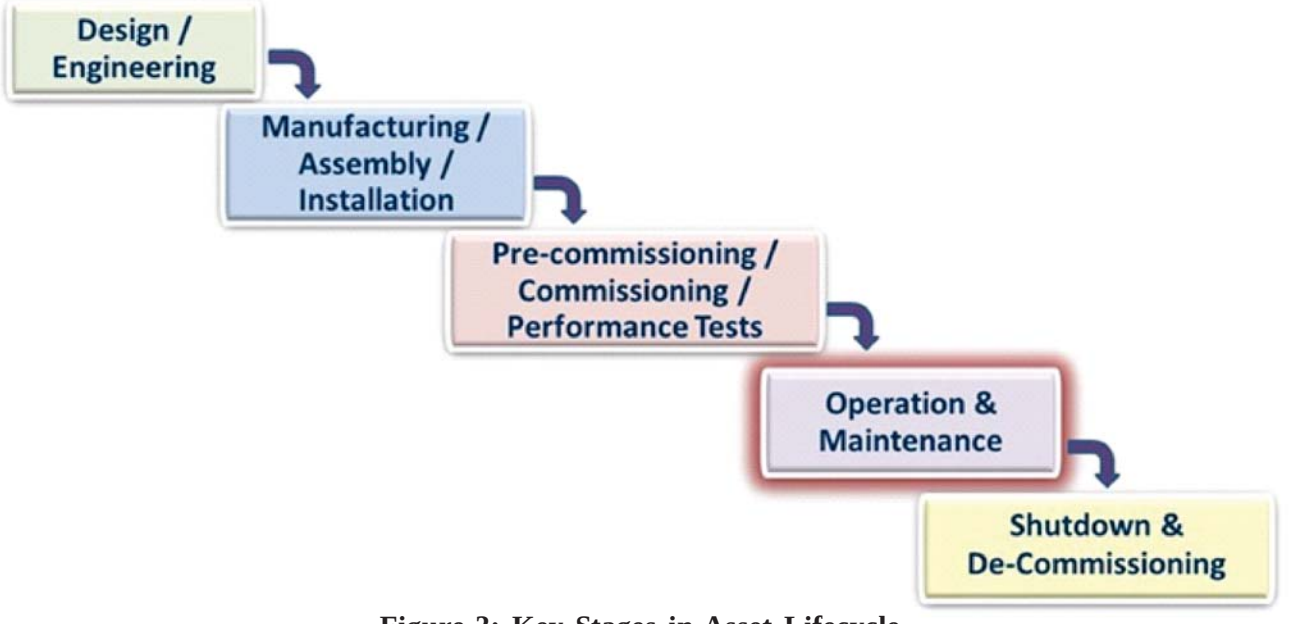

Figure-3: Key Stages in Asset Lifecycle

AIM: Key Tools & Techniques

As Asset Integrity Management strategies incorporate the existing expertise from several domains, the benefit available to the present owner's is the advantage of having many proven techniques at their disposal. It is feasible to develop an effective AIM road map for a given plant by drawing from the available pool of knowledge and methodologies of plant conceptualization, design/ engineering, equipment manufacturing/ fabrication, installation, testing and commissioning as well as best practices in operation & maintenance areas.

Figures-4 shows the key techniques from Design/ Engineering and Operation/ Maintenance fields, which serve as the building blocks for a successful AIM framework. It may be noted that the state of art in each of these areas is quite matured, though the extent of applicability or relevance of each of these techniques would depend on the individual plant or the system under consideration.

Overview of Integrity Solutions

As can be seen from Figure-4, there are a spectrum of solutions that could be adopted to implement the AIM program. The methodologies for most of these studies have been formalized through codes and standards, which ensures a fair degree of repeatability and collective learning within the AIM community. For example, **Fitness for Service (FFS)** studies are primarily carried out as per API RP-579/ ASME FFS-1-2007 **[1]** and BS 7910 – 2005 **[2]** codes. Each of these codes has its own area of applicability and limitations. Similarly, **Risk Based Inspection (RBI)** studies are commonly carried out by API or DNV methodologies, though some of the global majors operating in Hydrocarbon sector have developed their own customized versions. **Reliability Studies** are mainly based on the generic principles of Reliability Engineering, which are applicable to all businesses involving products, processes or projects. In the specific case of process industries, one could adopt Reliability, Availability & Maintainability (RAM) Study during the design/ engineering phase of the plant and then formulate a Reliability-Centered Maintenance (RCM) strategy subsequently, as the plant goes into operating phase. **Root Cause Analysis (RCA)** is also a generic approach, comprising many standard techniques such as Fault Tree Analysis (FTA), Fishbone or Cause-&-Effect Diagram, Failure Mode & Effect Analysis (FMEA), Pareto Analysis, 5-Why Methodology, and so on. A formal approach to RCA has been established through the governing code IEC 62740 – 2015 **[3].** Though such techniques are more popular in product design/ development and manufacturing sector, these could be easily adapted for application in troubleshooting and failure analysis of process plants. **Remaining Life Assessment (RLA)** Studies aim at determining the residual useful life of aged, damaged or degraded plant and machinery, such that informed decisions could be taken on continued plant operation, upgradation, revamp or decommissioning.

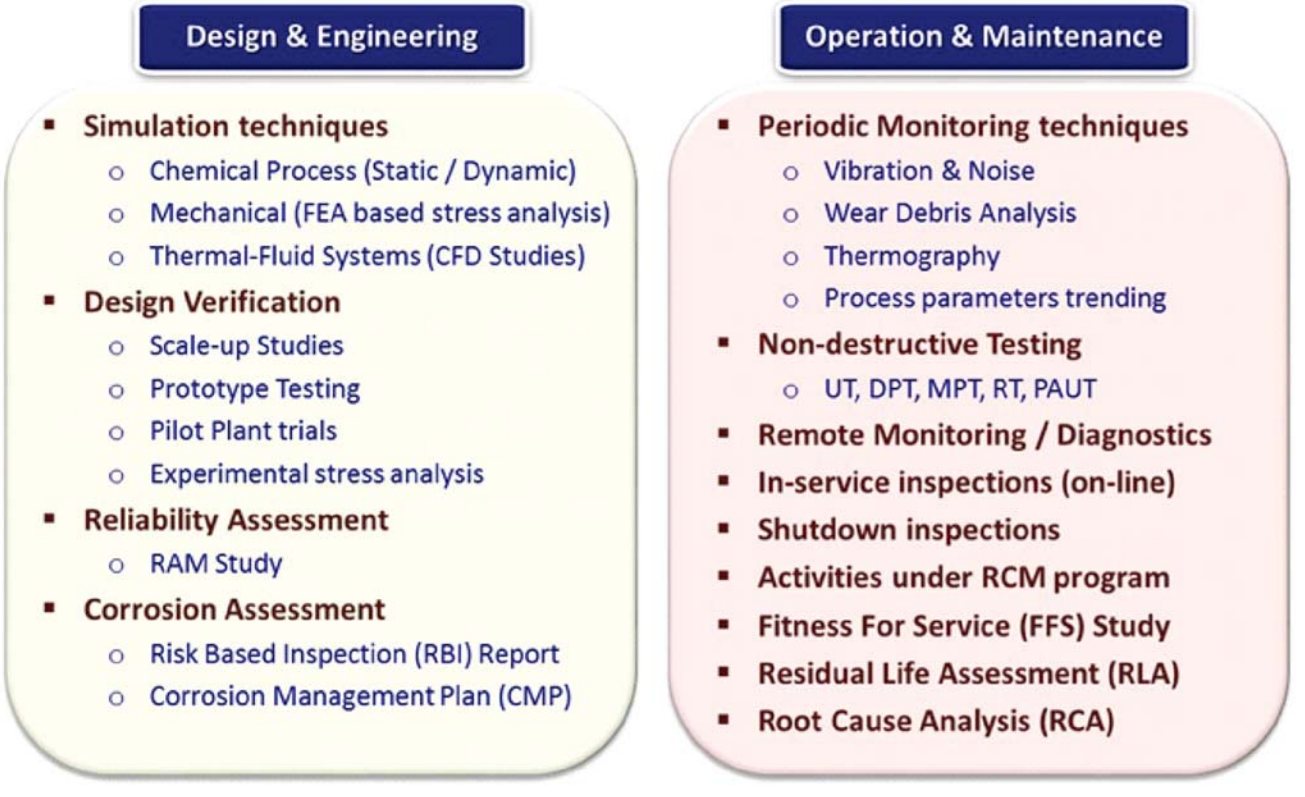

Figure-4: Key Tools & Techniques for AIM

Integrity Assessment of Pipelines

In the process industry, Pipelines are considered as Lifelines. In view of the operational criticality of pipelines, several dedicated techniques have been developed specifically to address integrity issues in pipelines. Theoretical simulation of corrosion risks in pipelines is possible during design and engineering phase, using specialized software tools. Major damage mechanisms in cross-country pipelines are material loss due to corrosion/ erosion and damage to protective coating. Cathodic Protection (CP) is the primary technique for preventing pipeline corrosion damage. Health assessment of CP systems is done through a number of field studies based on the measurement of electric current and voltage patterns. Direct Assessment (DA) techniques could be adopted for Internal Corrosion (IC), External Corrosion (EC) as well as Stress Corrosion Cracking (SSC) mechanisms. A major enabler in integrity assessment of piggable lines is In-Line Inspection (ILI), using instrumented "intelligent" pigging solutions, to generate key information about the pipeline condition. The framework for gas pipeline integrity assessment is provided in ASME B 31.8 S **[4].**

Conclusion

This article has presented an overview on Asset Integrity Management, which has emerged as an essential framework to be adopted for efficient and safe operation of critical process plants across sectors. Though there are a host of tools and techniques, they should be adopted judiciously - the ones that are relevant for the given application. It is also necessary to have a trade-off between the risks of not adopting AIM, the cost of implementing a chosen AIM strategy and the benefits that are likely to be achieved. The key is to realize that Asset Integrity Management as a strategy involves multiple domains and disciplines. Therefore, a holistic approach is imperative to achieve successful AIM implementation.

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Management Contract

A management contract is an arrangement under which operational control of an enterprise is vested by contract in a separate enterprise that performs the necessary managerial functions in return for a fee. Management contracts involve not just selling a method of doing things (as with franchising or licensing) but involve actually doing them. A management contract can involve a wide range of functions, such as technical operation and of a production facility, management of personnel, accounting, marketing services and training.

In Asia, many hotels operate under management contract arrangements, as they can more easily obtain economies of scale, a global reservation systems, brand recognition etc. It is not unusual for contracts to be signed for 30 years, and having a fee as high as 3.5% of total revenues and 6-10% of gross operating profit. Management contracts have been used to a wide extent in the airline industry, and when foreign government action restricts other entry methods. Management contracts are often formed where there is a lack of local skills to run a project. It is an alternative to foreign direct investment as it does not involve as high risk and can yield higher returns for the company. The first recorded management contract was initiated by Qantas and Duncan Upton in 1978

(Source: Wikipedia)

Digital Asset Management

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Overview

Construction is one of the least digitized industries. R&D spending in construction is less than 1% of the revenues, versus 3.5% to 4.5% for the auto and aerospace sectors. Productivity in construction industry has grown a meagre 6% since 1945 compared to manifold in agriculture or manufacturing.

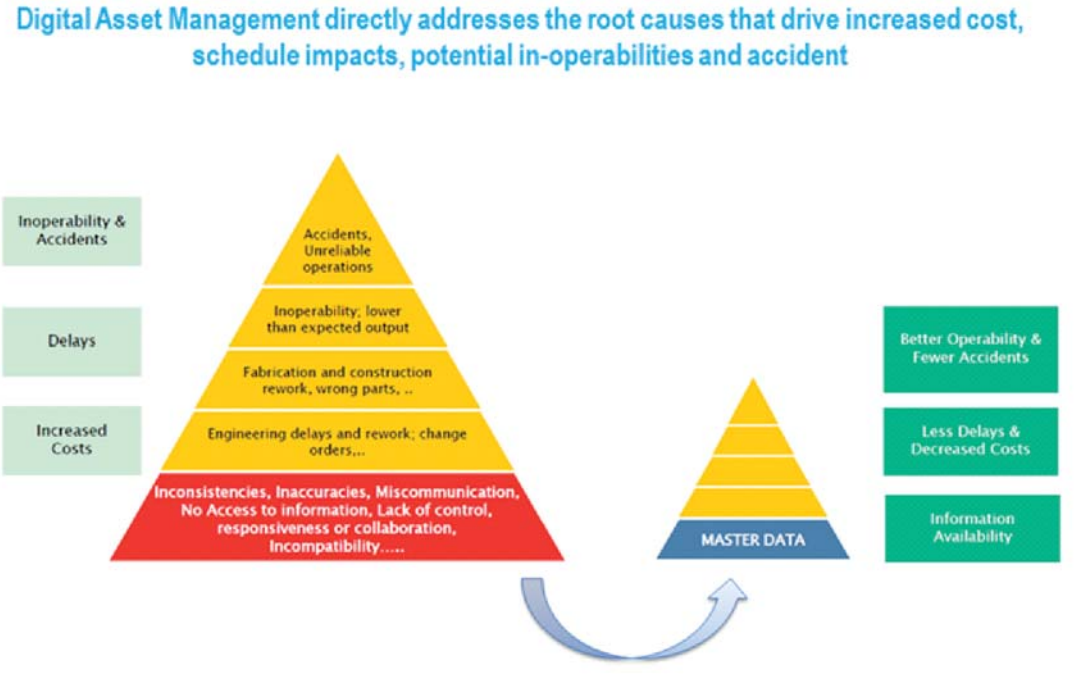
Well executed construction and handover are also the gateways to optimized operations during the lifetime of assets. These are now efficiently enabled by digitisation. A Strong Digital Asset Lifecycle Management requires creation of digitised asset data right from conceptualisation, planning, engineering and construction phase of an asset and seamless handover from construction to operations and maintenance. There is significant additional value to be made by increasing digitization in Construction industry.

Lack of Digitalisation in Construction Industry

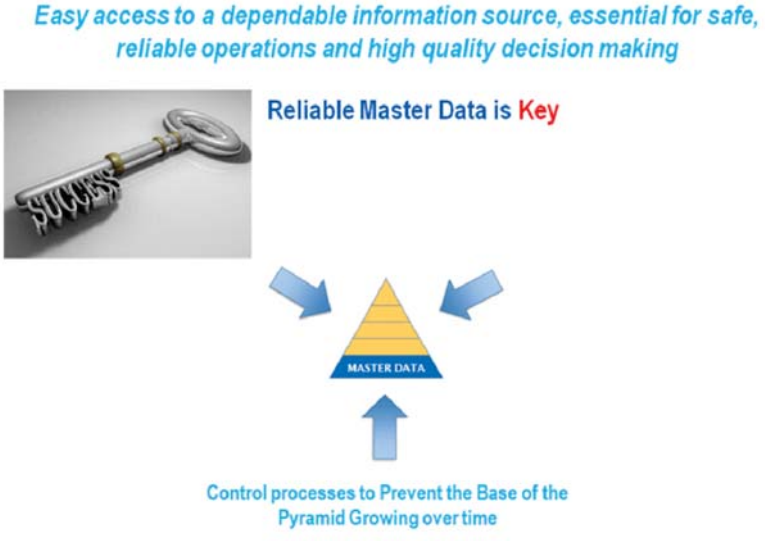
Assets represent such a significant financial investment for an enterprise, knowing what they are, where they are, their condition and performance are essential from both a financial and governance perspective.

Assets play a key role in the production of products or the delivery of services hence their performance have a direct and significant impact on the costs and quality of product and the services delivered.

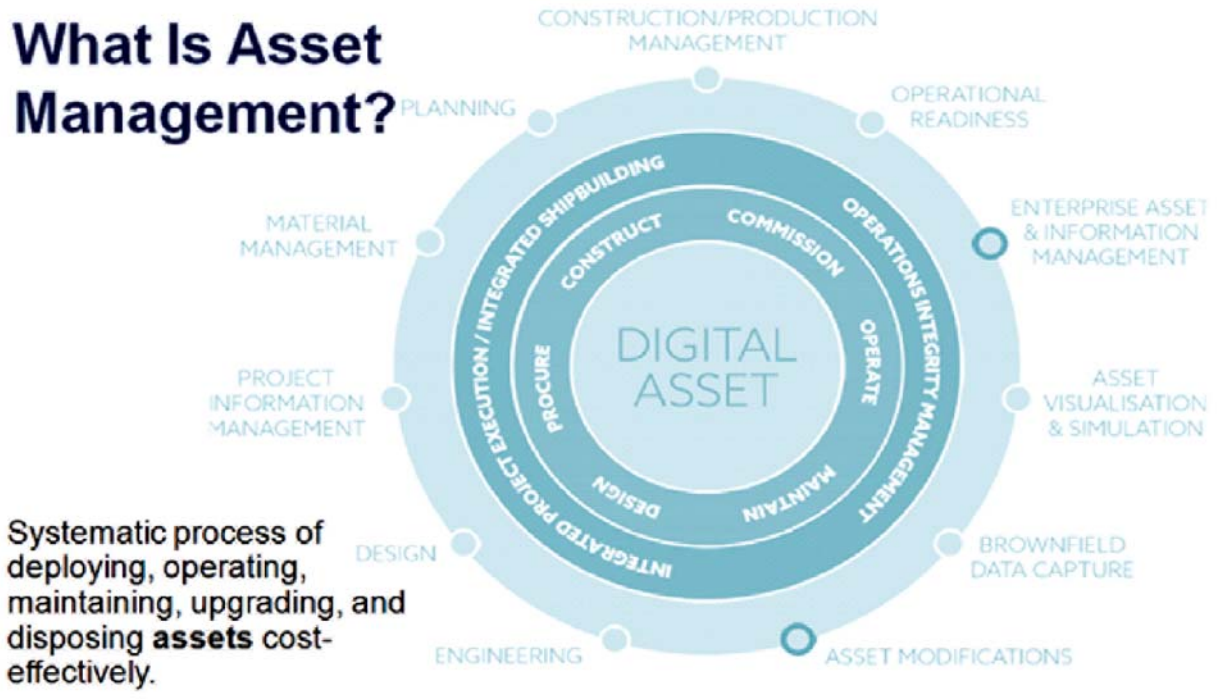
An Asset in the Digital world is represented by various attributes, performance characteristics, and relationship with other asset. This representation of the asset in Digital World is called Master Data of Asset. Reliable accurate Asset Master Data is key for safer, efficient, and reliable operation of asset.



In enterprises, Asset Master Data is spread across applications, systems, and departments in various forms and formats and maintained by various stakeholders of the asset. There is high likelihood that asset data can easily become fragmented, duplicated, and most commonly out of date. When this occurs, correct business and operations decisions are taken based on inaccurate data. Digitisation of Asset Data and management of Digital Asset Data using one centralised applications is the key step for accurate business decisions and safer and reliable operation of asset. Integrity, consistency, and comprehensiveness of Asset Master Data are the foundations to strong Digital Asset Management.



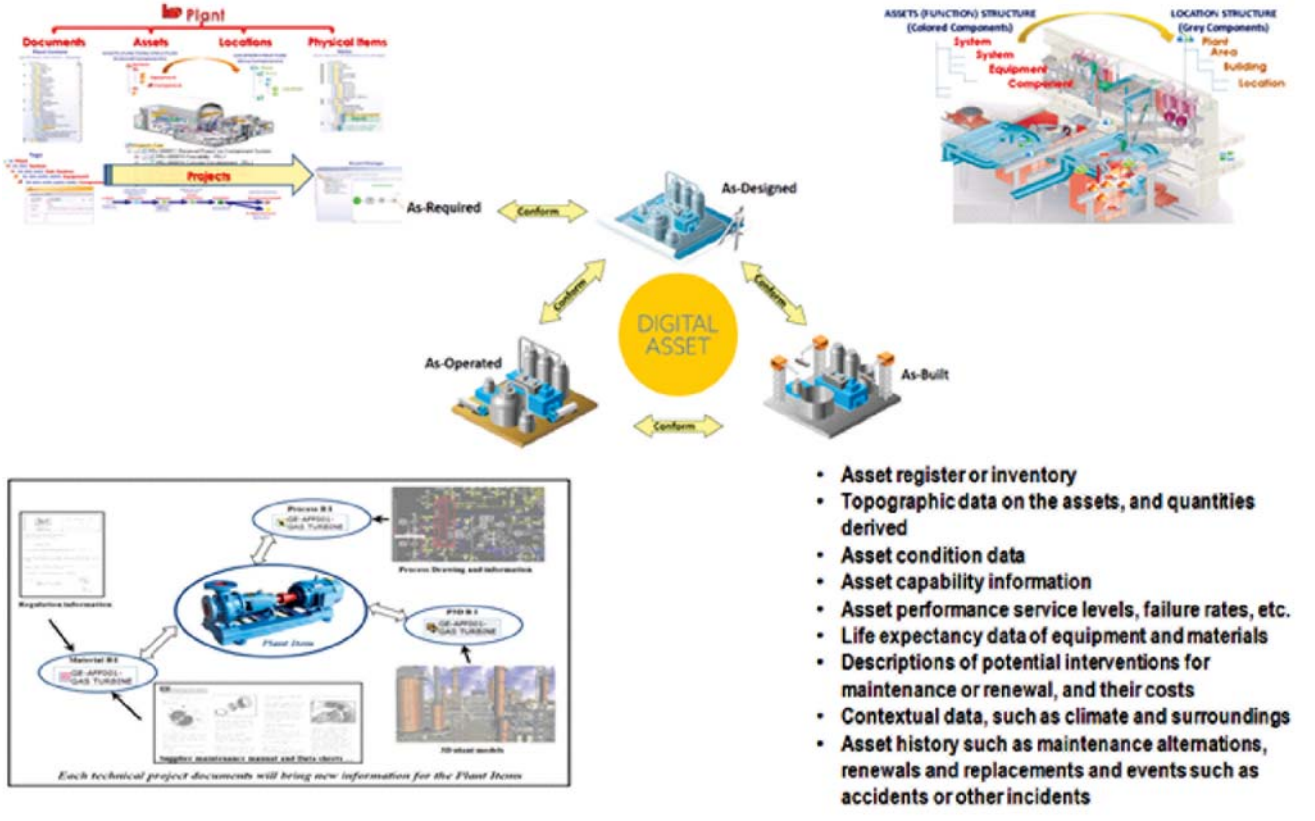
Digital Asset Management addresses challenges of asset management by making information easier to access, reliable, single version of truth and usable by the broader organization for making business and operational decisions. Enterprise's also pursue Digital Asset Management to streamline operational processes.



Implementation of Digital Asset Management

Typical steps to implement Digital Asset Management are:

- **Digitisation of Physical Asset**: Existing physical asset can be digitised using 3D laser scanning (this is just enough for visualisation) and converting to intelligent 3D models (for further engineering and intelligent linking to other assets). For green field plant or facilities, 3D engineering is the best way to create digitise asset.
- **Meta Data Association**: Various asset attributes which characterised the asset should be associated with digitised physical asset.
- **Asset Hierarchy**: Digitised Asset should be interlinked in a manner so as to create hierarchical tree like structure to represent the entire facility or plant.
- **Document Association**: Documents like P&ID, Plans, Sections & Elevations, Operation Manuals, Characteristics Curves, etc. should be associated with digitised asset.
- **Integration with Enterprise systems**: Finally Digital Asset Management should be linked an enterprise system viz. ERP, Building and Plant Maintenance systems to link financial, procurement, maintenance data of digitised asset.
- **MIS and Dashboards**: Good Digital Asset Management system should be able to provide comprehensive reports and dashboard regarding the assets. The reports and dashboard should be configured based on the business needs and for typical use cases of the system.



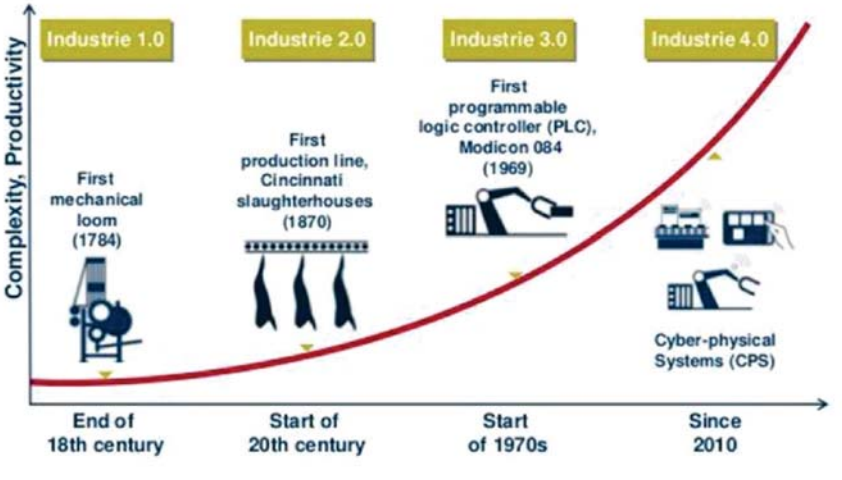
Typical Digital Asset Management System Landscape

If implemented well, Digital Asset Management can lead to following benefits:

1. Seamless communication within the organization,
2. Single version of truth,
3. Streamlined business processes,
4. Better Project Management,
5. Knowledge Management and reusability,
6. Safer and Reliable Operations, and
7. Foundation for Digital Twin

Industry 4.0 and IIoT

With availability of persuasive communication network and cost of computing coming down drastically, cloud computing is becoming the de facto standard. Boundaries between information technology and operation technologies are diminishing leading to evolution of Industry 4.0 and Industrial Internet of Things (IIoT).

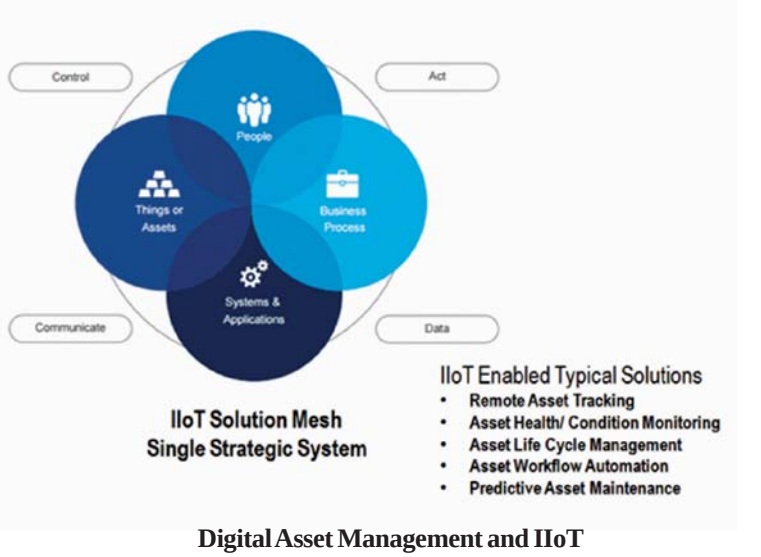


Evolution of Industry 4.0

The Industrial Internet of Things opens plenty of opportunities in automation, optimization, intelligent manufacturing and smart industry, asset management and industrial control.

It plays a key role in the overall digital transformation towards a digital supply chain in many parts and value chain components of the large ecosystem. With more and more data and real time analytics, IIOT paves the way for faster and better decision making.

Asset Condition Monitoring, Asset Performance Management, Predictive Asset Maintenance, and Environment Monitoring are some typical applications of Industrial Internet of Things.



Digital Asset Management and IIoT

Using machine learning, the IIoT data can be used for training algorithms to spot potential patterns that would indicate a future failure. Such insightful information would previously take weeks to discover and rely on the availability of skilled professionals at every site. The use of real-time data can help those with the right skills monitor more machines in multiple places, thus making decisions on maintenance faster, more reliable, and appropriate. In turn, the efficiency of operations can be speeded up considerably.

Digital Twin

A Digital Asset Management system integrated with IIoT platform enables virtual representation of the Actual Physical asset along with its functioning. Such digital representation of asset is identical to physical asset in its characteristics and functioning and is called as 'Digital Twin'. Digital Twin are used to simulate a real life scenario and based on the results, critical business decision can be taken.

Industry Ecosystem

Asset is created when it is conceptualised, however, due to lack of standards, varied contracting conditions, digital capabilities of various project stakeholders, the asset creation process employs limited digitalisation as of now. The Owner of an Asset should insist on a digital way of creation of Asset from Concept to Commissioning and later on in the Operation, Maintenance, and modifications stages using 3D Engineering tools and proper project governance. The Owner should align contract conditions to insist use of modern 3D tools during engineering and construction stage from all relevant project stakeholders and finally the As-Built digital handover of a project. Digital handover leads way to manage entire an asset digitally thought the life cycle of the asset.

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"Digitization leads the way in transformation of Enterprise Asset Management"

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Abstract:

Enterprise Asset Management (EAM) is a core area of managerial decision making for industries that have millions of dollars invested in physical assets. Optimum solutions that extend and sustain the lifecycle performance of the assets are the preferred choice due to higher ROI that accrues from their application. Digitization of EAM platform based upon the ISO 55000 international standards, and the functionality of technological breakthroughs is transforming the existing models with seamless real time integration of the asset performance management process.

Key words:

Digitization, Enterprise Asset Management, ISO 55000, Transformation, MaxPro

Introduction

The EAM segment is going through exciting times. On one hand, the recent advances in technology is shaping innovations which are leading towards full digitization of the asset management process by creating integrated, sophisticated EAM platforms, that transform into higher ROI, better management of resources, value addition assets. All these factors are fuelling the growth of the sector and creating unprecedented opportunities for the existing and potential players to capitalize upon.

The regulatory framework and safety measures have become more stringent to be complied with, which implies cost escalation to include the upgraded norms, technical parameters, training, and implementation of the revamped EAM solution. These are some of the challenges that are part of the industry environment and technologically oriented companies are embracing the disruptive technologies to digitize the process in order to be efficient, cost effective, competitive, and innovative.

At the same time the introduction of 'The ISO 55001 framework – a set of principles that defines the standards for lifecycle asset management for organizations' has further stimulated and strengthened the drive for digitization of the entire EAM ecosystem and companies lagging behind in adopting the technological advances risk being left behind for good.

Technological advances transforming the EAM segment

The last few years have been characterised by tremendous technological breakthroughs and spurt in innovations which have brought in the 'Fourth Industrial Revolution', also referred to as ***industry 4.0.*** According to the ***World Economic Forum,*** the ongoing process and phase is "characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres." The Automation and IT industry along with its allied functions like Asset Management, Project Management, Industrial IOT solutions, etc. is continuously deploying emerging and disruptive technologies.

However, the technology-based sectors must continually improve, innovate, and enhance the business processes, product development, and real time customer service. The emerging phase of digitization of the industry will support new applications and business models for end-to-end customer solutions and disrupt all phases of existing industry ecosystem. Digital transformation is the process of devising new business applications that integrate all this digitized data and digitalized applications.

Digitization can enhance the organizational infrastructure, maximize availability, and improve the operational efficiency of all assets. From the plant maintenance, inventory management to how organizations serve their customers, new technologies will lead to entirely new ways of doing business. The digitization process is changing the approach of doing business in the Enterprise Asset Management (EAM) segment. From 'customer focus' to 'customer centric' is the mantra that digitization is creating for EAM suppliers and users.

To maximize the potential gains and achieve the interconnectedness that 'Digitization' promises, the IT and automation industry need to:

Collaborate beyond their comfort zones by partnering with adjacent service providers, leverage competencies and combine resources thereby creating an ecosystem of value

Use cognitive computing to harness data both inside and outside their enterprises to drive revenue, reduce cost, expand the market size, and create a competitive edge.

Long-term substantive benefits happening due to the ***'fourth revolution – the industry 4.0'*** will be more challenging, requiring a new level of coordination between manufacturers, suppliers and end-users, and the willingness to embrace transformation that goes beyond information technology to the continuous revamping of organizational functions and activities as new game-changing innovations emerge.

Deploying cognitive technologies will enable organizations to become more efficient and effective, and will allow them to operate with more responsiveness, agility and precision.

ISO 55001- International Standard for Optimized Asset Management

ISO 55000 has clearly stressed the need and emphasized the necessity of an integrated asset management process as it is an enabler, a driver – done not for its own sake rather the organization requires it to achieve its objectives. The ISO charter outlines the following four principles that highlight the significance of enterprise asset management:

- Assets exit to provide value to stakeholders
- Asset management transforms strategic intent into decisions, plans and actions
- Leadership and workplace culture are determinants of value realization
- Asset management provides assurance that assets fulfil their required function

Said differently, assets need to be put to work efficiently and effectively in order to achieve the organizational objectives and deliver value to the stakeholders.

The ISO 55000 guidelines has created the framework to embrace digital technologies and transform the EAM platform into an innovative process which would enhance the value proposition to the end-users and help vendors, suppliers meet the challenges of cost, competition and compliance efficiently and productively.

Key functionalities accruing from Digitization of EAM

To understand better on functionalities of Enterprise Asset Management, we need to look for all aspects of assets management. Firstly comes the "Enterprise" which includes all the assets across the organization, departments, locations & geography, facilities, and business units. Secondly, "Asset" refers to all types of assets, viz., Fixed Assets, Non-Fixed Assets, Leased Assets, etc. Finally comes the "Management" system which involves maintenance of physical assets of an organization throughout each asset's lifecycle.

Hence EAM is a digitized system which is used not only to plan, optimize, execute, and track the needed maintenance activities with the associated priorities, skills, materials, tools, and information but also to track complete life cycle of the asset including warranty tracking, depreciation calculation, etc. It covers the design, construction, commissioning, operations, maintenance and decommissioning or replacement of plant, equipment, and facilities. In EAM, as enterprise is one of key components, the system must be capable to handle multi-tenant and/ or multi-site functionality to cover entire locations & geography of an organization.

Effective Enterprise Asset Management (EAM) software solutions include many powerful features, such as complete asset life-cycle management, flexible preventive maintenance scheduling, complete warranty management, integrated mobile wireless handheld options and portal-based software interface. As asset life-cycle management and maintenance are key components of the system, it must have modular native solution or tight integration with spare parts inventory, tracking, procurement, replenishment and electronic operations & maintenance document/ manual.

EAM is a tool which gives almost real time visibility of assets at enterprise level. Digitize and mobility platform improve the overall efficiency & productivity of asset sighting and maintenance process.

'Digital Transformation' in Enterprise Asset Management

In recent years, Industry 4.0, Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Augmented Reality (AR), Machine Learning (ML), Data Analytics, etc. are buzz words across the industry. Thus the question that arises is how these new technologies can bring improved visibility, efficiency and productivity and also better control on assets performance.

- Digitization enables data to be easily created and updated and thereafter be accessible for use across various platforms, devices, interfaces. The data is electronically stored safely for further use.
- It ensures a seamless integration of all devices, such as mobiles, gadgets, Barcodes & RFID readers, RFID label printers, self-service kiosks, etc., which enhances the usability, safety, reliability, etc.
- Using artificial intelligence, EAM platform can be optimized to ensure that the best solution is integrated with the customer requirements and expectations.
- Augmented Reality (AR) tools: Though AI applications ensure that the most optimal solution is offered to the client, still to successfully implement, operate, and follow it up would require application of augmented reality tools in the form of video tutorials, manuals, and even offsite experts to tackle complex issues, and retrain the staff onsite.
- Predictive Maintenance: IIOT enabled programmed sensors are used to measure parameters like temperature, wear and tear, and a slew of other indicators. Machine Learning (ML) tools can then analyse these machine data and predict in advance any breakdowns and malfunctions of the plant, equipment or device. This makes it possible to schedule repairs at convenient low productivity times, and to avoid costly downtimes. However,

it needs to be borne in mind that Predictive Maintenance is not a replacement of Regular / Routine Checks and Maintenance but is supplementary.

Integrated EAM with Operations Management for Process Industry

In a process plant, digitized operation management is a game changer to improve operational efficiency and productivity. To have a unified business process flow, it is required to have a tight integration with operation management system. In case of any critical situation, work order can be triggered automatically from Operation Management System or even a SCADA (Supervisory Control and Data Acquisition) System to EAM System with relevant permit to work.

Optimizing of Assets for better returns through an EAM Platform

An EAM needs to be continuous improved and remain in line with the customer's requirements which could change over time.

Some of the essential features for that an EAM are:

Be a multi-tenant, multi-site completely integrated system with SCADA, Operations Management, and ERP system

The Asset Management Solution should prolong the life of operation-critical assets through effective and timely maintenance management, and substantially lower the cost of maintenance for the entire lifecycle of the assets.

Be a component-based enterprise software that allows to plan, control and monitor physical asset events and maintenance tasks to enable better allocation of equipment and resources, and ensure that proper and timely maintenance is carried out.

Be an adept asset management solution designed to help maintenance engineers pinpoint unreliable assets or processes so that they can execute timely preventive and predictive maintenance strategies. This would significantly reduce replacement and repair costs due to premature asset breakdowns, substantially lowers the cost of maintenance and ensure optimal performance of critical assets.

It should be a web-based system that models the workflows to cover all phases of the asset lifecycle across all services, providing a comprehensive and efficient system for investment planning, specifications, design, operations and maintenance, and disposal.

Be a functionally and architecturally scalable system built with Service-Oriented Architecture (SOA) which would enable it to be easily integrated to all levels of the enterprise.

It must ensure complete integration of all aspects of the businesses between all departments to focus on the total value.

Conclusion

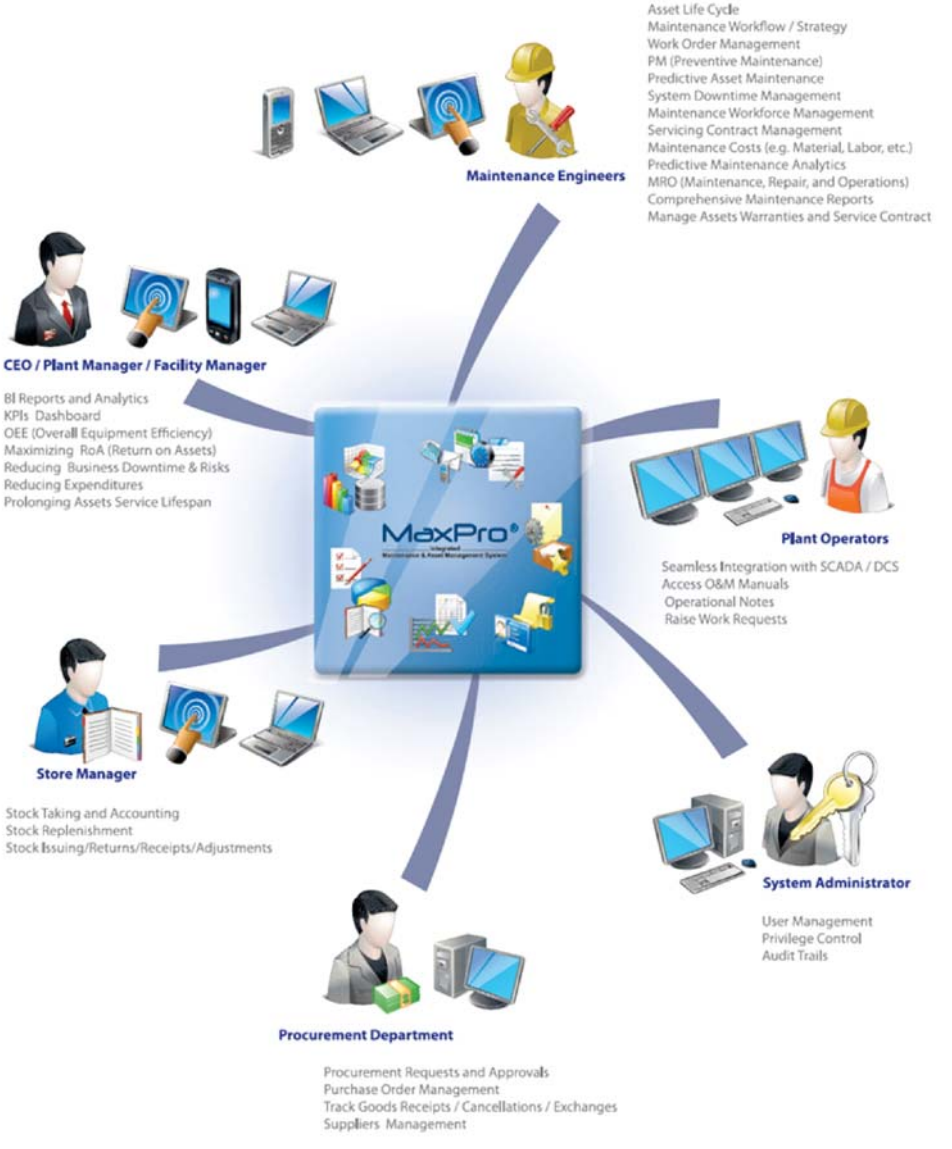
For industries or infrastructures that rely on physical assets, smart connectively and digitized work flow and processes with data analytics enables superior performance by unlocking value from digital transformation. Implementation of Asset Management starts from strategic Asset Manage planning and execution by creating digitized Asset Information base, Asset Plant View followed by seamlessly integrated management of maintenance, scheduling downtime, workforce management, Material inventory & procurement, track race, with data analytics & KPI Management.

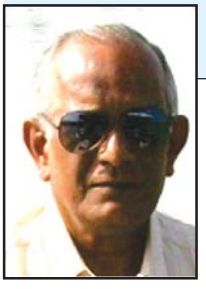
MaxPro – a fully integrated, value-added Enterprise Asset Management System has been developed by DNR Process Solutions Pte Ltd.

The processes and practices at DNRPS has led to the development of practical, advanced techniques for managing physical assets which have been further refined over the past decade to incorporate sophisticated features and best in class attributes.

These processes and techniques - a blend of process innovation and practical experience - have been steadily integrated into a holistic, globally comparable, user-friendly asset management framework that has delivered on its promise of 'quality with versatility' over the past decade and a half. A multifunctional globally admired in-house developed EAM platform that provides the best value in terms of cost, quality, efficiency, service, and regulatory compliance is MaxPro.

The following diagram illustrates the broad range of integrated solution and service platform that MaxPro provides and how it benefits all stakeholders





Corrosion in Coastal Areas and Remedial Measures Thereof

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Life Member, Consulting Engineers Association of India (FIDIC Affiliated)
Life Fellow, Institution of Engineers (India)
Senior Consultant and Chartered Mechanical Engineer

The total corrosion losses faced by the Indian industry especially ports, marine installations, harbours and industries located in the coastal belts accounts to an approximately Rs.1,50,000 cores or more per annum and approximately US $80 Billion per annum in the whole world as per recent figures obtained.

These damage costs are irreversible if not attended to in time and hence it's imperative to take cognizance of the situation and act upon in time to prevent the loses of machinery, equipment and metallic structures by (a) preventive maintenance, and (b) in process maintenance by deploying a proper corrosion prevention and eradication program, fine-tuned to balance the situation.

Contrary to popular belief, corrosions in coastal areas are not merely on account of salt spray corrosion alone but also due to the following:

Severe attack by microbes like fungi, algae, marine borers and moss, etc. which leads to inevitable organic decay and imminent slow organic inhibited corrosion. This needs to be addressed by a preventive maintenance system to avoid the growth of such micro organisms. The growth of these organic masses depends totally on the, anchoring possibilities based on the roughness of the surface; hence it's imperative that the surface has to be smooth, repellent to the above, one way or the other. The solution to this problem is by addressing with a suitable priming medium after proper scrubbing and application of a mastic type primer to repel water.

The second factor is the UV rays which tend to break the substrate by two major means viz. chalking and fading. This is tackled by a suitable top coat system which is capable of shielding the substrate against chalking and fading.

The third major factor which causes deterioration is the saline atmosphere. The main constituent is NaCl - brine solution, which causes the ultimate corrosion.

Hence a complete protection system capable of highest level of penetration, adhesion and moisture tolerance should be employed to counter the high rate of corrosion for plant, equipment and metal structures. The marine corrosion salvation/prevention program is a factor which is totally dependant on the correct selection of the process. This is very crucial for saving the plant, equipment and metal structures.

There have been many attempts to passivate steel against the adverse effects of abrasion and corrosion. It encompasses all structural members along a marine edge and the adjacent plant and equipment, off shore platforms, drilling rigs, pipelines, risers, pilings, berths, wharfs, jetties, etc. all of which exist in the splash or tidal zones of a marine environment. There are several known techniques for applying pre-installation protection coatings for protecting them from the ultimate effects of corrosion and erosion that attack the supports of the structure located in the splash zone.

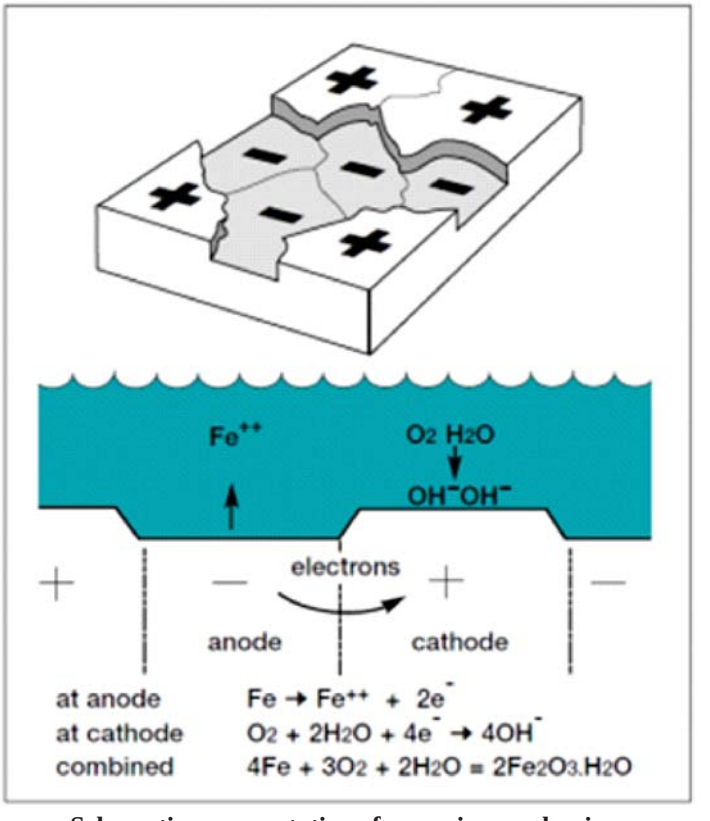
Once a structure such as a crane leg or a production platform is emplaced offshore and subjected to prolonged exposure of marine environment during normal operating procedures, the previously coated steel surfaces tend to be slowly penetrated and eroded to a point whereby the existing steel substrate is ultimately exposed. The corrosion rate of steel in the splash zone is typically about 100 mils per year. Normally these steel support members, without good repair procedures, will lose their structural integrity after about seven to ten years of exposure. The replacement cost of risers and other steel supports in situ offshore are extremely expensive and hence such replacement is preferably avoided.

Some common type of marine and coastal environment corrosions typically are:

- Pitting Corrosion
- Crevice Corrosion
- Stress Corrosion Cracking

Cost effective corrosion protection of structural steelwork present little difficulty for common applications and environments if the factors that affect durability are recognized at the outset. There are many steel structures that have continued in use satisfactorily for many years even in adverse conditions. The key to success lies in recognizing the corrosivity of the environment to which the structure would be exposed and in defining clear and appropriate specifications. Where steel is in a dry heated interior environment the risk of corrosion is not very significant and such protective coating may not be necessary. Conversely, a steel structure exposed to an aggressive environment needs to be protected with a high performance treatment and may need to be designed with maintenance in mind, if extended life is required.

The optimum protection treatment, which combines appropriate surface preparation, suitable coating materials, required durability and minimum cost, is achievable using modern surface treatment technology.



Schematic representation of corrosion mechanism for steel

The corrosion of structural steel is an electrochemical process that requires the simultaneous presence of moisture and oxygen. In the absence of either, corrosion does not occur. Essentially, the iron in the steel is oxidized to produce rust, which occupies approximately 6 times the volume of the original material consumed in the process.

As general corrosion, there are various types of localised corrosion that could also occur; bimetallic corrosion, pitting corrosion and crevice corrosion.

The rate at which the corrosion process progresses depends on a number of factors relating to the 'micro-climate' immediately surrounding the structure, principally the time of wetness and the atmospheric pollution

level. Because of variations in atmospheric environments, corrosion rate data cannot be generalised. However, environments can be broadly classified, and corresponding measured steel corrosion rates provide a useful indication of likely corrosion rates. More information can be found in BS EN ISO 12944-2 and BS EN ISO 9223

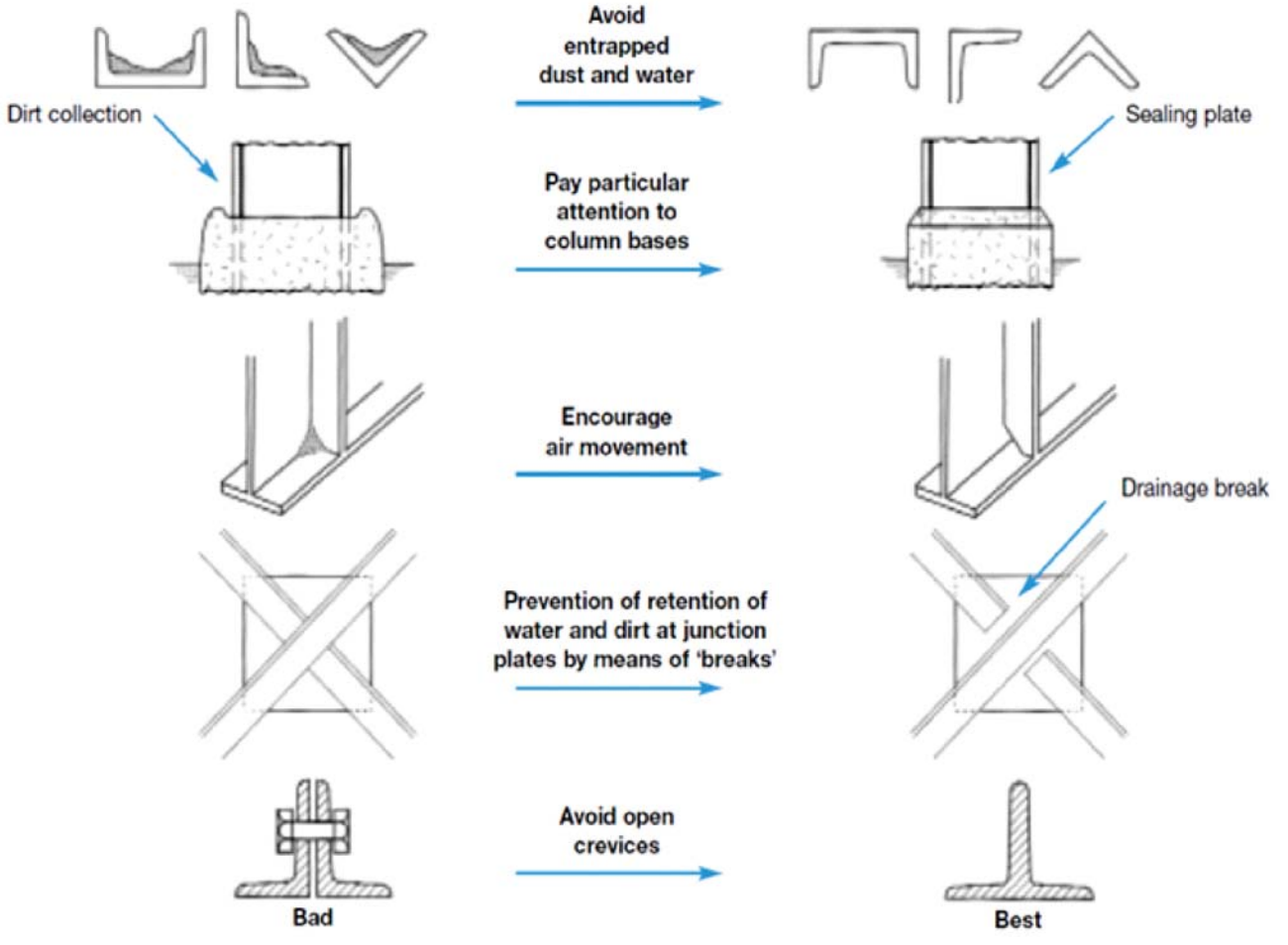
Corrosivity category	Low-carbon steel Thickness loss (µm)[a]	Examples of typical environments (informative only)	
		Exterior	Interior
C1 very low	≥ 1.3	-	Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels
C2 low	> 1.3 to 25	Atmospheres with low level of pollution: mostly rural areas	Unheated buildings where condensation can occur, e.g. depots, sports halls
C3 medium	> 25 to 50	Urban and industrial atmospheres, moderate sulphur dioxide pollution; coastal area with low salinity	Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundries, breweries, dairies
C4 high	> 50 to 80	Industrial areas and coastal areas with moderate salinity	Chemical plants, swimming pools, coastal ship and boatyards
C5 very high	> 80 to 200	Industrial areas with high humidity and aggressive atmosphere and coastal areas with high salinity	Buildings or areas with almost permanent condensation and high pollution
CX extreme	> 200 to 700	Offshore areas with high salinity and industrial areas with extreme humidity and aggressive atmosphere and sub-tropical and tropical atmospheres	Industrial areas with extreme humidity and aggressive atmosphere

Atmospheric corrosivity categories and examples of typical environments (BS EN ISO 12944-2)

Notes:

- 1µm (1 micron) = 0.001mm
- [a]The thickness loss values are after the first year of exposure. Losses may reduce over subsequent years.
- The loss values used for the corrosivity categories are identical to those given in BS EN ISO 9223

General guidance for the prevention of corrosion by good design detailing can be found in BS EN ISO 12944-3, and some typical do's and don'ts for steel framed buildings are shown below.



Examples of detailing for buildings

Reference should also be made to following publications and the subsequent amendments thereof:

- National Building Code of India 2016:PART 12 Asset and Facility Management
- IS 15183 Guidelines for Maintenance Management of Buildings:
- (Part 1) : 2002 General
- (Part 2) : 2002 Finance
- (Part 3) : 2002 Labour
- ISO 55000: 2014 Asset/Facility management. Overview, principles and terminology
- ISO 55001: 2014 Asset/Facility management. Management systems. Requirements
- ISO 55002: 2014 Asset/Facility management. Management systems. Guidelines for the application of ISO 55001
- BS 8210: 2012 Guide to Facilities Maintenance Management
- BS 8536: 2010 Asset/Facility Management Briefing Code of Practice
- BS 8572: 2011 Guide to Procurement Of Facility-Related Services

- BS 8587: 2012 Guide to Facility Information Management
- BSI PAS 55: 2008 Publicly available specification for the optimal management of physical assets.
- Maintenance Manual 2012, Central Public Works Department, Government of India.

Surface preparation is the essential first stage treatment of a steel substrate before the application of any coating, and is generally accepted as being the most important factor affecting the total success of a **corrosion protection** system.

The performance of a coating is significantly influenced by its ability to adhere properly to the substrate material. The initial surface condition of steel can vary in terms of the amount of residual mill scale and degree of initial rusting. However, generally it is an unsatisfactory base upon which to apply any high performance protective coatings. A range of methods of preparation and grades of cleanliness exist, but by far the most significant and important method used for the thorough cleaning of mill-scaled and rusted surfaces is abrasive blast cleaning. The standard grades of cleanliness for abrasive blast cleaning in accordance with ISO 8501-1are:

- Sa 1 – Light blast cleaning
- Sa 2 – Thorough blast cleaning
- Sa 2½ – Very thorough blast cleaning
- Sa 3 – Blast cleaning to visually clean steel

The surface preparation process not only cleans the steel, but also introduces a suitable surface profile and amplitude to receive the protective coating. High build paint coatings and thermally sprayed metal coatings need a coarse angular surface profile to provide a mechanical key. This is achieved by using grit abrasives. Shot abrasives are used for thin film paint coatings such aspre-fabrication primers.

After abrasive blast cleaning, it is possible to examine for surface imperfections and surface alterations caused during fabrication processes, e.g. welding. Certain surface imperfections introduced during the original processing of the steel may not be detrimental to the performance of a coating in service, particularly for structures in relatively low risk environment categories. However, depending upon the specific requirements of the structure, it may be necessary to carry out additional surface treatments to remove surface imperfections on welds and cut edges as well as soluble salts to produce an acceptable surface condition for painting.

All static parts, external as well as internal, need to be coated to prevent corrosion and enhance the life.

All surfaces, like in a box section made up of two[or I sections, etc. which become inaccessible after fabrication/ erection must be cleaned, primed and painted first. The weld also needs to be touched up later on. In all sections holes for rivets or bolts must be drilled prior to preparing them for coating.

Rust Removers—Rust Remover is a formulation containing an organic acid, tensio-active ingredients, and corrosion inhibitors to remove rust and dirt while providing a surface that will reduce further rusting potential. The chemical while acting as a rust remover also provides a film of corrosion protection.

Rust Remover can be used in a variety of concentrations from 1% to 10%. The parts to be cleaned can be in contact with the cleaning chemical for duration of 1 hour to 24 hours, depending on the application method and the working time required to remove the rust and other contaminants.

Commercial rust converters are water-based and contain two primary active ingredients: Tannic acid and an organic polymer. The first ingredient, tannic acid, reacts with iron oxide (rust) and chemically converts it to iron

tannate, a dark-coloured stable material. The overall chemical reaction converts rust into a stable, black protective polymeric coating that serves as an excellent primer for both oil and epoxy based paints.

Rust converter is usually applied to objects which are difficult to sand blast, such as vehicles, trailers, fences, iron railings, sheet metal, and the outside of storage tanks. It may also be used to restore and preserve iron-based items of historical importance

It is recommended that the surface to be cleaned or treated should initially be tested with a small amount of the selected chemical in a non-critical area, to determine if any adverse reaction takes place.

Passivators—A passivator is a type of corrosion inhibitor that appreciably changes the potential of a metal to a more noble (positive) value. It is a substance (e.g., chromate) that passivates, especially by forming a protective film on a metal. Oxidizing agents are the most common passivators, although other substances may also be used for passivation. Passivators can be used after:

- Pickling
- Mechanical treatments such as:
  - ✓ Grinding
  - ✓ Brushing
  - ✓ Blasting
- Removal of discolorations during pickling
- Removal of free iron
- Reducing the formation of toxic nitric fumes during pickling

A passivator can be an acidic, liquid passivating chemical used in either an immersion or spray final rinse to improve paint adhesion and minimize corrosion such as under-film corrosion and blistering. For instance, nitric acid is used to passivate aluminum and chromate solutions to passivate zinc coatings. Since passivation is primarily determined by metallurgical and environmental factors, the rate of corrosion is reduced by passivation depending on the type of metal and its environment.

Passivators are extremely useful in mitigating corrosion damage, however even a high-quality alloy corrodes if its ability to form a passivating film is hindered. Proper selection of the right grade of material for the specific environment is important for the long-lasting performance of this group of materials. If breakdown occurs in the passive film due to chemical or mechanical factors, the resulting major modes of corrosion may include:

- Pitting corrosion
- Crevice corrosion
- Stress corrosion cracking (SCC)

Passivators' working mechanisms are similar to passivation. For example, surface corrosion can occur when wet surfaces react with atmospheric oxygen. The formation of flash rust can be eliminated with the use of surface passivators, which chemically change the active surface of metal to a much less reactive state. It does not leave a film or residue to interfere with coating adhesion. It also removes soluble salts as it passivates, and is an effective alternative to hazardous chemical rust inhibitors.

Paint coatings for steel structures have developed over the years to comply with industrial environmental legislation and in response to demands from structure owners for improved durability performance.

Paint consists of apigment, dispersed in abinder, and dissolved in asolvent. The most common methods for the classification of paints are either by their pigmentation or by their binder type.

A modern paint system usually comprises a sequential coating application of paints or alternatively paints applied over metallic coat ingsto form a 'duplex' coating system. Protective paint systems usually consist of primer, intermediate/build coats and finish coats. Each coating 'layer' in any protective system has a specific function and the different types are applied in a particular sequence of primer followed by intermediate/build coats in the shop, and finally the finish coat(or top coat) either in the shop or on site.

Prefabrication primers are used on structural steelwork, immediately after blast cleaning, to maintain the reactive blast cleaned surface in a rust free condition through the fabrication process until final painting can be undertaken. These types of primers are not used before the application of thermally sprayed coatings.

The method of application of paint systems and the conditions of application have a significant effect on the quality and durability of the coating. Standard methods used to apply paints to structural steelwork include application by brush, roller, conventional air spray and airless spray/electrostatic airless spray.

Airless spray has become the most commonly used method of applying paint coatings to structural steelwork under controlled shop conditions (dust free, low humidity with correct ambient temperature as well as that of the steel surface being painted). Brush and roller application are more commonly used for site application, though spraying methods are also used. 'Stripe' coatings applied to edges and sharp corners are usually applied by brush.

The principal conditions that affect the application of paint coatings are temperature, both steel and ambient and humidity. These can be more easily controlled under shop conditions rather than on site. With modern high performance coatings, correct application and environment have become increasingly important to achieve the intended performance. Industry has recognized this and established a training and certification scheme for paint applicators.

There are four commonly used methods of applying **metal coating to steel surfaces**. These arehot-dip galvanizing, thermal spraying, electroplating and sherardizing. The latter two processes are not used for structural steelwork but are used for fittings, fasteners and other small items. In general the **corrosion protection** afforded by metallic coatings is largely dependent upon the choice of coating metal and its thickness and is not greatly influenced by the method of application.

Hot-dip galvanizing is a process that involves immersing the steel component to be coated in a bath of molten zinc (at about 450°C) after pickling and fluxing, and then withdrawing it. The immersed surfaces are uniformly coated with zinc alloy and zinc layers that form a metallurgical bond with the substrate. The resulting coating is durable, tough, abrasion resistant, and provides cathodic (sacrificial) protection to any small damaged areas where the steel substrate is exposed. The typical minimum average coating thickness for structural steelwork is 85μm. Some structures like transmission line towers are hot double dip galvanized to enhance their life.

Thermally sprayed coatings of zinc, aluminium, and zinc-aluminium alloys can provide long-term corrosion protection to steel structures exposed to aggressive environments. The metal, in powder or wire form, is fed through a special spray gun containing a heat source, which can be either an oxygas flame or an electric arc. Molten globules of the metal are blown by a compressed air jet onto the previously grit blast cleaned steel surface. No alloying occurs and the coating consists of overlapping platelets of metal and is porous. The pores are subsequently sealed by applying a thin organic coating, which penetrates into the surface. It is essential that the sealer completely satisfies the filling of all porosity in the metal coating.

The adhesion of sprayed metal coatings to steel surfaces is considered to be essentially mechanical in nature. It is therefore necessary to apply the coating to a clean roughened surface and blast cleaning with coarse grit abrasive.

Specifications for Coatings: The overall success of a protective coating scheme starts with a well-prepared specification. It is an essential document that is intended to provide clear and precise instructions to the contractor on what is to be done and how it is to be done. The specification should be drafted by someone with appropriate technical expertise, and it should be clear as to what is required, and what is practical and achievable. It should be written in a logical sequence, starting with the environment in which the coating is to be applied, the surface preparation, going through each paint or metal coat to be applied and finally dealing with specific areas, e.g. welds. It should also be as brief as possible, consistent with providing all the necessary information. The most important items of a specification are as follows:

- Metal dressing to remove sharp edges, projections, etc. and steel contamination.
- The method of surface preparation and the standard required.
- Environment in which coating is to be done.
- The maximum interval between surface preparation and subsequent priming or metal coating.
- The types of paint or metallic coatings to be used, supported by relevant standards.
- The method/s of application to be used.
- The number of coats to be applied and the interval between coats.
- The wet and dry film thickness for each coat.
- Where each coat is to be applied (i.e. shops or site) and the application conditions that are required, in terms of temperature, humidity, etc.
- Details for treatment of welds, and bolted connections, etc
- Rectification procedures for damage, etc.
- At times, there is a possibility of chalking of even epoxy finish coats. This may occur due to various reasons.

Most epoxies feel hard or dry in a few hours but continue to cure and harden for about a week. Generally it is best to paint or topcoat epoxy within a few days of the epoxy application, before the week full cure period has passed. This way the solvents in the topcoat will combine with the not fully cured epoxy and the topcoat product some so that there is chemical bonding as well as the normal mechanical bonding. None of these are completely on the mark. The problem appears to happen in warm, humid environments. There is a different set of conditions/ causes for the same problem when the temperatures are cool. Many brands of epoxy, especially marine epoxies use a curing agent that will 'blush' during curing in cool, damp situations. The result is a visible or not visible waxy film on the surface of the epoxy that affects the adhesion of anything applied over it.

Inspection forms an integral part of quality control. Its purpose is to check that the requirements of the specification are being complied with and to provide a report with proper records to the Owner. One of the greatest assets to the coating inspector is a clear written specification that can be referred to without doubt.

The appointment of an appropriately qualified third party inspector should be seen as an investment in quality and not just an additional cost. Inspection of the processes, procedures and materials required for the protective coating of steel structures is vital, since a major error in even one operation cannot be easily detected after the next operation has been carried out, and if not rectified immediately, can significantly reduce the expected life to first maintenance.

CEAI NEWS

CEAI NATIONAL AWARDS CEREMONY 2017

The CEAI National Awards Ceremony 2017 was held on 23rd April 2018 at the PHD Chamber of Commerce in New Delhi. Prof V Ramgopal Rao, Director, IIT Delhi was the Chief Guest.

Prof. V Ramgopal Rao, Chief Guest, sharing his views during the Panel Discussion with Ms Sayona Philip, President and Mr. Sudhir Dhawan, Past President, CEAI seated on either side

A panel discussion moderated by Mr. Sudhir Dhawan, CEO, Aether Engg and Past President CEAI on ***"Engineering Revolution in 2030"*** was held, with participation from Prof V Ramgopal Rao, Director IIT Delhi, Ms Sayona Philip - President CEAI, Mr Ajay Pradhan, CEO C2S2 and Dr. Sundaram, MD, JP Mukherjee & Associates. The guests also actively participated in the interactive Q&A session, thereafter.

Panel discussion is in progress

It has been the tradition in CEAI to honour Women Engineers at the Annual Awards ceremony. In keeping with that, Mrs Vartika Shukla, Executive Director (Technical), Engineers India Ltd. gave a special address

Ms. Vartika Shukla delivering her Special Address

which included some important qualities, a young professional needs, to succeed in his/ her personal and professional life.

The awards for the year were selected by an independent Jury headed by **Ambassador Sudhir Vyas**, Retired IFS and an engineer, who is an alumnus of IIT Kanpur, **Mr. V L Patankar,** former DG, MoRTH and former Director, Indian Academy of Highway Engineers and **Dr. R Ayothiraman**, Professor, IIT-Delhi.

The *Award for Excellence in Engineering Innovation by an Individual* went to **Mr Subhash Chand Mehrotra, Mehro Consultants, New Delhi**. The project was selected for the uniqueness of the design of a Jain temple at Chennai. The main requirement of the Jain temple was that steel could not be used in the construction on religious grounds. Mr Mehrotra developed an innovative solution using bamboo reinforced concrete for all components, including the foundation.

Mr. Subhash Mehrotra receives Award for Engineering Innovation for an Individual

To make the competition fair, the Committee had categorised according to the turnover of the companies.The *Award for Excellence in Engineering Innovation in Category 1*, was given to **B & S Engineering Consultants Pvt. Ltd., New Delhi.**

Mr. Alok Bhowmick and his team receiving the award on behalf of B&S Engineering Consultants Pvt Ltd

The *Award for Excellence in Project Engineering in Category 2*, was jointly given to **J P Mukherji & Associates Pvt Ltd.,** Pune and **M/s Tandon Consultants Pvt. Ltd, New Delhi.**

Dr. M S Sundaram and his team receiving the award on behalf of J P Mukherji & Associates Pvt Ltd

Prof. Mahesh Tandon and his colleague receiving the award on behalf of Tandon Consultants Pvt Ltd

The *Award for Excellence in Project Engineering in Category 3* went to **WAPCOS Ltd, New Delhi** for the Afghanistan-India Friendship Dam.

Mr. A N N Prasad and his colleague receiving the award on behalf of WAPCOS Ltd

The CEAI Awards Committee conferred the *Life Time Achievement Award* on **Mr. K. K. Kapila, Chairman & Managing Director of ICT**, a doyen of the engineering consultancy profession.

Mr K K Kapila receives the Lifetime Achievement Award

The award function ended with a Vote of Thanks by Mr. Somenath Ghosh, Vice President CEAI.

SEMINAR ON 'ARBITRATION – TIME TO RELOOK'

The CEAI Western Region Centre had organised a seminar on **"Arbitration – Time to Relook"**on 15th June 2018 in Mumbai, which was well attended – with over 110 persons, from different sectors of the industry.

CEAI-WRC, encouraged by the feedback received, based on interactionat the seminar *"Indian Contracts and Risks – Time to Relook"* and also keeping in view the extensive infrastructure developments taking place in the country and the Asia region, organized yet another session on the all important theme of Arbitration as the successor theme. The purpose was to deliberate on the impact of the recent changes in the Arbitration & Conciliation Act, and just how vibrant the eco-system on arbitration, mediation and conciliation has become in India, **which the government recognises is necessary for 'ease of doing business' and attracting foreign investment.**

The seminar analysed and examined the procedures available for enforcing contracts through Arbitration and Conciliation Act, Commercial Courts Act, Insolvency and Bankruptcy Code, and Specific Relief Act.

The talks and presentations were very focused and dealt with various aspects of Arbitration, be it in the fields of construction, economic, financial or Intellectual Property Rights.

Dr. Harshavardhan Subbarao, Co-Chairman, CEAI-WRC while warmly welcoming the Chief Guest, the dignitaries and the participants, informed them regarding CEAI and its activities. Mr. A P Mull, Past President, CEAI introduced the seminar theme as to why disputes arise and the importance of time and money in business contracts. Mr. Uttam Sengupta, Vice President, CEAI and Chairman, CEAI-WRC dealt with the need for the seminar on "*Arbitration-Time to Relook*". He mentioned that in India, dispute resolution is adhoc and that institutional arbitration is advisable. He added that Mumbai should be a Global Arbitration hub. He stated that on an average, Arbitration takes 1445 days in India vis-à-vis 164 days in Singapore. Although the 2015 reform was enacted there were still wrinkles to be ironed out and he wished the government and the judiciary woulddo that. Mr. Rajat Taimni, the Convenor, introduced the speakers for the seminar and requested the Chief Guest, Hon'ble Justice S N Variava, (Retd) Judge Supreme Court of India to deliver his address. Justice Variava mentioned that as human beings we may not agree on an issue and that leads to difference in the stances taken. He clarified that the reasons for the current slow pace of resolution were interference by courts and too few judges to arbitrate. He wished that the day's deliberations would be fruitful.

Mr. Kirindeep Singh, Senior Partner, Dentons Rodyk & Davidson LLP, Singapore, while talking regarding the recent trends in International Arbitration, mentioned that although India has one of the best legal systems, implementation was a problem. He added that setting aside of Arbitration awards and resisting enforcement on ground of public policy, an unruly horse, was a matter of concern. Public Policy is derived from the common law maxim *ex turpi causa non orituraction* (an action does not arise from a disgraceful cause). He then dealt with the systems in Australia, China, Hong Kong, Malaysia, Singapore and the revision of FIDIC Red Book Clause 21.7.

Mr. Rohit Singhal, Managing Director, Masin Projects outlined how construction disputes which involve both time and cost over runs arise due to the challenge to manage change and complex business environment of construction contracts. He mentioned that there is no specialized construction law firm. He then explained as how disputes could be resolved by seeing them from an engineering perspective. He expounded on the types of delays and how Delay Analysis could be carried out. Based on circumstances, a suitable methodology such as Time Impact, As-Built But-For, and Windows analysis could be adopted to resolve disputes.

- At Registration Desk
- Mr. A P Mull giving the opening address
- Mr. Rajat Taimni briefing regarding the speakers
- Chief Guest Justice (Retd.) S N Variava delivering his address
- Interaction from audience
- Dr. Subbarao welcoming the Chief Guest, Dignitaries and Participants
- View of Audience
- View of Audience
- Justice Variava making a point
- Mr. Umesh Dhargalkar, on behalf of CEAI, felicitating nonagenarian Engineer, Mr. N N Shrikhande
- At Registration Desk
- Mr. Uttam Sengupta briefing about the seminar
- Mr. Jeffrey Nambiar presenting a token to Mr. B Ravindranath
- Listening to the Chief Guest
- Interaction over tea

The two standards governing the methodology of Delay Analysis are 'Society of Construction Law Guidelines' and 'American Association of Advancement of Cost Engineering-RP'. He also listed the Essentials in Construction Disputes.

Dr. P V Amarnadha Prasad, a well known engineer, construction Lawyer and Arbitration practitioner dwelt on how disputes hamper business. He said that for ease of doing business a robust Dispute Resolution Mechanism is required with minimum delay in Arbitration Awards and Enforcement of the Award. He added that these would be possible only with a vibrant arbitration culture. He talked of the time, cost and quality issues and then moved on to the amendments made and those proposed in the Arbitration act.

Mr. Pranav Mago, Asia Head, Singapore International Arbitration Centre (SIAC) explained as to why institutional arbitration should be resorted to and how the SIAC framework helps to expedite the overall procedure of dispute resolution in an independent and neutral manner. He added that the procedure helps easy calculation of costs, for efficient functioning of the tribunal, scrutiny of the award to make it less susceptible to challenge. He also talked about the SIAC model arbitration clause, Arb Med Arb clause and the Expedited Procedure Protocol.

Mr. Rajat X Taimni, a partner with Tuli & Co., Advocates and Solicitors is Head of Practice-Dispute Resolution. He covered the importance of Joinder of Non-signatories to Arbitration since with contractual arrangements becoming more complicated a claimant could have claims against related or independent parties under different contracts. Hence the Joinder issue has to be resolved otherwise it would make dispute resolution complicated and expensive. He clarified as to who are the parties to an arbitration; practical issues of Joinder where multiple parties are involved; the issues not resolved by the 2015 amendments, and the challenge of clubbing international and domestic arbitration. He summed up by saying that there could be a case for further amendments to definition of "Party"; that on Joinder there should be an authoritative pronouncement so there is certainty; International practices and standards can be examined, and that a Strategy on how to claim and against whom, should be carefully planned to avoid Joinder complications when disputes arise.

Mr. Montek Mayal, Managing Director and India Leader of the Economic Consulting segment of FTI Consulting covered Commercial Arbitration. He explained that the role of an expert is to give opinions and not witnesses of facts; the Experts reduce uncertainty by giving their objective opinion to help Parties, Courts and Tribunals make informed decisions. He clarified as to what quantum experts do. He explained the governing principles for calculating damages and the two positions – the 'Actual Position' and the 'But for' or 'Counterfactual Position'. He deliberated on Characteristics of reliable and persuasive quantum evidence; business valuation in the context of damages; and the factors and methods of estimating value. He also presented Case Studies.

Ms. Anuradha Maheshwari, one of the Founding Partner, Lex Mantis spoke on the recent trends in IP (Intellectual Property) Arbitration. After talking about arbitration in general, she moved on to explain Construction IP rights. She said that IPR are not commonly sought in India although a large number of cases do occur which could perhaps be fit for IPR. She explained the various elements of a building for which IP rights could be sought including those aspects which deal with energy efficiency. She explained the difference between Copyright, Trade Marks, Design, Trade Secrets and Patents which, in India, are governed by TRIPS. She then talked of the type of IP disputes and the IP Risks in the construction industry, ADR vs. Litigation, the Indian position and the Arbitral Institutions tailored to IP disputes.

The open house discussion was very lively and had M/s Uttam Sengupta, Rajat Taimni, Harshavardhan Subbarao, S Ramchandani, Dileep Kelapure, Kirindeep Singh and Prof Satyanarayana A as the panel members. Audiences raised their queries to which clarifications were provided by the panelists as well as participants from the audience.

Mr. Umesh Dhargalkar, seminar Committee Member proposed the Vote of Thanks.

- Mr. Kirindeep Singh talking on recent International trends in Arbitration
- Mr. Pranav Mago explaining on Institutional Arbitration
- Interaction from audience
- View of audience
- Panelists on the dais
- Interaction from audience
- View of audience
- Mr. Rajat Taimni expounding on Joinder in Arbitration
- Ms. Anuradha Maheshwari dwells on Construction IPR
- Mr. Ramchandani responding to queries
- Mr. Rohit Singhal explaining how to resolve disputes from an engineering perspective
- Dr. PV Amarnadha Prasad on current practice and amendments in Arbitration act
- Mr. Montek Mayal speaking on Commercial Arbitration
- Panelists on the dais
- Mr. Umesh Dhargalkar, Committee Member, giving the Vote of Thanks

SEMINAR ON 'RIVER ACTION PLAN, FLOOD MANAGEMENT AND BASIN DEVELOPMENT'

Considering the magnitude of problems related to Water Management, Sedimentation, Flooding and Pollution in rivers experienced across the country, CEAI has organised a Seminar on ***'River Action Plan, Flood Management and Basin Development'*** on 27th& 28th July 2018 at Shangri-La's Eros Hotel,19 Ashoka Road, Connaught Place, New Delhi 110001. The prestigious project, in which the Hon'ble Prime Minister of India has keen interest viz., ***National Mission for Clean Ganga*** and which has created a buzz, worldwide would be discussed.

We intend to leverage on the vast experience of CEAI member organisations & Experts plus International members of the Consulting fraternity for this Seminar. The endeavour would be to harness the experiences in other countries, best practices adopted and highlight the latest advances in technology for the benefit of executing agencies, Indian consultants and other stakeholders.

The **National Mission for Clean Ganga (NMCG)** of the Ministry of Water Resources, River Development and Ganga Rejuvenation, **NITI Aayog**, **Inland Waterways Authority of India** of the Ministry of Shipping, **Bureau of Indian Standards**, **International Commission on Irrigation and Drainage, Indian Water Resources Society, Central Water Commission, Australian Water Partnership** have kindly agreed to provide logo support for the seminar.

The Seminar will comprise two Plenary Sessions, five technical sessions and a concluding Panel Discussion covering River Basin Management, Integrated Flood Management, Pollution Abatement, Procurement Strategies, Current Policies and Effectiveness, Country Specific Intervention, Institutional Strengthening & Capacity building, etc.

Some of the confirmed session Chair/ Speakers are: Mr. M Gopalakrishnan, Former Chairman CWC Secretary General Hon., ICID/ Mr. Arun Kumar Sinha, Chairman, Ganga Flood Control Commission/ Mr. Ashwin B Pandya, Secretary General, ICID/ Mr. Rajiv Ranjan Mishra, Director General, NMCG, Ministry of Water Resources, etc./ Mr. Rajesh Yadav, Senior Projects Officer, ADB/ Dr. Sharad K Jain, National Institute of Hydrology/ Mr. Kamal Singh, Executive Director- Sustainable Development, U N Global Compact/ Mr. M E Haque, Former Member, CWC/ Mr. D P Mathuria, Executive Director (Technical) Ministry of Water Resources/ Mr. Srinivas Chokkakula, Research Professor, Centre for Policy Research / Prof. A K Gosain, Professor-Department of Civil Engineering, IIT/ Mr. Alok Sikka, International Water Management Institute/Dr. Ruprekha Dalwani, National Green Tribunal Expert on Waste Management (Haryana & Delhi NCR) & Former Advisor, NRC / Dr. R M Bhardwaj, Divisional Head - Water Quality Management -I Division ,CPCB/ Tata Consulting Engineers/ Dr. Chandan Ghosh, Professor & Head, NIDM/ et al.

Major players from the Government, Public and Private Sector have already expressed their intent to participate in the Seminar to deliberate and share their experiences with other Stakeholders. This would provide all participants a unique opportunity to network and interact with Experts in the field.

We invite members and others to send delegates to participate in this very important and prestigious conference.

For more information please visit our website www.ceai.org.in or contact CEAI Secretariat.

DELHI HIGH COURT JUDGEMENT ON COA MATTERS

In relation to the Public Notice dated 20.05.2013 issued by the COA prohibiting incorporation of companies whose objects is to carry on the business of architecture, BDP Design Engineering Pvt. Ltd. had filed a writ petition – "BDP Design v UOI & Ors" - in the Delhi High Court. CEAI was one of the respondents in the case and Advocate Anish Dayal appeared on behalf of CEAI.

The Delhi High Court has upheld the right of unregistered persons to practice architecture including of juristic entities. Additionally, the Court has quashed part of the circulars which directed such companies to remove practice of architecture from their objectives. This is a firm and conclusive endorsement of the stand taken by CEAI with the support of IAStructE, ECI and ACCE(I).

The judgement of Delhi High Court is available on CEAI website at https://ceai.org.in/engineers-bill/court-judgements/

CEAI INTERVENTIONS

CONSULTANCY SERVICES FOR AUTHORITY'S ENGINEER

CEAI wrote to NHAI on 22nd March 2018, requesting for release of Logistic payments as per quoted rates without linking it to the percentage of financial progress of the Project work as specified in Consultancy Contract Agreement for Authority Engineer Services. CEAI plea was partly met, due to some constraints. The Letter received from NHAI is reproduced below:

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन और राजमार्ग मंत्रालय)
National Highways Authority of India
(Ministry of Road Transport and Highways)
जी-5 एवं 6, सेक्टर-10, द्वारका, नई दिल्ली-110075
G-5 & 6, Sector-10, Dwarka, New Delhi-110075

दूरभाष / Phone : 91-11-25074100/25074200
फैक्स / Fax : 91-11-25093507 / 25093514

NHAI/TIC/R&D/58/Misc/2018/116528 — 20th April'18

To,
Mr. S. Philip,
President,
M/s. Consulting Engineers Association of India
CEAI, Centre, OCF Plot No. 2,
Pocket -9, Sector-B,
Vasant kunj, New Delhi-110070.

Sub : Consultancy services for Authority's Engineer.

Ref : Your letter No. CEAI/159/2018 dated 22nd March'18.

Sir,

This is reference to your letter dated 22nd March'18 on the subject mentioned above. In this regard, it is submitted that the request submitted by you has been considered by the Competent Authority and it is found that the amendments to the existing Contract documents cannot be approved for all such projects in general, as it may amount to change in contract conditions, subsequent to signing of agreement.

2. However, in the cases of abnormally delayed projects, the demand of consultant for payment of expenses of logistics as per actuals can be considered by the Authority on case to case basis, with proper justification.

3. This issues with the approval of the Competent Authority.

(Ajay Kumar Sabharwall)
GM (T)–SRD&Q

MEETING WITH DG SERVICES EXPORT PROMOTION COUNCIL OF THE MINISTRY OF COMMERCE

Ms. S Philip, President, CEAI and Mr. Somenath Ghosh, Vice President, CEAI, had a meeting with Ms. Sangeeta Godbole, Director General, Services Export Promotion Council (SEPC) on 22 March 2018. She expressed that a lot of opportunities are available for CEAI members to work with SEPC.

The salient points of the discussion were:

- Currently, there is no representation of engineering consulting organisations at SEPC
- SEPC would be happy to support our case to address the needs of the sector for the export of services
- She advised that we participate in the exhibition being held in Mumbai titled "Global Exhibition on Services" between May 15 to 18, 2018
- She can help setting up Buyer-Seller meet at GES 2018
- SEPC has schemes for supporting participation in Trade Shows
- SEPC can sponsor trade delegations to potential market destinations
- SEPC can help define Terms of Business for Market Access of International Consultants for doing business in India
- SEPC can help define standards that can act as barriers to trade for International Consultants for doing business in India.

Some desk work is required to be done at our end to explore each of these opportunities.

Members are requested to kindly give their feedback so that CEAI can utilise the opportunities.

ADB WORKSHOP ON 'ASSESSMENT OF CONSULTING SERVICES PERFORMANCE'

ADB organised a Workshop on *'Assessment of Consulting Services Performance'* at Hotel Pullman, Aerocity on 24 April 2018. The report on the workshop is given below:

ADB engaged CRISIL to assess the performance of Consultants in ADB funded projects, identify the key issues faced by various stakeholders which impact the quality of the deliverables and project implementation, and recommend measures in order to strengthen the governance and performance mechanism of project delivery.

Mr. Bisma Husen, Sr Procurement Specialist made the opening remarks; thereafter, Ms. S Philip, President, CEAI made her opening remarks.

CRISIL gave a detailed presentation of their findings and recommendations for an hour. It included field studies undertaken between 30th October 2017 to 28th February 2018, covering 14 States, 27 ADB projects and was based on interactions with all stakeholders, including CEAI. The recommendations also involve measures to be taken by all stakeholders – ADB, EAs, Consultants and CEAI.

A few of the recommendations that ADB wishes to involve CEAI in, with respect to consultants pertain to:

a) An Accreditation and Certification System

b) Evolving a Data base of Consultants at the National level

c) Formulating an approach for Capacity Building of the Consultants, in consultation with ADB.

ADB expects CEAI's assistance in the above. CEAI is, in principle, agreeable to collaborate with and assist ADB in the interest of the Consulting Engineering fraternity. Whilst the feasibility and modalities of (a) and (b) need to be worked out in greater detail, (c) could be taken up sooner.

Presentations were made by the Executing Agencies – Kolkata Municipal Corporation and Rajasthan Urban Infrastructure Development Project (RUIDP); and by the Consultants -

Mr. K K Kapila, CMD, ICT and Mr Ramesh Kumar, Portfolio Manager for funded projects, Mott Mac Donald made presentations on behalf of Domestic and MNC consultants respectively.

Thereafter, Ms. Philip, President CEAI made a presentation. She spoke about CEAI's endeavour to promote the interests and establish the rights and privileges of the consulting engineering profession. She highlighted its activities in contributing to consultants' growth, development and CEAI advocacy for and on behalf of Consultants with Government agencies, Ministries, Financial Institutions, MDBs, etc. She also mentioned what CEAI's approach would be to resolve the various issues brought out by the CRISIL study from the Consultants' perspective.

The floor was thrown open to the participants for an interesting Q&A in which JICA, other EAs, consultants and all the CEAI representatives participated.

ADB agreed to the CEAI (Mr Dhawan's) suggestion of forming a task force to carry forward recommendations of the study. The CEAI team also made some valid points with respect to the issue of cash flow in project execution, the need to incorporate the same when considering payment terms and about the resource issues faced by Consultants.

ADB thanked all the delegates for their participation and conveyed its appreciation of CEAI and described it as a 'responsible representative body of professional consultants'and hoped they would be able assist and advise ADB to carry out some of the recommendations.

ADB mentioned that they will be sharing the presentations made and the Proceedings of the Workshop with the participants.

Mr Kenichi Yokoyama, Country Director, ADB, could not attend since he got called for a meeting with the Ministry.

The Workshop was well attended by officials from ADB, Executing Agencies of the Government, World Bank, JICA including the Chief Representative of JICA in India, CEAI representatives – Mr. Sudhir Dhawan, Mr. Pradeep Chaturvedi, Mr. Rajinder Khazanchi and Mr. Pankaj Vats and representatives from Consultancy firms who were directly invited by ADB viz., SMEC, AECOM, LEA Associates, Shah Technical, Feedback, Tata Consulting Engineers, et al.

FIDIC PRESENTATION TO INDIAN NAVY

A meeting was held with the officers of Indian Navy and a CEAI team on 17th April 2018 at office of the Indian Navy. Maj. SJM Jafri, Former Hon. Secretary CEAI and Capt. Prerana Dubey, Dy Director represented CEAI in the meeting. The Indian Navy represented by Vice Admiral DM Deshpande, CWP&A, Rear Admiral V Raja Sekhar, DG P-75, Rear Admiral Sanjeev Srivastav, DGND (SDG), Rear Admiral Dhiren Vig, ADG Project Seabird, Rear Admiral GK Harish, ADG Tech, Commodore Vikram Sharma, and 35 more senior Naval officers including 2 from Army.

Maj. Jafri gave his presentation and introduced the audience to FIDIC, its background and its different Contract Forms (FIDIC Rainbow Suite of Contracts). He highlighted the salient features of each form, deliberating further on Silver Book, which is closest to what can be of use to Indian Navy. He then compared the DPP Chapters IV & VI of Indian Navy to the FIDIC Conditions of Contract with specific reference to some important Clauses relating to, Arbitration, Claims, Payments, Variations, etc.

The Presentation was followed by an enthusiastic Q & A interactive session with one of the important queries being whether the MES (Military Engineering Services) was using FIDIC Contracts or not. The Navy informed that Project Seabird and Project Varsha were already using FIDIC conditions of contract. They also informed that the Defence DPP is reviewed and

upgraded regularly. Admiral Deshpande encouraged all officers present to study FIDIC contract conditions.

NATIONAL HIGHWAY BUILDERS FEDERATION

In Aug 2014/ Feb 2015 IHMCL awarded a 5 year contract to 5 companies to collect traffic data across National Highways in India using Automatic Traffic Count and Classification equipment. They remain satisfied with the work of the 5 companies and have recently given letters to them expressing the same. 32 months of the assignment are currently over, and 28 months remain.

However, in March 2018 IHMCL invited fresh bids for the balance period of 24 months of the work; the reason given is that they expect lower bids and thus savings to IHMCL. Such an act of inviting fresh bids for works where a contract agreement exists, and there is no deficiency in the working of the contractor, simply because one expects a lower price is unheard of.

CEAI wrote a letter to Mr. VC Verma, President, NHBF to inform him about the unjust and potentially risky action being taken by IHMCL and appealed to him to review the decision, as it has legal implications and immense, far reaching consequences on the contracting and consulting industry as a whole.

EXPLORING THE POSSIBILITY FOR MOU WITH IIT-D

CEAI and Prof. V Ramgopal Rao, Director IIT-D discussed on ways to cooperate in fields of mutual interest. CEAI President, Ms Sayona Philip and Mr. Sudhir Dhawan, Immediate Past President, suggested that one such area could be introduction of Procurement Practices and FIDIC Conditions of Contract which are being used by Indian executing agencies. CEAI would be glad to provide guidance and material for conducting classes.

CEAI OUTREACH

CEAI continues to expand its outreach by way of providing support to other professional events and promoting its own, to reach out to new members. Some of the events are:

- Conference on *'International and Domestic Arbitration: Current Scenario and Way Ahead'* on October 26-27, 2018 being organized by India Institution of Technical Arbitrators at Chennai.
- BAUMA CONEXPO INDIA 2018 which will take place in December 2018 at HUDA Grounds, Gurgaon

FIDIC NEWS

FIDIC-ASPAC CONFERENCE 2018

The FIDIC-ASPAC 2018 Conference on *'Infrastructure Connectivity in the ASPAC Region'*was held on 24-27 June 2018 at Colombo, Sri Lanka.

A report of the Conference will be published in the next issue.

FIDIC INTERNATIONAL INFRASTRUCTURE CONFERENCE 2018

The 2018 FIDIC International Infrastructure Conference will take place in Berlin from 9-11 September 2018. The main theme of the conference will be *"Mobility & Smart Infrastructure"*.

For more details please visit FIDIC conference website http://fidic2018.org

OTHER NEWS, VIEWS & NOTES

HOW STRUCTURAL ENGINEER MAHENDRA RAJ SHAPED MODERN INDIAN ARCHITECTURE

The article published in the Business Standard edition of 26 May 2018 hailed the senior most Founder member of CEAI, Mr. Mahendra Raj.

The article begins with his journey as a young civil engineer from Lahore to India during partition and encapsulates his journey towards building infrastructure for a new administration, and for a vast populace and the millions of refugees to shaping a new nation.

ARTICLE ON HOWRAH BRIDGE BY AMITABHA GHOSHAL

The article *"Howrah Bridge"*, published in the Outlook April 2018 issue was penned by Mr. Amitabha Ghoshal, Chairman of CEAI Eastern & North Easern Region.The article is reproduced below:

HOWRAH BRIDGE diary

AMITABHA GHOSHAL

(The author has engineered many bridges in India and abroad in a 60-year career.)

Much Water Has Flown

We mark the anniversaries of people, even institutions, but seldom keep track of the age of the magnificent structures surrounding us, till one day, they begin to show signs of distress, and a witch-hunt begins to identify a scapegoat! It was, therefore, a surprise when that warm invitation came from the engineering advisor to the Prime Minister of Bangladesh. It was the centenary of the famed Hardinge Bridge (aka Sarah Bridge), across the lower Ganges. My association: I was the engineer entrusted with repair of major damages inflicted on it during the 1971 war. An unusual assignment, it had called for innovative solutions, and urgently—the railway bridge was the lifeline of a newborn country recovering from war. Now, we got a fabulous reception, including a trip to the bridge by a special train. Judged against the utter negligence the engineering community suffers in our country, being honoured thus was a dream come true.

A Bridge Between Yesterday, Tomorrow

Now Howrah Bridge, the silent hero of many a film, including one by the same name, is completing 75 years. At a Victoria Memorial seminar, I had occasion to slip into a rare retrospective mood, telling the story of a bridge. How many Calcuttans remember this bridge was a replacement for one on floating pontoons, designed by Sir Bradford Lesley? It had a removable central section to allow river traffic that fed Calcutta port! Designed for a life of 25 years, it had to serve for 69 years, till the "New Howrah Bridge", as it was called then, was inaugurated in 1943. The old one was struggling with the ever-growing traffic across the river to Howrah, which housed the main railway station and was the gateway to Calcutta. It also had to convey the raw material sourced from the rest of India for Britain via the port, and the finished materials from the colonial masters to the populace of the colony. It was the main artery of empire, and it was choking! The new bridge, therefore, was designed to have a road carriageway of 71 feet, enough to accommodate eight lanes of traffic, including two tram tracks, and, additionally, two 15-ft-wide footways on either side, keeping in view the huge pedestrian traffic disgorged by the railway station.

The River, Right of Way

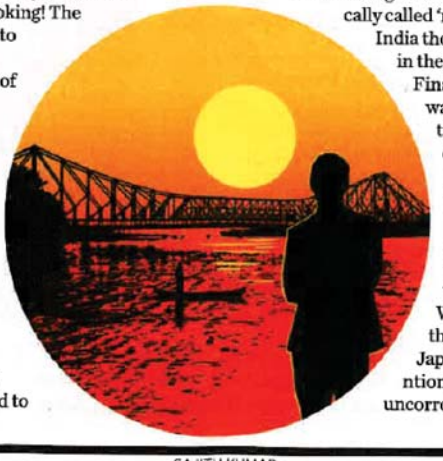
Interesting debates shaped the new bridge. Port authorities vetoed a foundation inside the river channel, fearing that would change siltation patterns permanently and affect ship movement. That dictated the broad plan—the bridge was forced to have a span of 1,500 ft. The designers decided on a balanced cantilever suspension bridge: a 1,500-ft-long ropeway of steel, slung on two towers rising about 300 ft above the ground on either side. A mammoth 26,500 tonnes of steel work! The 1,500 ft length has three parts. Two arms of 470 ft each cantilevered from the towers—at a gentle slope of 1 in 40, to make it easy for bullock carts and manual carts that made up the bulk of traffic—which in turn support a central suspended girder of 560 ft. The arms have two short anchor spans, held down by massive concrete anchor blocks behind each tower. If you stand bang in the centre, you may not realise you're being held aloft in the air by anchors 1,000 ft away!

Make in India 1.0

Stirrings against total domination by Britain too inflected this essay in steel. The UK-based Cleveland Bridge, the selected contractors, faced off against British-owned but Calcutta-based structural fabrication companies, which insisted the contract should not be awarded to any company from outside India! The claim of the lowest tenderer from Germany was brusquely dismissed because of the growing war clouds in Europe. Finally, a compromise was arrived at: Cleveland would get the construction contract, and the entire fabrication would be subcontracted to the 'Indian' players, who merged to form 'The Braithwaite, Burn & Jessop Construction Co. (BBJ)'. The skills they picked up doing Howrah Bridge allowed them to do almost all major steel bridges across India and abroad for the next 60 years, including the next bridge across the Hooghly, the Vidyasagar Setu.

We Also Make Steel

Then came steel—this needed 'high tensile' stuff, almost 1½ times stronger than what's normally used, euphemistically called 'mild steel'. It wasn't manufactured in India those days—but the Tatas put their foot in the door and promised to upgrade! Finally, 23,500 tonnes of the total 26,500 was forged at Jamshedpur. The foundation work saw high-tech digging at levels much below the river bed. They were pioneers and martyrs diving into aqua incognito: Bend Disease, caused by the formation of nitrogen bubbles in the bloodstream, felled a few. When it was completed, on cue within five years, it was the middle of WWII. Howrah Bridge went under the cover of barrage balloons to evade Japanese bombs! It still eludes our attention, Calcutta's proud and silent icon, uncorroded, a testimony to India's skills.



SAJITH KUMAR

OUTLOOK 30 April 2018

ACCE(I) AWARDS TO CEAI MEMBERS

A) Mr S C Mehrotra of Mehro Consultants has received ACCE(I) award for his Bamboo Reinforced Concrete in Jain Temple

B) Prof Mahesh Tandon of Tandon Consultants Pvt Ltd, was awarded with "Gaurav Award" (Life Time Achievement Award)

The awards were presented by the Association of Consulting Civil Engineers (India) on 2nd June 2018 at Madurai.


Mr. S C Mehrotra


Prof Mahesh Tandon

VIEW POINT

The next issue of the View Point will be published in **September 2018.**The topic for the September issue will be on "Built Environment – Energy Conservation for Utilities"

Considering the experience of CEAI members and various stakeholders in the subject, CEAI would be happy to receive articles on the above theme.

Authors could share their knowledge enriched by the works executed, first hand accounts of the challenges faced, practical issues experienced and the solutions to those, etc. Photographs would benefit our readers for better appreciation of the issues encountered and addressed.

The articles for September issue need to reach CEAI by 15th August 2018. Articles need to be in Times New Roman 12 with single line spacing on A4 size.

Advertisement in View Point

VIEW POINT is circulated to all CEAI Members, FIDIC, Ministries of the Government of India, Public & Private Sector Undertakings, Construction Firms, Contractors, Consultants, Foreign missions and Funding Institutions in India and other organisations related to or dealing with the engineering profession.

Therefore, advertising in the VIEW POINT gives the advertiser wide exposure and visibility.

The rates for advertisements in VIEW POINT are given below. This is excluding GST @18% or as prescribed, which will be extra:

	Rate Per issue*	Discounted rate at 20% for 4 consecutive issues (from June 2018 to March 2019)*
Back Cover**	Rs. 25,000/-	Rs 80,000/-
Inside Front Cover	Rs. 15,000/-	Rs 48,000/-
Inside Back Cover	Rs. 15,000/-	Rs 48,000/-
Full Page	Rs. 10,000/-	Rs 32,000/-

*GST @ 18% or as prescribed will be added to the above rates.
** Booked till December 2018. Available from March 2019 issue.

Tech Quiz[1]

1. Which was the first city built?
   a. Uruk b. Harappa
   c. Eridu d. Mohenjo daro
   e. Byblos
2. Which is the oldest continuously inhabited city in India?
   a. Patliputra b. Ujjain
   c. Madurai d. Varanasi (Kashi)
   e. Kannauj
3. Which is the oldest stone structure in India you can enter?
   a. Great Stupa, Sanchi b. Mahabodhi Temple, Bodh Gaya
   c. Qutub Minar d. Charminar
   e. Taj Mahal
4. When was the Public Works Department started in India
   a. 1800 b. 1870
   c. 1854 d. 1845
   e. 1900
5. Who according to Hammurabi was responsible for a building's safety?
   a. Owner b. Architect
   c. Engineer d. Builder
   e. Tradesmen
6. Who in present time is responsible for a building's safety?
   a. Owner b. Architect
   c. Engineer d. Builder
   e. All the above
7. What material was used for construction in Harappa?
   a. Timber b. Stone
   c. Bricks d. Mud & Clay
   e. Lime mortar
8. What is the oldest natural sustainable building material?
   a. Mud & Clay b. Timber
   c. Stone d. Bamboo
   e. Brush/ Thatch
9. When was the Central Pollution Control Board established?
   a. 1969 b. 1974
   c. 1982 d. 1950
   e. 1965
10. Where was India's first electricity generating plant located?
    a. Darjeeling b. Bokaro
    c. Shivanasamudram d. PrinsepGhat
    e. Bhira

The first person who mails the correct answers to *CEAI info@ceai.org.in* will get a congratulatory mail and will be acknowledged by publishing his/ her photograph in the next issue.

[1]Contributed by Mr. A P Mull and Ms S Philip

Answers to Tech Quiz March 2018 issue:

1(b), 2(d), 3(c), 4(b), 5(c), 6(b), 7(d), 8(a), 9(d), 10(c)

Prof. Mainak Ghosal, Consultant, is the winner of the Tech Quiz with full/ maximum marks.

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STRUCTURAL ENGINEERING SPECIALISTS
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You may be posted anywhere in the Country to take care of challenging metro project designs including in TCPL head office at Delhi.

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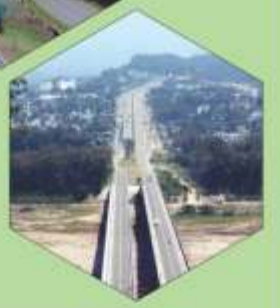

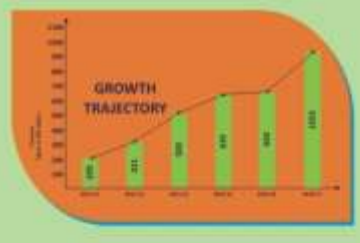

"Build Together, A Better World"

Rodic Consultants Private Limited - a name which spells excellence and inspires confidence - was established in the year 2000 with a vision to provide a spectrum of consulting services in the filed of infrastructure. Over the last sixteen years, It has emerged as a strong, motivated and sound organisation that has time and again proven its core competence in providing expertise in the sectors of Highways, Bridges, Tunnels, Railways, Rodic has also made inroads into Hydropower. Power - T&D, Inland Waterways, Water Resources and Urban Development sectors.

Certified with an ISO9001:2008, ISO14001:2004, OHSAS 18001:2007 and TRACE certification. Rodic has moved from strength to strength in its quest for excellence. Our confidence has further grown by being associated with projects involving major funding institutions such as The World Bank and The Asian Development Bank, the Government of India. We have a strong Pan-India client base, whose confidence and trust we have earned with our exemplary expertise in the areas of Consulting and Engineering, Advisory Services, Feasibility Studies, Detailed Engineering, Proof Checking, Value Engineering, Detailed Design, Detailed Project Report Preparation, Construction Supervision, Owner's Engineer and Project Management.

Our strength lies in the value of sincerity and hardwork that our Company upholds. We are further enriched by the more than one thousand four hundred skilled and motivated professionals who work with us in a spirit of team-work and productive co-operation. A continuous striving for excellence has always been our Mantra and we lay a high premium on commitment and client satisfaction. Our Value-system encompasses - competence, innovation, client-centric approach and delivering within time frames.

AWARDS AND RECOGNITION'S

- Achievers Award 2015 conferred on Mr. Raj Kumar, Chairman and Managing Director, for successfully achieving milestones in the implementation of the AIIMS - Digha Elevated Corridor by the Hon'ble Chief Minister of Bihar Shri Nitish Kumar, on the occasion of 6th foundation day of BSRDCL.
- Rodic Consultants Pvt. Ltd. was featured in "Leading SME of India" published by Dun and Bradstreet.

JOB OPENINGS

We are also looking for qualified and experienced professionals from relevant disciplines to join Rodic family for our various current and upcoming projects on a Pan India basis. Interested candidates are encouraged to forward profiles by email to career@rodicconsultants.com

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