UNIT – V

5.1 REPAIRS TO OVERCOME LOW STRENGTH MEMBER

Need for Strengthening:

Load increases due to higher live loads, increased wheel loads, installations of heavy machinery or vibrations

Damage to structural parts due to aging of construction materials or fire damage, corrosion of the steel reinforcement, and impact of vehicles

Improvements insatiably for use due to limitation of deflections, reduction of stress in steel reinforcement and reduction of crack widths

Special Modification of structural system due to the elimination of walls/columns and openings cut through slabs.

Errors in planning or construction due to insufficient design dimensions and insufficient reinforcing steel.

Deflection due to strengthened in Flexural members

Many situations in which flexural members, and especially bridge girders, have been found to haveless than their special attention was paid to the paid to the bond between the old concrete and thenew anchor blocks. The existing concrete was cut back to the depth of the cover and roughened.

After the new block had been cast in-situ the contact surface was injected with low viscosity epoxy resin under pressure, the injection being monitored ultrasonically. Some of the new tendons were deflected at existing diaphragms, reinforced required.

In view of the importance of the new anchor blocks to the success of the repair, we might have expected that dowel bars would be provided to connect the block to the existing concrete but no mention is made of this possibility and apparently what was done has been found to be successful.

The basis of this success is the roughness imparted to the old concrete. Epoxy jointing between smooth concrete surfaces would be expected to deform over a period over a period of time and relax the stressed tendons.

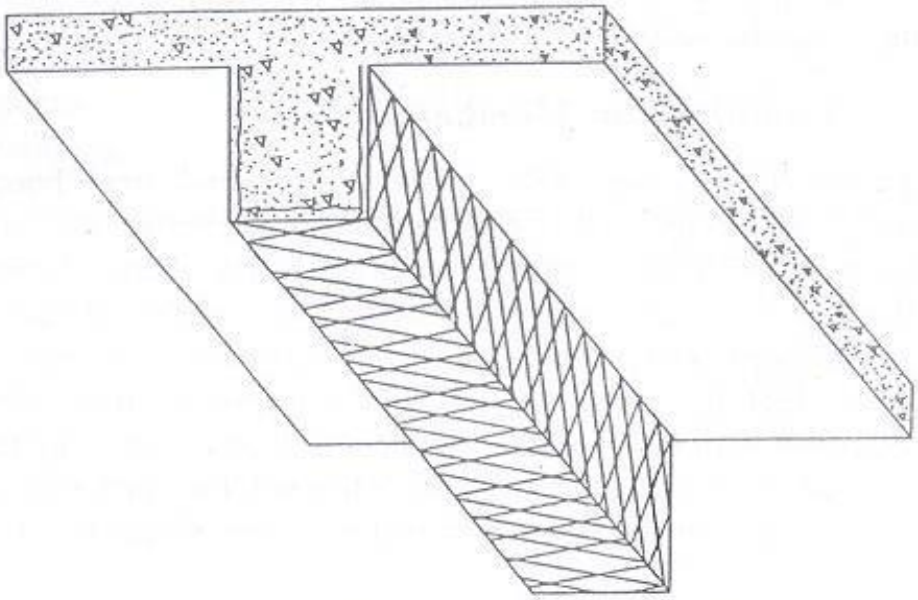
Strengthening of Beams

The strengthening of a beam, the load acting on it should be reduced by removing the tiles, bed mortar etc. From the slab. In addition props may be erected at mid span of each slab and tightened in such a manner that slabs are not damaged. After chipping off of the existing plaster on the beam, additional reinforcement at the bottom of beam together with new stirrups are provided.

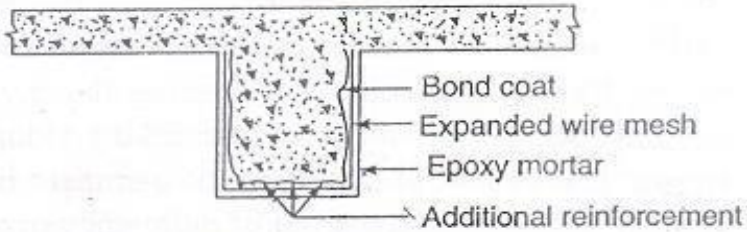
The bars are passed through or inserted in the supporting columns through holes of appropriate diameter drilled in the columns. The spaces between bars and surrounding holes are filled with epoxy grout to ensure a good bond.

Expanded wire mesh is fixed and anchored on three sides of the beam as shown in fig. To ensure a good bond between old concrete and polymer modified mortar, an epoxy bond coat is appliedto the concrete surface.

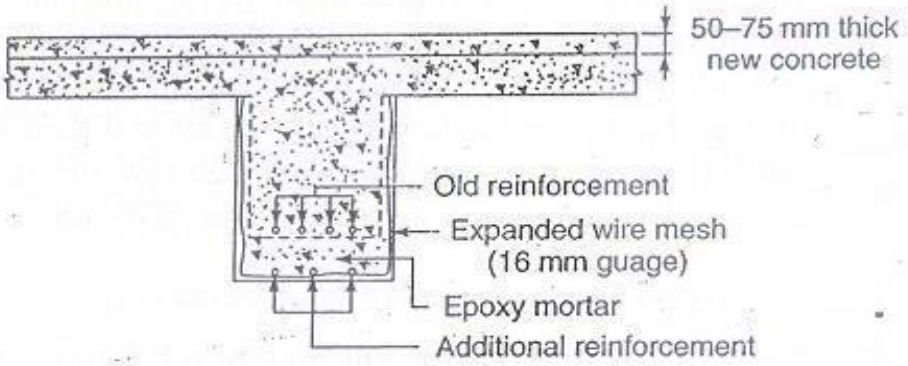
While the bond coat is still fresh, a layer of polymer modified mortar is applied. The required thickness on all the three sides is achieved by application of 2 to 3 layers of mortar. While applying mortar at the bottom of beam, the thickness of mortar layers should be so adjusted that sagging is completely covered and beam looks deflected. The mortar is cured for appropriate period in water and thereafter it is allowed to cure in air. Epoxy resin should also be injected in the cracks along top of beams. If new stirrups are required for shear strength enhancements should be followed.



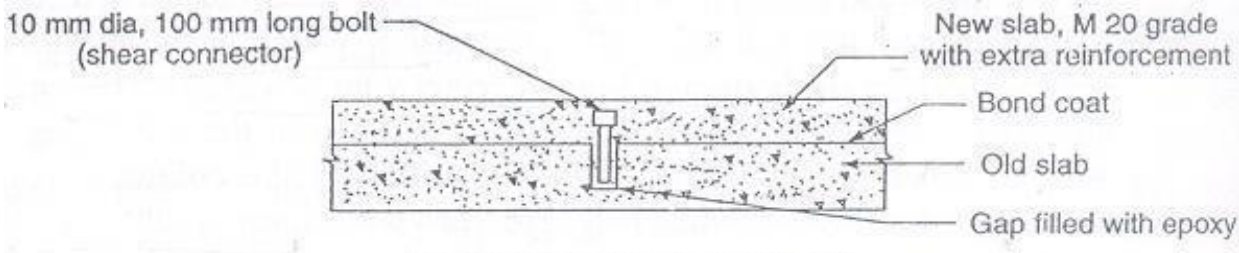
(a) Expanded wire mesh in position



(b) Repair scheme of the beam



(c) Strengthened section of the beam



(d) Strengthening scheme of slab

Strengthening of a slab–beam system

Deflection due to Strengthening of slabs

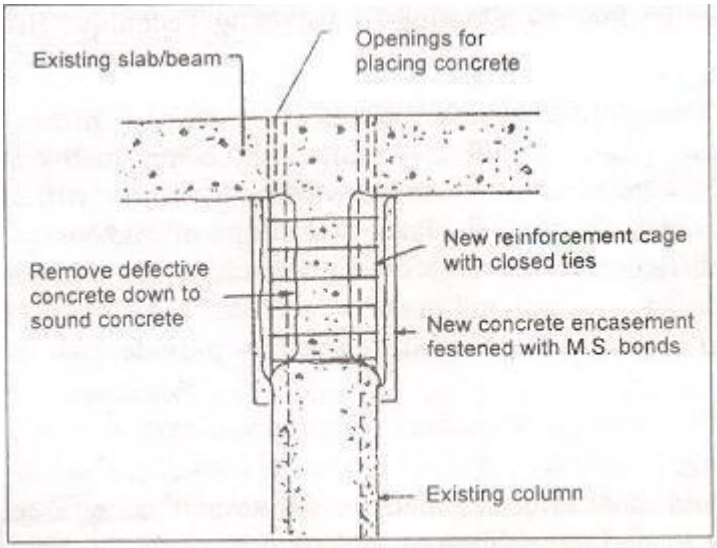
The strengthening of slab is taken up only after the strengthening of beams is completed. A reinforced structural concrete topping over the existing slab can be used which provides a composite construction of old and new slabs, with additional depths to slab and beam. To ensure a good bond between new and old concretes, mechanical anchorage consisting of steel bolts inserted in holes drilled into the slab at suitable intervals may be provided. The spaces surrounding the holes are filled with epoxy grout.

A shear connector is embedded for half of its length in old concrete and the remaining half which is projected will subsequently b embedded in new concrete.Before applying topping the surface of old floor slab should be thoroughly scrabbled and cleaned. Additional reinforcement may be required over the supports, because the old reinforcement at supports acquires a position which is near to the neutral axis of compositors section. After the preparation of old concrete surface, epoxy bond coat is applied on it and while this coat is still touch-dry 25 to 50mm thick M20 grade concrete topping is laid. The thickness of topping is governed by the strength and thickness of old floor slab. However application of topping increases the dead weight on the slab. With suitable treatment the top layer of topping maybe utilized as floor finish etc, After curing the beam and slab for 14 to 21days props can be removed.

Deflection due to Strengthening of columns

Jacketing is the process of fastening a durable material over concrete and filling the gap with a grout that provides needed performance characteristics. The column jacket can also be used for increasing the punching shear strength of column slab connections by using it as a column capital. When the jacket is provided around the periphery of the column, it is termed a collar. In most of the applications, the main function of the collar is to transfer vertical load to the column. Circular reinforcement can be used for load transfer. The practice of transferring load through dowel bars embedded into columns or shear keys has disadvantage in that they require drilling of holes for dowels or cutting shear keys which are costly and time consuming, and can damage the existing column. Reinforcement encircling the column can be used to transfer the load through shear friction. The expansion of collar as it slides along the roughened surface causes the

tensioning of circular reinforcement resulting in radial compression, which provide normal force needed for load transfer. The shear transfer strength is provided by both frictional resistance to sliding and dowel action of reinforcement crossing the crack.



Process of jacketing technique

The collar is subjected to shear and bending along the collar circumference as well as direct bearing stress under concentrated load. In addition shear transfer reinforcement, the collar should be provided with reinforcement for shear and moment within collar. Column collars can be provided below the slab to act as column capital to improve punching shear strength of the slab column connection.