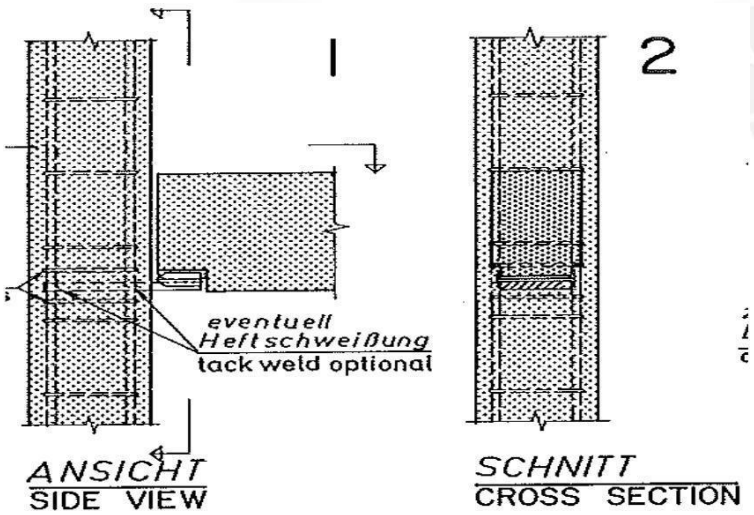
4.5 BEAM TO COLUMN CONNECTION

Various Types Of Connections

- Beam To Column Connection With Steel Plate Corbel
- Beam To Column Connection With Angle Corbel
- Beam To Column Connection With Built Up Steel Corbel
- Beam To Column Connection With Steel Joist Corbel, Encased In The Beam
- Beam To Column Connections With Vertical Steel Bearing Plates
- Beam To Column Connection With Concrete Corbel
- Beam To Column Connection With Steel Joist Hanger
- A Beam column joint is said to be desirable if it is able to transmit large amount of vertical shear forces.
- Depending on the type of bearing and the size of the bearing surface, different beam column joints will be able to transmit various magnitudes of vertical shear force.

BEAM TO COLUMN CONNECTION WITH STEEL PLATE CORBEL

- The beam is supported on a horizontal steel bearing plate which is cast into the column and is tack welded to the main reinforcing bars



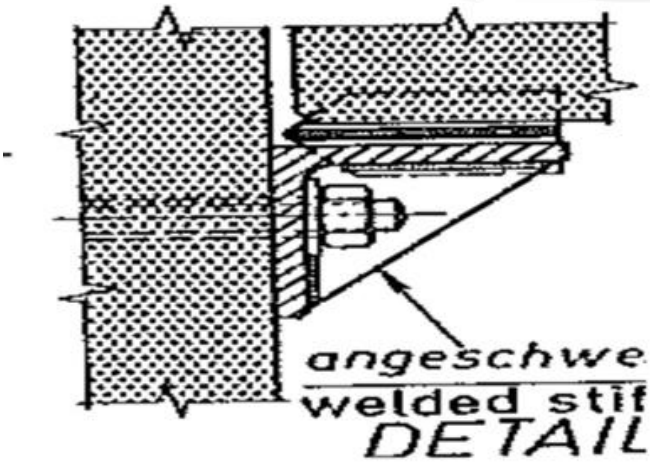
- This connection for SSB beams may be considered if the vertical shear force is very

small

- The plate should have sufficient thickness to prevent it from bending. In determining the thickness, the maximum cantilever moment may be assumed to occur at the column reinforcing bars.
- To avoid point bearing ,special care should be taken to install the beam perpendicular to column face.
- For lateral location of the beams ,saddle plates may be used.
- The bearing plate must be provided with permanent protection against corrosion and against fire.

BEAM TO COLUMN CONNECTION WITH ANGLE CORBEL

- This connection for SSB when carried out according to variant ―A‖ is only able to transmit small vertical shear force and could be generally considered only for temporary structures
- **VARIANT "A"**
- In variant A the angles are connected with the horizontal flange up and by mild steel bolts
- Point bearing on the column face can be avoided by applying an epoxy layer at the interface with the vertical angles just prior to placing the angles



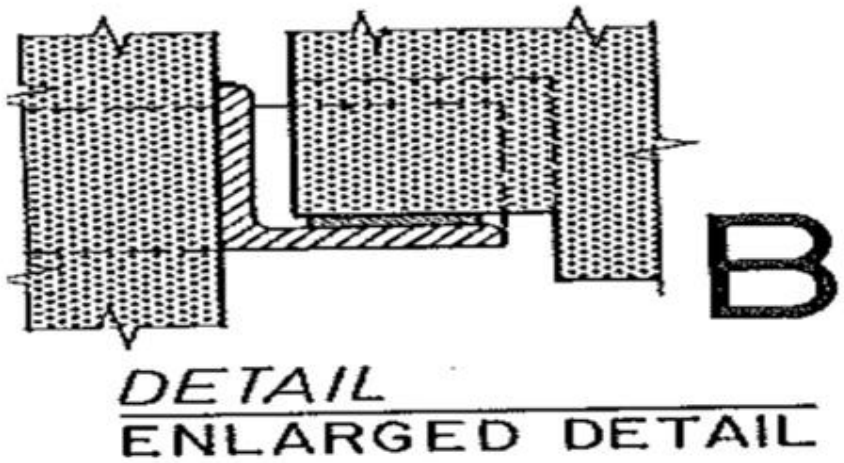
- The entire corbel construction should be prefabricated and must be cast in which

makes manufacture of corbel more complicated

- This should not be considered for fire proof buildings.

VARIANT "B"

- In variant B ,the angles with the horizontal flange down are connected by vertical flat bars welded to the ends of the angles.
- In the column ,the bearing surface is increased by horizontal flat bars welded to the undersides of vertical flat bars.
- Ensures a better anchorage and greater stiffness of the corbel and lateral location of the beams.



BEAM TO COLUMN CONNECTION WITH BUILT UP STEEL CORBEL

- This connection for SSB will be able to transmit a large vertical shear force.
- The beams are supported on a built up steel corbel which is cast into the column.

VARIANT A

- In variant A the corbel consists of two vertical flat bars to which the horizontal bearing plates are welded
- In column the bearing surface is increased by horizontal flat bars welded to the undersides of the vertical flat bars.
- The max B.M in the vertical flat bars is assumed to occur over the centre of the horizontal connection plates.

VARIANT B

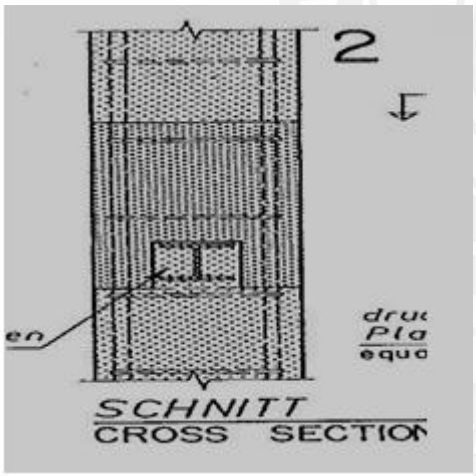
- The corbel consists of two vertically placed channels to which, outside the column horizontal bearing plates are welded
- An additional tie must be provided immediately under the corbel, in an end column also above the corbel to counteract the splitting forces

BEAM TO COLUMN CONNECTION WITH STEEL JOIST CORBEL, ENCASED IN THE BEAM

- This connection for SSB can depend the size of the bearing surface, transmit a fairly large vertical shear force.
- In this case the beams are supported on a steel joist corbel which extends into a recess in the end of the beam.

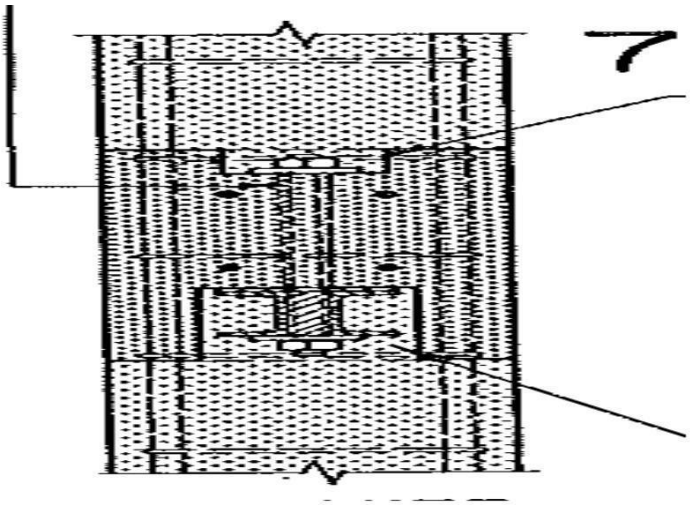
VARIANT A

- The corbel is formed by a cast-in broad flange rolled steel I section.
- Additional tie is provided to counteract the splitting forces.



VARIANT B

- Could be considered if the beams must also be located vertically.
- The corbel consists of two rolled steel I sections with splice plates welded in between the webs, so that the bolts can pass through a hole in the beam.
- Additional tie under the corbel to counteract the splitting forces.
- Corbel must be provided with a permanent protection against corrosion and fire



BEAM TO COLUMN CONNECTIONS WITH VERTICAL STEEL BEARING PLATES

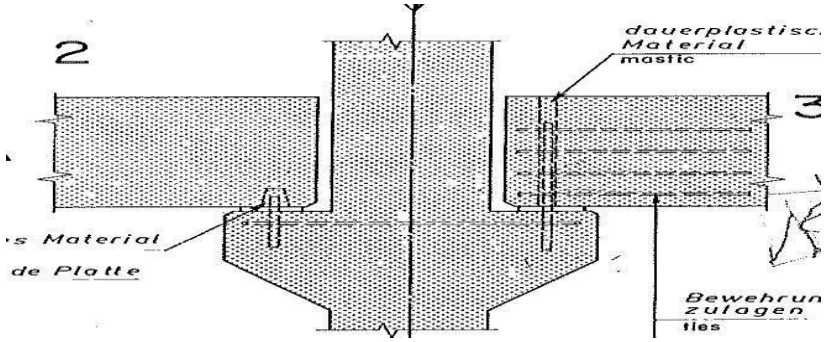
- The beams are supported on vertical steel plates against the column faces. The beam ends are also provided with a vertical steel plate.
- The entire bearing construction is contained within the beam section.
- This connection will be able to transmit large vertical shear force. Due to limited bearing surface this connection should be considered only for short beams.
- Anchorage of steel plates must not only cater for transmission of vertical shear but also prevent the plates from being pulled out.
- To avoid point bearing ,care must be taken to install the bearing plates perpendicular to the column face
- Disadvantage is that only very small tolerances can be allowed. Temporary safety measures during erection are necessary and permanent stability after erection is required.

BEAM TO COLUMN CONNECTION WITH CONCRETE CORBEL

- The beams are supported on concrete corbels
- This connection is generally applied to simply supported beams

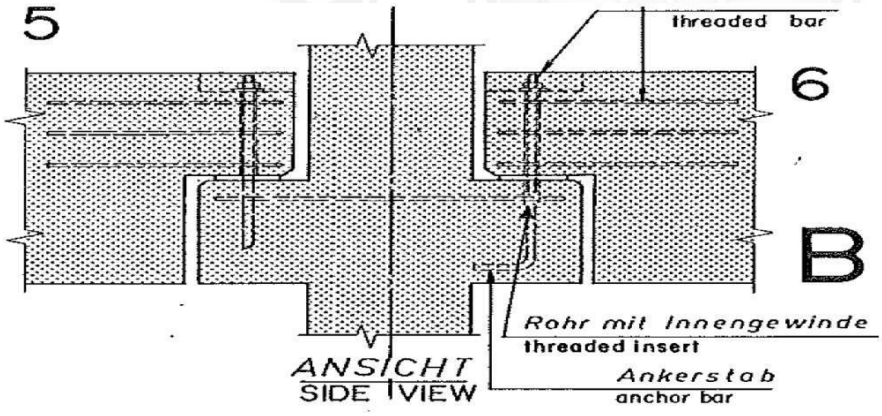
VARIANT A

- The concrete corbels protrude under the beams.



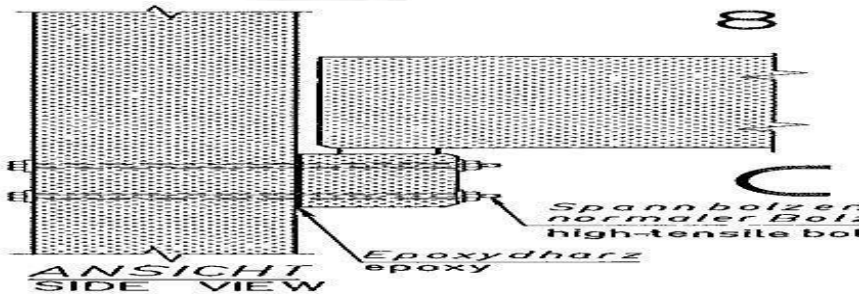
VARIANT B

- The beams have notched ends and are supported on corbels.
- The notched ends must be reinforced against the vertical shear force and also against torsion if it is eccentrically loaded.



VARIANT C

- Columns are provided with concrete corbels which are bolted to the column faces.

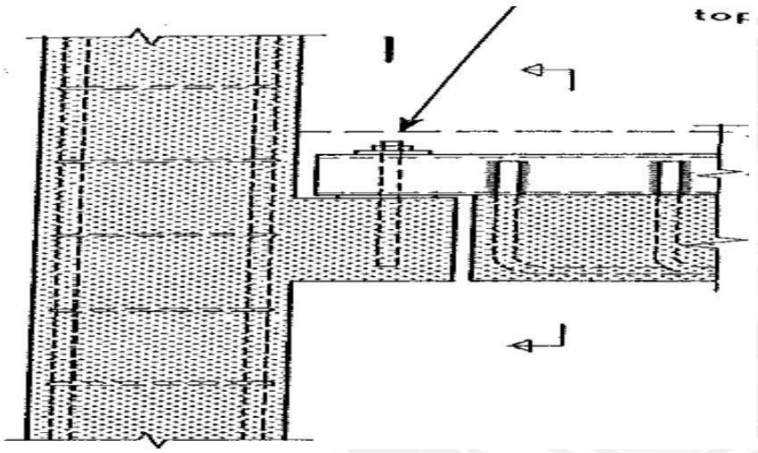


- It is advisable to use high tensile bolts and provide an Epoxy layer at the column a d corbel interface. The bolts and nuts must have permanent protection against corrosion and fire.

- To prevent the beams from toppling, beam and column interface could be shaped to form a tongue and groove joint.

BEAM TO COLUMN CONNECTION WITH STEEL JOIST HANGER

- Beams are supported by means of steel joist hangars on concrete corbels.
- This connection is suitable for limited construction depths.
- The hangar construction must be designed to transmit the total vertical shear force. Since the connection cannot transmit torsion, it is unsuitable for edge beams.



- The hanger construction consists of two vertical channels with flanges facing each other which are welded to anchor bars projecting from top of beam
- During erection, these channels are placed on an equalizing pad on top of the corbel.
- The beam is secured vertically and laterally by tightening a nut with washer on a bolt which projects from the corbel through the slot in between the channel flanges.