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RETROFITTING THE EXISTING: RESIDENTIAL BUILDINGS

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ABSTRACT

Building industry is a guide to the reduction of the low-cost world economy. This region is the world's second-largest emitter of co_2 after the steel industry, accounting for around one-third of global total emissions. Retrofitting is one of the best options to make an existing building safe against future problem like earthquake, energy loss and other environmental forces. It aims to strengthen a structure to satisfy requirements of current situation of seismic design. There re different deficiencies in building these causes due to impropriate construction, building requires different measures with respect to their climatic conditions. The study was to recognize and review the suitable solution for buildings that can be used to achieve level of sustainability.

Key words- retrofits, deficiencies, energy measures, buildings.

INTRODUCTION-

Retrofitting shall be any alteration made to the current structure in order to mitigate or remove the risk of damage to the structure from floods, erosion, high winds, earthquakes or other hazards. About 40% of India's electricity usage in 2015 was in the residential and industrial industries. Adapting and retrofitting a building will increase its life will help to reduce the effects on the environment by reducing the use of raw materials and the emissions associated with the construction of new buildings. The energy-efficiency analysis shows that it would take 25 years for the high energy usage of new buildings to recover the cost of demolishing old buildings and the resources needed to manufacture building materials and to carry out the necessary construction. For the case of a modern low-energy home, the payback period will be less than 15 years. If the renovated building had been used as the basis for measuring the payback period rather than the original building, the estimated electricity payback period would have risen to 45 years. Retrofitting the building will help to reduce the consumption of energy.

1. ADAPTION OF EXISTING BUILDINGS-

Future of the building environment would rely on the need to reduce the use of natural resources and the effect of buildings on climate change. The need of buildings to be more adaptable to change is driven by these main factors.

Adaptation refers to any adaptation that may react to the expected or real effects of climate change. Adaptation of climate changes in building can be a key to good environmental conditions. It can have potential to reduce environmental impact for many years.

Rehabilitation is characterized as the act or method of making it possible for a property to be used compatible by renovations, modifications and improvements while retaining those sections or features that convey its historical, cultural or architectural significance. Reuse will produce useful community capital from unproductive property, dramatically minimize the costs of land accession and development, revitalize local neighborhoods and help manage the spread. One of the key environmental advantages of the re-use of buildings is the preservation of incarnated carbon from the original structure. That is, the energy used by all activities correlated to the construction of structures, from the procurement of natural resources to the distribution of goods.

2. BUILDING DEFICIENCIES-

There are two different deficiencies which are commonly found in buildings in India. those are global deficiencies and local deficiencies.

The following two ways describe some common deficiencies observed in residential, industrial, multi-storey RC buildings in India. Building deficiencies can be generally categorized as local deficiencies and global deficiencies.

Global Deficiencies- these are usually categorized as plan and vertical irregularities. things left out are classified under a variety of deficiencies. Any of the problems observed as follow

Plan Irregularities-

- Vulnerability of building under seismic load.
- Torsional irregularity.
- Gaps in corners.
- Level of ductility of the buildings.
- Non parallel lateral load tolerant structures.

Vertical Irregularities –

- Stiffness or strength irregularity
- set-back of building or vertical geometric irregularity
- Placing of column in irregular manner.
- Lateral force – resisting vertical discontinuity in plane.
- Weak building efficiency. Installation of beam and columns.

Local Deficiencies – they have contributed to the failing of specific elements of the building. The applications are in following ways-

Columns-

- Insufficient shear capacity.
- Tension stress in column joints.
- Uniformly disturbed load to columns
- Lack of solid foundation result in cracked in columns

Slab to column connection-

- Deflection of shear strength to column and slab.
- Incomplete reinforcement to connection slab and beam

Beam and beam to column joints-

- Cracking at load stages
- Defects in bottom rebar anchorages
- Unusual strengthening of shear force for flexural member.
- Incomplete plastic hinge rotation capacity

Structure walls

- Cracking in walls due to improper construction and using low grade materials.
- Water intrusion.
- It can be due to electrical wiring

Deficient Construction-

- Connection inadequate side faces cover, contributing to rebar corrosion.
- Regularly volume batching
- Column beam casting
- Deficiencies of material at construction time
- Supplement workable water
- Unsatisfactory quality control and lack of tie beam.

3. RETROFIT MEASURES-

- Steel Jacketing- Steel jackets are also an important way to increase the specific strength efficiency. Steel jacketing not only ensures adequate insulation, it also avoids the corrosion of shell steel, which is the primary cause for bond breakdown and longitudinal bar buckling.
- Cracks stitching- it is a masonry repair techniques used to patch broken walls to ensure that they are repaired. It requires the retrofitting of a variety of cracks stitching bars that are scattered around the gaps in the walls in order to repair them and provide the masonry with protection.

- Anchoring the walls- the anchorages of the roof is needed to improve the lateral stability of the wall at the top. This also increases the load distribution function of the wall and the slab. Stress accumulation should also be there.
- Foundation- the weak foundation parts can be replaced by building a concrete block just next to existing foundation as a skin frame. Connection bars and metal bolts are used to connect the concrete block to the building base in order to increase the degree of load transfer to bottom point.

Energy efficient retrofitting strategy-

- Insulation and thermal bridge – In order to overcome the problem of thermal bridging, the studs must be constantly insulated. During the building of the room, the insulation can conveniently be applied to the wall layer to crack the thermal barrier. In a remodeling case, a sheet of insulation may only be applied from inside or outside the home. Expanded Polystyrene System (EPS) insulation and structural insulation panels (SIP)are new approaches to buildings for insulation.
- Air tightness and infiltration- 'Forced' or 'mechanical' ventilation is not used to create cooling air. Alternatively, natural airflow, by open windows and other holes, exhaust fans and drainage are used to supply fresh air. Usually, at least one-third of the climate shift every hour is known to be a minimum. There are various measures that can increase air leakage; it can be reduced by uses of gasket and sealants.
- Windows – Windows has a variety of features. A building loses 10% of heat through windows, we can replace the existing windows with high performance window which will provide protection and control flow of heat. Flow of heat varies with time and seasons. Energy efficient windows require understanding of high thermal performance which is overall energy balance is equal to deduction of heat loss in solar heat gain. There were some technical terms are high u- values, g value help to reduce the heat effect.
- Solar shading – Solar shading may have major environmental advantages for buildings; minimize glare and overheating; and provide savings in cooling capacity. Productivity and worker productivity are decreasing at high internal temperatures and there could be negative health consequences. Particular problems can occur in heavily glazed buildings or those with heavy use of computers.

4. CASE STUDY-

The case study represented in the paper is a residential RC building, located in Itarsi, M.P. this is a government buildings for defense which is constructed in 1970-75. The building is G+1 with area 4545sqft.the site is having deep medium black soil with shallow foundation. The height of the building is approximately 7m.

Slabs in the building were intended to play the role of solid diaphragms. Slabs are 170 mm thick at the floor level. The wall thickness is 230 mm for the outer wall and 120 mm for the inner walls, as in the typical building in India.

This building is in need of retrofitting as it has been made many years of construction and it’s losing its strength day by day. Structure evaluation included quick visual screening, data gathering, and condition evaluation. The

inspection revealed many faults and the subsequent examination different parts of the building, revealed the real condition and thus confirmed the demand for work to be done to repair this condition

Significant issues and remedial measures-The main challenges found in the evaluation of the structure and the subsequent action plan are set out below-

- Load distribution and water proofing of structure causing cracks-
Measures- In order to use epoxy injection to patch the crack, the crack is first cleaned by vacuuming or flushing with water to eliminate any debris or contaminants. The holes on the surface are then covered with an epoxy gel to prevent the epoxy being applied from leaking out. in joints of brickwork

Fig no .1 Gap

(Source: Author)

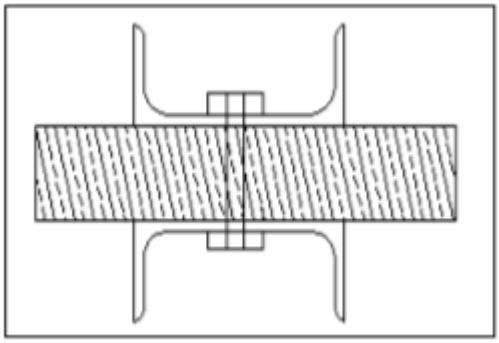

Fig no.2 Reinforcement details of the wall

(Source: Google image)

- Crack in the brickwork and slab-
One of the key reasons for this is the uneven movement of columns and masonry due to temperature variation. This difference can be either expansion or contraction depending on the temperature. Terracotta tiles were lay under the limeconcrete and which is clear from lower part.
Measures- These fractures may be covered by a gap between a reinforced concrete column and a masonry junction. Alternatively, the placement of chicken wire on the plaster between the intersection of the columns and the masonry will also assist with this difference.
Weakened stones have been repaired. Steel parts were welded and steel pieces broken were repaired.

Fig no.3 Breakage in slab

(Source: Author)

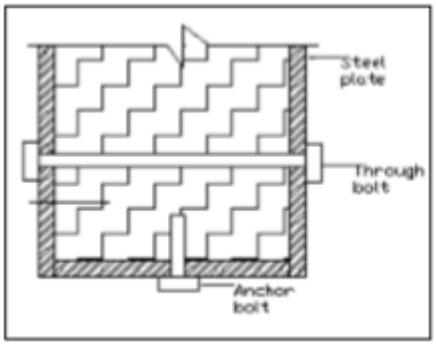

Fig no.4 Details of porch slab

(Source: Google image)

Collapsing of column-The length of the overlap of steel rods at the junction of the pile and column is inadequate. Structure is fragile due to the number of columns used and Unsymmetrical wall loads on the structure.

Fig no.5 Collapsing column (Source: Author)

Fig no.6 Reconstruction of partially collapsed column (Source: Author)

Remedial Measures - Encasing or enlarging the cross section of t d the corrosion of steel. Re-alkalization of reinforced steel to avoid corrosion. Extraction of chloride to prevent the degradation of stainless concrete. Confinement use materials such as steel plate, paper or glass fiber.

- Roofing leakages –

Leaks caused by inadequate construction may include roof insulation, roof lighting, roof vents or chimneys, and they can be punctured by a number of issues. The most frequent issue with these areas is the poor application of materials. Falling branches or trees, hail or other objects can cause significant damage to the roof.

Fig no.7 Roof members (Source: Author)

Measures - Cut the groove or chipping any 10 mm of concrete around the crack axis. For this reason, the dust may be absolutely cleaned from the crack line, brush or void cleaner. Cleaning is very important as the dust prevents the bonding of materials and therefore the repair will become weak.

CONCLUSION

This is a preliminary criterion, based on the requirement to determine whether reconstruction is the product of the wishes and needs of the community. Whether reconstruction is a response to issues of wider significance for the community, such as human rights, identify, the preservation of social patterns the familiarity of the homeland, etc. New codes and architectural regulations, reverence for the cultural context, environmental requirements, attainable advantages, conventional and creative approaches, etc., present significant challenges to the preservation of heritage buildings. Preventive treatment is the safest remedy to reduce deterioration. energy efficiency of existing buildings is essential to our country. It must be built from a demonstration project to popularization. The retrofitting process would concentrate on the exterior wall and the energy-efficient rate of construction should be more than 50%. It should be remembered that both the enclosure and the heating system have to be retrofitted in order to serve the function of energy efficiency.

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