SNS COLLEGE OF TECHNOLOGY

Vazhiyampalayam, Coimbatore, Tamil Nadu, 641035

An Autonomous Institution

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DEPARTMENT CIVIL ENGINEERING

19CEE409 – REPAIR AND REHABILITATION OF STRUCTURES

IV YEAR / VII SEMESTER

Unit 1 : MAINTENANCE AND REPAIR STRATEGIES

- **Preventive maintenance:** This is intended to preserve by preventing failure and detecting incipient faults (Work is done before failure takes place)
- **Opportunity maintenance:** Work did 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.

- Rehabilitation: *Rehabilitation of a building means returning a building or a structure to a useful state by means of repair, modification, or alteration*.
- It is related to the strength aspect of structures.
- To Bring back the position and condition of the structure by considering the strength aspect.
- Some of the examples of Rehabilitation…..
  - To fill the wide cracks using some suitable material
  - Injecting epoxy like material in to cracks in walls,columns,beams, etc.
  - Removal ofdamaged portion of masonry and reconstructing it using rich mortar mix.

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FACETS (Distinct Feature) 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.

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Classification of Maintenence

- 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

Importance of Maintenance various aspects of Inspection

- 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 safely to occupants
- Ensures feeling of confidence by the user

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
- 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

Yearly Routine Maintenance

- Attending to small repairs and white 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

A. **Analysis**

i. Add latest information to database

ii. Examine progression of defects

iii. Relate defects to action criteria

A. **Action possibilities**

i. Note and wait for the next inspection

ii. Alter inspection frequency

iii. Institute repairs

iv. Further detailed investigation

v. Put safety procedures in place

Necessitation of the maintenance

The causes which necessitate the maintenance effects the service and durability of the structure as follows:

- Atmospheric Agencis
- Normal wear and tear
- Failure of structure

Atmospheric Agencis

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

Expansion And contraction

- The material is subjected to repetitive expansion and contraction while they become wet and dry and develops the stresses
- Dissolving and carrying away minerals as it is universal solvent

Chemical: The water available in nature contains acids and alkali 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.

Temperature: The diurnal, seasonal and annual variation of the temperature, difference in temperature it causes expansion and contraction.

Normal wear and tear

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

Failure of structure

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 they not designed impurities from industrial fuel burning, sea water minerals etc.

Maintenance processes

- ✓ Design for maintainability
- ✓ Preventive maintenance
- ✓ Predictive maintenance
- ✓ Reliability centered maintenance
- ✓ Reactive maintenance
- ✓ Spares management
- ✓ Maintenance logistics support
- ✓ Total productive maintenance
- ✓ Organizing for maintenance
- ✓ Computerized maintenance management program

- Statutory requirements

Repair and rehabilitation

Repair is the technical aspect of rehabilitation. It refers to the modification of a structure, partly or wholly which is damaged in appearance or serviceability.

The following factors to be considered repair of concrete structures:

- The cause of damage
- Type, shape and function of the structure
- The capabilities and facilities available with builders
- The availability of repair materials

Stages of concrete repair

Repair of concrete structures is carried out in the following stages:

- Removal of damaged concrete
- Pre treatment of surfaces and reinforcement
- Application of repair material
- Restoring the integrity of individual sections and strengthening of structure as a whole

Repair procedure

A repair procedure may be selected to accomplish on or more of the following objectives:

- To increase strength or restore load carrying capacity
- To restore or increase stiffens
- To improve functional performance
- To provide water tightness
- To improve durability
- To prevent access of corrosive material to reinforcement

Types and classification of repair Types of repair:

- Cosmetic treatments on surfaces
- Partial replacement of surface and subsurface material
- Additional of reinforcements and bonding materials to strengthen the element
- Total replacement of the structural element

Methods of Repairs

The following considerations are to be taken care of and observed:

- ✓ Determination of extent, location and width of cracks
- ✓ Classification of cracks as structural and non-structural

Dormant cracks:

Dormant cracks are caused by some event in the part, which is not expected to recur. They remain constant in width, and may be repaired by filling then with a rigid material.

Active cracks:

Do not remain constant in width, but open and close as the structure in loaded, or due to thermal and hydras changes in the concrete**.**

Growth cracks:

Increase in width becomes the original reason for their occurrence persists.

Applications:

The repair of cracks can be achieved with the following techniques:

- Resin injection
- Routing and Sealing
- Stitching
- External stressing
- Bonding
- Blanketing
- Overlays
- Dry pack
- Vacuum impregnation
- Polymer impregnation

Rehabilitations

The success of repair activity depends on the identification of the root cause of the deterioration of the concrete structures. The repairs can be done for the improvement of strength and durability, thus extending the life of the structure, is not difficult to achieve.

It is the processes 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.

The following steps are generally used in the rehabilitation of distressed concrete structure:

- Support the structural members properly as required.
- Remove all cracked, spalled and loose concrete.
- Clean the exposed concrete surfaces and steel reinforcement
- Provide additional reinforcing bars, if the loss in reinforcement is more than 10%
- Apply protective coatings over the exposed/repaired surface.

Applications:

Shotcrete/Gunite

- Resin injection
- Dry pack and Epoxy-bonded dry pack
- Slab jacking Technique
- Sprayed concrete

Thank you !!!