



LECTURE # 4

In this lecture you will learn about:

- Repair & Rehabilitation.
- Maintenance.
- Facets of Maintenance.
- Classification of Maintenance.
- Necessitation of Maintenance.
- Importance of Maintenance.
- Inspection Periods.
- Various Aspects of Inspection.
- Stages of Inspection.

Course Name:

“Material Testing, Repair & Maintenance”

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REPAIR & REHABILITATION

REPAIR

It refers to the modification of a structure, partly or wholly, which is damaged in appearance or serviceability

REHABILITATION

It is the process of restoring the structure to service level, once it had and now lost.

Strengthening consists in endowing the structure with a service level, higher than that initially planned by modifying the structure not necessarily damaged area



MAINTENANCE

- It is the act of maintaining the building in its serviceable condition.
- It is defined as the work done to keep the Civil Engineering structures and work in a condition so as to enable them to carry out the functions for which they are constructed. The maintenance of structure is done to meet the following objectives
 1. Prevention of damages due to natural agencies and to keep them in a good appearance and working condition
 2. Repair of the defects occurred in the structure and strengthen them, if necessary



FACETS OF MAINTENANCE

Maintenance operations have many facets such as

Emergency Maintenance: Necessitated by unforeseen breakdown drainage or damage caused by natural calamity like fire, floods, cyclone earthquake etc.

Condition Based Maintenance: Work initiated after due inspection

Fixed Time Maintenance: Activities repeated at predetermined intervals of time.



FACETS OF MAINTENANCE

Preventive Maintenance: This is intended to preserve by preventing failure and detecting incipient faults (Work is done before failure takes place)

Opportunity Maintenance: Work done as and when possible within the limits of operation demand.

Day-to-Day Care and Maintenance

Shut Down Maintenance: Thorough overhaul and maintenance after closing a facility.

Improvement Plans: This is essentially maintenance operation wherein the weak links in the original construction are either replaced by new parts or strengthened.



CLASSIFICATION OF MAINTENANCE

- Preventive Maintenance
- Remedial Maintenance
- Finding the deterioration
- Determining the causes
- Evaluating the strength of the existing structures
- Evaluating the need of the structure
- Selecting and implementing the repair procedure
- Routine Maintenance
- Special Maintenance



NECESSITATION OF THE MAINTENANCE

- Atmospheric Agencies
- Normal Wear and Tear
- Failure of the Structure



ATMOSPHERIC AGENCIES

Rain: It is the important source of water, which affects the structure in the following ways;

Physical: Dissolving and carrying away minerals as it is universal solvent.

Expansion and Contraction: The materials is subjected to repetitive expansion and contraction while they become wet and dry and develops the stresses.

Expansion of Water: The variation of temperature causes the expansion and contraction of absorbed water and affects the micro-structures of the materials.

Erosion: Transportation and attrition and abrasion of the materials is quite evident effect of the water.



ATMOSPHERIC AGENCIES

Chemical: The water available in nature contains acids and alkaline and other compound in dissolved form acts over the material to give rise, which is known as chemical weathering.

Wind: It is the agent, which transports the abrasive material and assists the physical weathering. Its action is aggravated during rains and when it is moving with high speed, it may contain some acidic gases like CO₂ fumes which may act over the material and penetrates quite deeply in the materials and structure.



ATMOSPHERIC AGENCIES

Temperature: The seasonal and annual variation of the temperature, difference in temperature in two parts of the materials and the surface of material causes expansion and contraction. By this movement of the material bond and adhesion between them is lost when it is repeated. This is responsible for the development of cracks and the rocks may break away into small units.

Exploitation or Peeling Off the shell takes place if exterior layer are heated externally with respect to internal layers. The temperature variation may also cause change in the structure and chemical composition of the material.



NORMAL WEAR AND TEAR

During the use of structure it is subjected to abrasion and thereby it loses appearance and serviceability.



FAILURE OF STRUCTURE

Failure is defined as behaviour of structure not in agreement with expected condition of stability or lacking freedom from necessary repair or noncompliance with desired use of and occupancy of the completed structure. In field it may result in visual collapse of the structure or even suspension of the services e.g. the collapse of towers, sliding or over turning of dam, settlement of foundation, crushing of columns etc.



FAILURE OF STRUCTURE

The causes of failure may be broadly grouped as:

Improper Design: Due to incorrect, insufficient data regarding use, loading and environmental conditions, selection of material and poor detailing.

Defective Construction: Poor materials, poor workmanship, lack of quality control and supervision.

Improper Use of Structure: Overloading, selecting the structure for the use for which they are not designed such as deteriorating environment due to impurities from industrial fuel burning, sea water minerals, chemicals, storage of chemicals etc.

Lack of Maintenance: Lack of upkeep, proper protection, precaution and preservation, deteriorated the structure, which may result in the failure.



IMPORTANCE OF MAINTENANCE

- Improves the life of structure
- Improved life period gives better return on investment
- Better appearance and aesthetically appealing
- Leads to quicker detection of defects and hence remedial measures
- Prevents major deterioration that leads to collapse
- Ensures safety to occupants
- Ensures feeling of confidence by the user

IMPORTANCE OF MAINTENANCE

Maintenance is a continuous cycle involves every element of building

- Structural
- Electrical wiring
- Plumbing-Water supply-Sanitation
- Finishes on floors and walls
- Roof terrace
- Service platform / Veranda
- Lifts
- Doors, Windows and other elements



INSPECTION PERIODS

■ **Pre-Monsoon Period**

To decide the maintenance programmer to be done before monsoon such as cleaning of drains, checking of roof leakage, collection material etc (Cleaning of drains, checking of roof leakages, collection of materials and equipment's require during monsoon repairs, bridges and other structure which are not easily approachable during the monsoon)

■ **Monsoon Period**

It is needless to mention that the emergency work carried out in monsoon period. e.g.: railway tracks, collapse of roof etc. (Washing away of roads, railway tracks, collapse of roof and failure of walls)



INSPECTION PERIODS

▪ **Post-Monsoon Period**

It is made to repair the damage caused by water and draw up the programme of repair according to the priorities. (Replacement and rehabilitation work)



VARIOUS ASPECT INSPECTION

The following are the various maintenance aspects,

- Daily Routine Maintenance
- Weekly Routine Maintenance
- Monthly Routine Maintenance
- Yearly Routine Maintenance



DAILY ROUTINE MAINTENANCE

Basically an inspection oriented and may not contain action to be taken

Help in identifying major changes, development of cracks, identifying new cracks etc

Inspection of all essential items by visual observation

Check on proper function of sewer, water lines, wash basins, sinks etc

Check on drain pipes from roof during rainy season.



WEEKLY ROUTINE MAINTENANCE

- Electrical accessories
- Cob webs cleaning
- Flushing sewer line
- Leakage of water line



MONTHLY ROUTINE MAINTENANCE

- Cleaning doors, windows etc
- Checking septic tank/sewer
- Observation for cracks in the elements
- Cleaning of overhead tanks
- Peeling of plaster, dampness, floor cracks



YEARLY ROUTINE MAINTENANCE

- Attending to small repairs and while washing
- Painting of steel components exposed to weather
- Check of displacements and remedial measures



STAGES OF INSPECTION

A. Inspection

- Collect data at specified intervals in specified form

B. Analysis

- Add latest information to database
- Examine progression of defects
- Relate defects to action criteria



STAGES OF INSPECTION

C. Action Possibilities

- Note and wait for the next inspection
- Alter inspection frequency
- Institute repairs
- Further detailed investigation
- Put safety procedures in place

Thank You