3.5 Test on Hardened concrete:

1. Compressive strength test
2. Tensile strength test
3. Flexural strength test

1. Compressive strength test:

- Remove the specimen from the water after specified curing time and wipe out excess water from the surface.
- Take the dimension of the specimen to the nearest 0.2m
- Clean the bearing surface of the testing machine
- Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast.
- Align the specimen centrally on the base plate of the machine.
- Rotate the movable portion gently by hand so that it touches the top surface of the specimen.
- Apply the load gradually without shock and continuously at the rate of 140 kg/cm2/minute till the specimen fails
- Record the maximum load and note any unusual features in the type of failure.
- Compressive strength=load/area

2. Tensile strength test:

- The cylindrical mould shall be of 150mm diameter and 300mm height. Similarly the mould and base plate shall be coated with a thin film of mould oil before use, in order to prevent adhesion of the concrete.
- Prepare three cylindrical concrete specimens.
- After molding and curing the specimens for seven days in water, they can be tested. The cylindrical specimen is placed in a manner that the longitudinal axis is perpendicular to the load.
- Two strips of nominal thick plywood, free of imperfections, approximately (25mm) wide, and of length equal to or slightly longer than that of the specimen should be provided for each specimen.
- The bearing strips are placed between the specimen and both upper and lower bearing blocks of the testing machine.

- The load shall be applied without shock and increased continuously at a nominal rate within the range 1.2 N/(mm2/min) to 2.4 N/ (mm2/min).
- Record the maximum applied load indicated by the testing machine at failure.

$$f_c = \frac{2P}{\pi DL}$$

P=compressive load at failure

L=length of cylinder

D= Diameter of cylinder

3. Flexural strength test:

- **Beam mould** of size 15 x 15x 70 cm (when size of aggregate is less than 38 mm) or of size 10 x 10 x 50 cm (when size of aggregate is less than 19 mm)
- the bed of the testing machine shall be provided with two steel rollers, 38 mm in diameter, on which the specimen is to be supported, and these rollers shall be so mounted that the distance from centre to centre is 60 cm for 15.0 cm specimens or 40 cm for 10.0 cm specimens.
- The load shall be applied through two similar rollers mounted at the third points of the supporting span that is, spaced at 20 or 13.3 cm centre to centre. The load shall be divided equally between the two loading rollers, and all rollers shall be mounted in such a manner that the load is applied axially and without subjecting the specimen to any torsional stresses or restraints.
- Prepare the test specimen by filling the concrete into the mould in 3 layers of approximately equal thickness. Tamp each layer 25 times using the tamping bar as specified above. Tamping should be distributed uniformly over the entire crossection of the beam mould and throughout the depth of each layer.
- Clean the bearing surfaces of the supporting and loading rollers , and remove any loose sand or other material from the surfaces of the specimen where they are to make contact with the rollers.
- Circular rollers manufactured out of steel having cross section with diameter 38 mm will be used for providing support and loading points to the specimens. The distance between the outer rollers (i.e. span) shall be **3d** and the distance between the inner rollers shall be **d**.

- The specimen stored in water shall be tested immediately on removal from water; whilst they are still wet. The test specimen shall be placed in the machine correctly centered with the longitudinal axis of the specimen at right angles to the rollers.
- The load shall be applied at a rate of loading of 400 kg/min for the 15.0 cm specimens and at a rate of 180 kg/min for the 10.0 cm specimens.
- The Flexural Strength or modulus of rupture ($\mathbf{f_b}$) is given by

  $\mathbf{f_b = pl/bd^2}$ (when **a** > 20.0cm for 15.0cm specimen or > 13.0cm for 10cm specimen)

  or

  $\mathbf{f_b = 3pa/bd^2}$ (when **a** < 20.0cm but > 17.0 for 15.0cm specimen or < 13.3 cm but > 11.0cm for 10.0cm specimen.)

Where,

a = the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen

b = width of specimen (cm)

d = failure point depth (cm)

l = supported length (cm)

p = max. Load (kg)

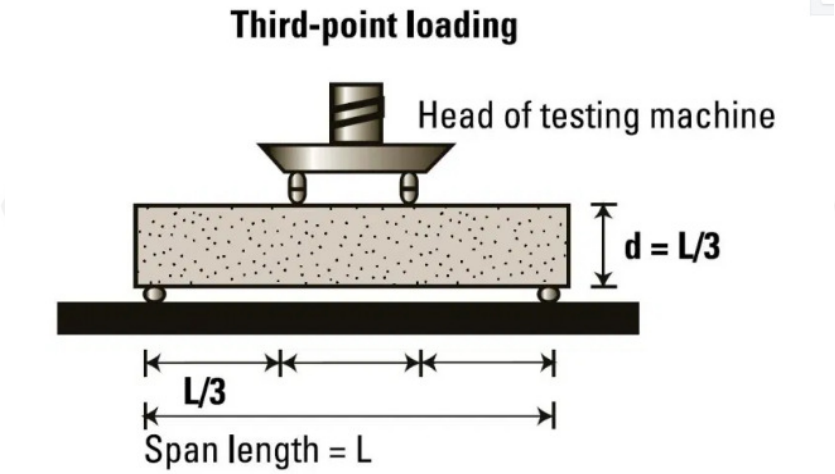

Fig 6 Flexural strength –Three point loading