



ECONOMICAL COST CONTROL AND DURATION ANALYSIS IN REPAIR AND REHABILITATION OF BUILDING

S.Eraibalan¹, Mr.R.Babu²

¹PG Student, Department of CIVIL ENGINEERING, K.S.R. College of Engineering,
Tiruchengode – 637302, Tamil Nadu, India

²Assistant Professor, Department of CIVIL ENGINEERING, K.S.R. College of
Engineering, Tiruchengode - 637302, Tamil Nadu, India

Abstract-- Reinforced concrete structures are designed as per codes/standards but enough care is not always taken during construction process. As a result, the structures start showing signs of distress, some times less than 10 years of service life, requiring early repair and rehabilitation work. In project to repairing of Micro cracks, Major cracks, Corrosion of reinforcement, Spelling, Door repair, Tails and floor repair, Pipe leakage, Painting work in cost economically.

Keywords— repair & rehabilitation of building, cost control and building analysis

INTRODUCTION

The term rehabilitation in broad sense implied restoring the structure to its original condition. Technique developed for rehabilitation may also be used for modifying the structure to meet new functional or other requirements. In general, structure may need rehabilitation for one of the following:

- Normal deterioration due to environmental effect
- New functional or loading requirements and modification to a structure.
- Damage due to accident.

The first task when a structure shows sign of cracking, spalling or any other sign is to determine whether the damage is structural or non-structural. The engineer in charge of rehabilitation should have qualities of investigator, structural designer, material technologist and awareness of application techniques.

The repair and rehabilitation of structures includes the following:

- Inspection method, assessment, monitoring, and maintenance of structures.
- Concrete durability, testing and analysis.

- General repairs.

LITERATURE REVIEW

➤ REPAIR AND REHABILITATION OF A BUILDING

- Information regarding this paper discusses the review of repair and rehabilitation of building. In current scenario of building research, repair and rehabilitation plays vital role as it serves important in building application. The structural examination under sect. 353(B) of the bomber municipal corporation act, 1888. As per request of managing committee of the building. We have inspected “YASHASHREE C.H.S. LTD,” situated anant nagar, kulgaon badlapur, badlapur (E). Tal Ambernath, Dist thane- 421503.

➤ REPAIR EFFECT OF CRACKED REINFORCED CONCRETE BASED ON ELECTROCHEMICAL REHABILITATION TECHNOLOGY

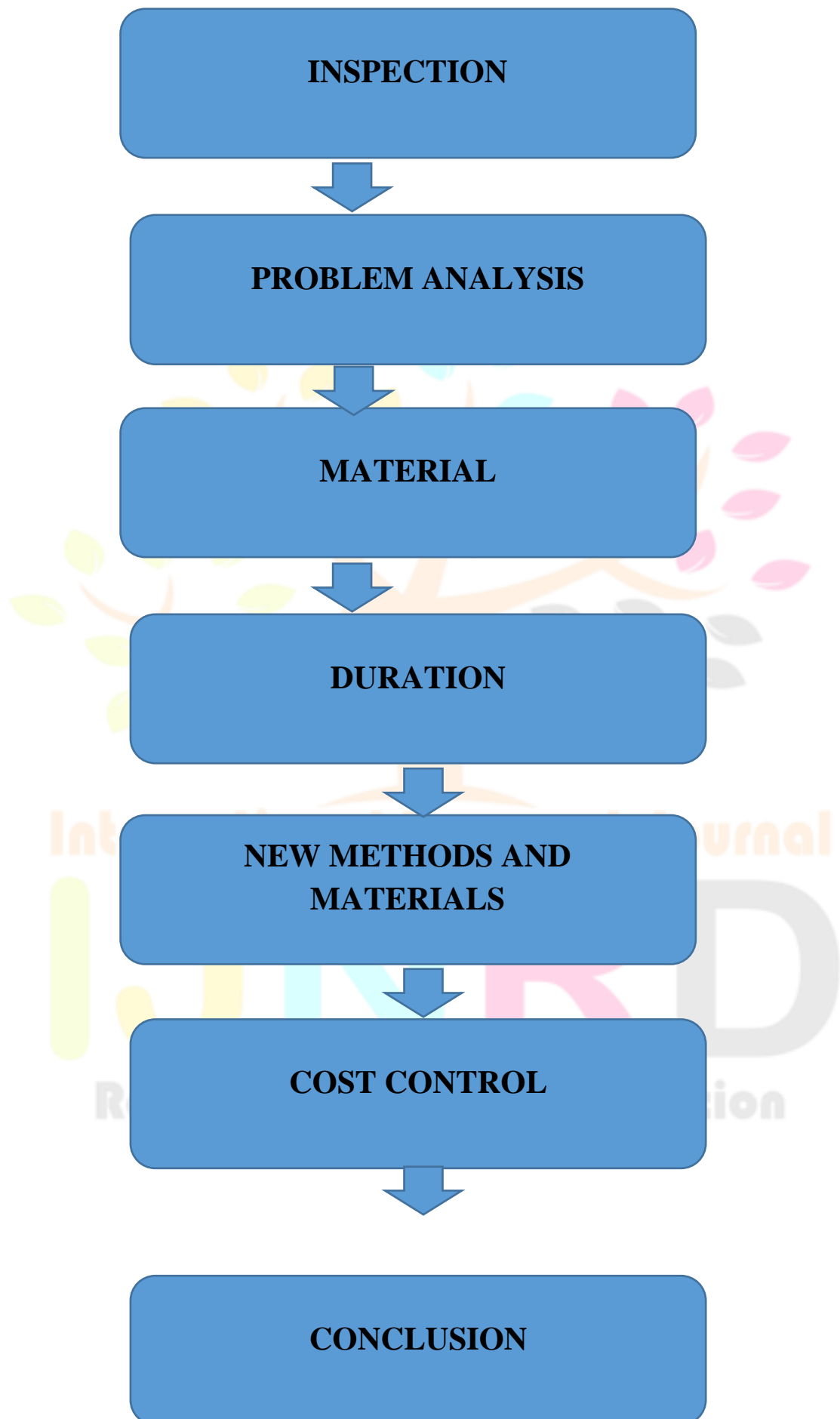
To solve the problem of durability deterioration of cracked concrete structures in coastal environments, this study investigates the effect of repairing loading cracks and corrosive cracks. In particular, the immediate and long-term effects of combining electrochemical repair technology with traditional repair methods were studied. After the repair, the corrosion potential of steel bars, cracking duration, and cracking speed obtained by different repair methods were compared. The results showed that the repair effect of the comprehensive repair technique is significantly better than using a single repair method. Based on the characteristics of the cracks, the sequence of each step in the combined repair technique was designed.

➤ STRUCTURAL REPAIR AND REHABILITATION OF 3 NO. (G+8) MULTI-STOREYED RESIDENTIAL BUILDINGS, AT ONGC COLONY AT CHANDKHEDA, AHMEDABAD, GUJRAT

Although reinforced concrete structures are designed as per codes/standards but enough care is not always taken during construction process. As a result, the structures start showing signs of distress,



METHODOLOGY



INSPECTION

An inspection report is a record produced by either insurance or safety inspection companies who look for potential risks at a property or in the functioning of machines. The risks could be related to physical, environmental, or financial considerations.

1 Routine inspection

2 Detailed inspection

3 special inspection

4.1 ROUTINE INSPECTION

- General inspection – inspecting the property to make sure it's in good condition (this is also sometimes called a routine inspection). Repairs or other legal responsibilities – making repairs or doing something else the law says the rental provider must do.

4.2 DETAILED INSPECTION

- An intensive examination of a specific item, installation or assembly to detect damage, failure or irregularity. Available lighting is normally supplemented with a direct source of good lighting at an intensity deemed appropriate.

4.3 SPECIAL INSPECTION

- Special inspections is defined by the current International Building Code (IBC) as the “inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with the code and the approved construction documents”

5. PROBLEM ANALYSIS

- Micro cracks
- Major cracks
- Corrosion of reinforcement
- Spelling
- Door repair
- Tails floor repair
- Pipe leakage
- Painting work

5.1 CRACKS

The principal causes of cracks in a building are as follows:

1. Permeability of concrete
2. Thermal movement

3. Creep movement
4. Corrosion of reinforcement
5. Moisture movement
6. Poor construction practices
7. Improper structural design and specifications
8. Poor maintenance
9. Movement due to chemical reactions
10. Other factors

5.1.1 MINOR CRACKS

The commonly used building material namely masonry, concrete, mortar etc. are weak in tension and shear. Therefore the stresses of even small magnitude causing tension and shear stresses can lead to cracking.

5.1.2. MAJOR CRACKS

Cracks can occur due to various reasons chemical reactions in construction materials, foundation movements and settling of buildings, changes in temperature and climate, environmental stresses like the nearby movement of trains, earthquakes etc. The crack is more than 3mm is to be consider major crack.

5.2. CORROSION OF REINFORCEMENT

Reinforcement corrosion is one of the major deterioration mechanisms of reinforced concrete structures worldwide. The presence of chlorides increases the severity of the corrosion attack considerably.

5.3. SPALLING

Spalling is a term used to describe areas of concrete which have cracked and delaminated from the substrate. There are a number of reasons why spalling occurs including freeze thaw cycling, the expansive effects of Alkali Silica Reaction or exposure to fire.

5.4. DOOR REPAIR

As moisture settles along the door and frame, it can begin to soften the structure of wooden doors and frames and cause rotting, warping, bowing, bending, and cracking. Steel and fiberglass doors, in contrast, are much more durable and will not suffer these same effects in harsh spring weather

Termite droppings - After consuming wood, dry wood termites often leave behind brown-coloured and grainy faecal mounds. These faecal pellets are usually found beneath the infested wood. Floor damage - Termites can damage laminate flooring and even skirting boards.

5.5. FLOOR TILE REPAIRS

Don't panic if you crack, chip, scratch, stain or damage a tile. Even if replacement tiles aren't available, our finishers can make it right again. We'll assess the damage then repair or fill the area, before colour and texture matching to the rest of the floor.

5.6. PIPE LEAKAGE

Peeling paint or wallpaper on your wall. A warped or stained wall. A buckle, crack, or water stain on drywall ceiling or your floor. Pools of water on the floor near walls or drips from the ceiling

5.7. PAINTING WORK

Painting is done to protect the surface from the effects of weathering, to prevent wood from decay and metal from corrosion, to provide a decorative finish and to obtain a clean, hygienic and healthy living atmosphere.

6. PREVIOUS METHODS AND MATERIALS

1. Concrete patching
2. Corrosion of reinforcement repair
3. Fix a broken beam
4. Methods of concrete column repair for damages and cracks six a broken beam
5. Concrete jacketing
6. Repairing process of spalling of concrete.

6.1. CONCRETE PATCHING

Wide cracks in concrete are best patched and sealed with a concrete patching compound. Smaller cracks, less than 1/4 inch wide, can be repaired with a concrete caulk or liquid filler. Patching compounds typically are mixed with water and applied with a trowel.

Fill in the area to be repaired with DAP Ready-Mixed Concrete Patch. Like as a cement mortar

6.2. CORROSION OF REINFORCE CEMENT REPAIR

Remove concrete along the bar length until the corrosion product cannot be observed. Utilize abrasive blasting techniques to remove corrosion, expose new clean steel, and prepare the original hardened concrete for bonding. Apply a rebar coating to re-passivity the reinforcing steel Corrosion of Reinforce Cement Repair work is has be show in figure 6.3.

1. Remove Concrete around Steel Bars
2. Clean and Inspect Reinforcement

3. Mild Reinforcement or Pre stressed Strand Repair

4: Supplemental Reinforcement.

6.3. REPAIRING PROCESS OF SPALLING OF CONCRETE

1. Clean Spalled Concrete Area
2. Remove Loose Concrete
3. Clean and Coating Corroded Steel Bars
4. Apply Repair Material Mixture
5. Finishing
6. Curing
7. Apply Pain or Coat on Repaired Surface.

6.4. DOOR REPAIR

Patching Holes and Cracks

Cut away any loose or broken wood from around the opening. Pack the hole with paper towels, cardboard, or mesh. Fill the hole with insulation. Leave the insulation foam to dry overnight. Trim away the excess foam carefully with a utility knife. Apply a layer of auto-body filler for a strong repair. Cover the hole with spackle for a quicker fix. Wait 24 hours for the surface to completely cure. Sand down the surface of the repair. Find paint or wood stain that matches the color of your door. Apply an even coat of paint or wood stain to the entire door. Apply a second coat of paint or wood stain if necessary and let it dry.

6.5 STEEL JACKETING

Steel jacketing is also an effective method to increase basic strength capacity. Steel jacketing not only provides enough confinement but also prevents deterioration of shell concrete, which is the main reason for bond failure and buckling of longitudinal bars. Steel jacketing refers to encasing the section with steel plates and filling the gap with non-shrink grout. It is a very effective method to remedy the deficiencies such as inadequate shear strength and inadequate splices of longitudinal bars at critical locations. But, it may be costly and its fire resistance has to be addressed. In practice, the most commonly used strengthening technique is by steel strips and angles. Steel jacketing helps to restore the strength, ductility, and energy absorption capacity of columns thus it seems to be effective in retrofitting columns. And also the steel jacket helps to increase the flexural strength and ductile behavior of the lap-spliced column thus increasing the lateral performance of columns.

6.6. FLOOR TILE REPAIRS

Previously to buy extra tiles for repairing work. Epoxy for Hairline Cracks and Chip. Purchase a 2-part epoxy repair kit online or at a hardware store. Clean the cracked tile with paper towels and a cleaning solution. Mix the 2 epoxies together on a spare sheet of cardboard.

Smear the mixed epoxy along the hairline fracture in the tile. Wait 7 days or so for the epoxy to completely cure. Paint the epoxy to disguise the patch and blend it into your tile.

7. NEW METHODS AND MATERIALS

New material and methods are Building Materials and Repair and Renovation” is a popular Section of the journal “*Buildings*”, with a large number of published articles. The objective of this section is to collect and spread valuable scientific research dealing with innovative, smart, and eco-friendly building materials addressing the general sustainability of buildings and infrastructure systems. This section also focuses on promoting and disseminating materials, tools, and techniques related to the repair and rehabilitation of older structures and building components in an eco-friendly manner. Multidisciplinary research and cross-cutting techniques are encouraged with the support of a broad range of methodological and technical approaches, such as advanced experimental tests, numerical methods, and artificial intelligence.

New materials is want make the repairing work quick and to give for long life of the building. New method are to make the easy to work flow.

7.1 SEALING OF CRACKS BY EPOXY RESIN INJECTION

The method of sealing the cracks in the wall is as follows. Loose material is removed from the outer surface and cleaned. A plastic injection port is placed on the surface of the crack on both sides of the member. Such an injection port is sealed with an epoxy sealant. The spacing between such injection ports is kept approximately equal to the thickness of the member. After the epoxy sealant freezes, a low-fluidity epoxy resin is forcefully filled into a port. If there is a vertical crack, start filling the epoxy resin in the lowest port, and if the crack is horizontal, start filling the resin in one end port. Continue injecting the resin until the resin starts coming out of the same port on the other side of the member or the port above it. Then close the injection port and inject resin in another port like this. If the crack is small, high pressure is required or the spacing of the part has to be reduced so that the epoxy resin is filled in the full depth and thickness of the member. This method is useful for all types of structural members such as beams, columns, walls, slabs. This method is useful for both masonry work and concrete.

7.2 USE OF FRP LAMINATES

Composite materials like fibre reinforced polymer (FRP) is used in different forms for retrofitting reinforced concrete structure.

FRP gains high strength and high resistance to corrosion.

Figure 7.2.

One of the most commonly used methods for retrofitting is Fibre Reinforced Polymer (FRP) jacketing. FRP is widely used for its properties such as high strength to weight ratio, stiffness, good impact properties, high resistance to corrosion in harsh environmental and chemical condition, and also it causes only a minimum alteration to the geometry of structural elements than other methods FRP is used to strengthen the corroded rectangular columns considering different levels of corrosion and various volumetric ratios and the test results indicate that shear resistance of FRP and column increases with the increase in volumetric ratio and decreases with increase in different levels of corrosion. Shrinkage is one of the factors responsible for the formation of cracks in structural elements like beams and slab. To reduce the shrinkage hybrid fibre-reinforced polymer (FRP) reinforced shrinkage compensating concrete is used.

7.3 Epoxy Mixture

For smaller steel sections, an effective and handy approach to repairing steel is by using epoxy specialized in reconnecting and reinforcing broken and cracked steel sections. The procedure is done by creating the epoxy mixture, which then leads to the application of the epoxy into the damaged section. The final step is to polish the section with epoxy using sandpaper, which would then be smoothed even further with a grinder.

This process works in ensuring that steel would be repaired and reinforced even without the need to do some welding. This is a convenient and quick process that works best for quick repairs for smaller steel parts and sections. In order to build up the section, either cement based repair, or Resin based repair can be carried out. As usual, the priming coat is applied over the prepared surfaces to protect the surfaces. The interval between coats should not be too long; otherwise there will be bond failure. Resin-based materials cure by exothermic chemical reaction immediately, when the constituents are mixed. It is essential that the materials should be well compacted to become impermeable, because they do not protect the steel by alkalinity.

7.4 DOOR REPAIRING

Cut away any loose or broken wood from around the opening. Pack the hole with paper towels, cardboard, or mesh. Remove all rooting dust to clean. In spraying, the chemicals pesticides to be applied are dissolved or suspended in water or, less commonly, in an oil-based carrier. The mixture is then applied as wooden area. Mixing to two parts which is wood filler harder and resin so it's thoroughly combined.

A 2-part wood filler comes separately as a resin base and a hardener. Use a putty knife to scoop a golf ball-sized amount of resin onto a paper plate. Add a 1 inch (2.5 cm) squirt of the hardener to the resin and stir it together into a thick paste.

A 2-part wood filler will have a greater resistance to future nicks and scratches than other types of wood filler or putty. You can also use wood filler to cover screw holes in your door frame.

Use a putty knife to apply the filler into the gouges and dents. Apply the wood filler to the damaged area on your door frame to fill it entirely. Try to smooth out the filler so it's flush with the rest of the door jamb, but it's okay if you overfill the gouge and it looks a little messy right now. After you mix the hardener with the resin, your wood filler will start to set and harden within a few minutes.

Apply the wood filler quickly so it's still easy to work with. Slice off the excess wood filler with a utility knife after 5 minutes. Let the wood filler set for 30–60 minutes. Sand the wood filler smooth with fine-grit sandpaper. Prime and paint the wood filler to match the rest of the frame.



7.5 REPAIR SPALLING CONCRETE

The loosely attached concrete blocks may be gently removed. Generally, an extra two inches of concrete surrounding the affected area is also removed for added safety. To further increase the safety, sounding devices may be used to find any unevenness in the vicinity of the affected area due to the spalling. Any area of concern can also be treated to avoid problems in the future. The reinforcement may be cleaned with a wire brush to remove any rust in the steel. The exposed area shall be cleaned with compressed air and the reinforcements shall be coated with Anti-rusting polymer or paint. The old concrete surface may be made rough for providing enough teeth for proper bonding, or bonding agents may be used to ensure adhesion. The affected area will be filled with normal or polymer-based concrete. It is important to ensure that the thermal expansion coefficient of the old concrete and the new filler material are the same. This will avoid any discrepancies due to uneven heating and cooling.

The surface shall be finished smoothly to reduce the water accumulation on the surface. The surface shall be coated with water repellent paints to prevent the seepage of water. Spalling concrete is very common in cold-weather regions. It can be significantly reduced by proper supervision, introducing air-entraining agents, and finishing the surface with a water-repellent coat.

WEATHER PLUS CEMENT –WATERPROOFING

UltraTech Weather plus Is a PPC Grade Cement is a premium class construction powdered materials which is synthesized by adding many different types of ingredients which includes materials like fly ash, claimed clay, rice husk ash and other chemical additives for excellent bonding. 7.6 TAILES

Weber epoxy adhesive is a three-component, heavy-duty, chemical resistant adhesive for fixing tile & stone of small & big format on wall & floor. It provides excellent, high durable bond strength for fixing tile & stone on metal surfaces. Weber epoxy adhesive can be used in wet, internal and external areas. Follow the procedure Find a replacement tile that matches. Flooring contractors often leave spare tiles in the garage or storage room for when the homeowner might need to repair tile mishaps. Previous to store 0.15% for repairing process or choose a matching grout. Borrow coloured grout samples from a well-stocked flooring supply store and bring it home to find the closest match. Remove the old tile completely. Be careful not to damage any of the surrounding tiles. Use an electric drill with a masonry bit to drill a diagonal series of small holes into the cracked tile, keeping drilled holes less than 1 inch (2.54 cm) apart. Split the tile through the horizontal hole-line by using a ball-peen hammer to tap a cold chisel into the tile. Tap very lightly so as not to crack neighboring grout joints. Remove the loosened pieces. Use a flat bar to pry up any shards that you cannot get up by hand. Scrape the remaining old mortar from the subfloor using a stiff-bladed scraper. It is not important that you get every last bit up. Just make sure the area is fairly clean of mortar. Vacuum up any loose dirt or debris.

Set the replacement tile. Mix the thinnest mortar to a pancake batter consistency. Let sit for 5 minutes, stir again, and begin spreading. Use a notched trowel to spread mortar onto the subfloor and lay the new tile in. Use a level to ensure tile is laying perfectly flat and also to determine that the newly set tile is flush with surrounding tiles.

Grout the area according to the grout manufacturer's directions. Generally, it is done the following way: Mix your grout in a clean container with fresh water. Slowly add a little bit of water, mix and then repeat until you reach a consistency of pancake batter. Using a grout float, scoop out a bit of grout. Place the float at a 45-degree angle and in diagonal strokes spread the grout in the gaps between the tiles. After 20-30 minutes your grout should start to harden, and you can clean the surface of tiles with a wet sponge. You may need to do 2-3 rounds of cleaning.

COST CONTROL

The cost of repair and maintenance has also changed over time. In the past, repairs were more expensive because of the limited materials and tools available. However, today's methods are more cost-effective because of the advanced materials and techniques that are used. Newer materials may be more expensive than older materials, but they may also be more cost-effective in the long run if they require less maintenance or have a longer lifespan.

In a repairing old method is Ready mixed concrete, corrosion resistance in steel bar, spalling, wooden door filler, FRP Jacketing, tails binder cost is low. Joint tape and Epoxy, corrosion resistance in steel bar weather plus cement, epoxy filler in wood damage, FRP Laminated and Weber epoxy adhesive used in tiles are slightly high compared to ready mixed concrete.

CONCLUSION

In the project to discussion about inspection, Problem analysis, material in this Economical Cost Control and Duration Analysis in Repair and Rehabilitation of Building. Old materials and method is which mean 20 or 30 years back. The repairing work not well for long duration and cost also high but in now day repairing works are easy assessable of the material and its durable is also high. Conclusion of the project is building strength and durability is more important cost is not a matter to compare the building life. This project to fill the gap of old maters and new materials.

Durability: Newer materials may be more durable and have a longer lifespan than older materials. For example, modern concrete formulations often have additives that make them more resistant to cracking and erosion than older formulations.

Cost: Newer materials may be more expensive than older materials, but they may also be more cost-effective in the long run if they require less maintenance or have a longer lifespan.

Availability: Older materials may be harder to source than newer materials. For example, some traditional building materials may be difficult to find or may only be available from specialized suppliers.

Overall, the choice of materials for repairing a building will depend on many factors, including the age of the building, the desired lifespan of the repair, the available budget, and the desired aesthetic appearance. A qualified contractor or architect can help make informed decisions based on the specific needs and goals of the repair project.

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