Reinforced Cement Concrete Slab

A Reinforced Concrete Slab is the one of the most important component in a building. It is a structural element of modern buildings. Slabs are supported on Columns and Beams.

RCC Slabs whose thickness ranges from 10 to 50 centimetres are most often used for the construction of floors and ceilings.

Thin concrete slabs are also used for exterior paving purpose.

In many domestic and industrial buildings a thick concrete slab, supported on foundations or directly on the sub soil, is used to construct the ground floor of a building.

In high rises buildings and skyscrapers, thinner, pre-cast concrete slabs are slung between the steel frames to form the floors and ceilings on each level.

While making structural drawings of the reinforced concrete slab, the slabs are abbreviated to “r.c.slab” or simply “r.c.”.

Design of various types of slabs and their reinforcement

For a suspended slab, there are a number of designs to improve the strength-to-weight ratio. In all cases the top surface remains flat, and the underside is modulated:

Corrugated, usually where the concrete is poured into a corrugated steel tray. This improves strength and prevents the slab bending under its own weight. The corrugations run across the short dimension, from side to side.

A ribbed slab, giving considerable extra strength on one direction.

A waffle slab, giving added strength in both directions.

Reinforcement design

A one way slab has structural strength in shortest direction.

A two way slab has structural strength in two directions.

These slabs could be cantilevered or Simply Supported Slabs.

Construction

A concrete slab can be cast in two ways: It could either be prefabricated or cast in situ.

Prefabricated concrete slabs are cast in a factory and then transported to the site ready to be lowered into place between steel or concrete beams.

They may be pre-stressed (in the factory), post-stressed (on site), or unstressed. Care should be taken to see that the supporting structure is built to the correct dimensions to avoid trouble with the fitting of slabs over the supporting structure.

In situ concrete slabs are built on the building site using formwork. Formwork is a box-like setup in which concrete is poured for the construction of slabs.

For reinforced concrete slabs, reinforcing steel bars are placed within the formwork and then the concrete is poured.

Plastic tipped metal, or plastic bar chairs are used to hold the reinforcing steel bars away from the bottom and sides of the form-work, so that when the concrete sets it completely envelops the reinforcement.

Formwork differs with the kind of slab. For a ground slab, the form-work may consist only of sidewalls pushed into the ground whereas for a suspended slab, the form-work is shaped like a tray, often supported by a temporary scaffold until the concrete sets.

Materials used for the formwork

The formwork is commonly built from wooden planks and boards, plastic, or steel. On commercial building sites today, plastic and steel are more common as they save labour.

On low-budget sites, for instance when laying a concrete garden path, wooden planks are very common. After the concrete has set the wood may be removed, or left there permanently.

In some cases formwork is not necessary – for instance, a ground slab surrounded by brick or block foundation walls, where the walls act as the sides of the tray and hardcore acts as the base.

Span – Effective Depth ratios

Excessive deflections of slabs will cause damage to the ceiling, floor finishes and other architectural details. To avoid this, limits are set on the span-depth ratios.

These limits are exactly the same as those for beams. As a slab is usually a slender member the restriction on the span-depth ratio becomes more important and this can often control the depth of slab required in terms of the span – effective depth ratio is given by,

Minimum effective depth = span/(basic ratio x modification factor)

The modification factor is based on the area of tension steel in the shorter span when a slab is

singly reinforced at midspan, the modification factors for the areas of tensions and compression steel are as given in the figure 2 and 4 of the code.

Solid Slab spanning in two directions

When a slab is supported on all four of its sides, it effectively spans in both directions, and it is sometimes more economical to design the slab on this basis. The moment of bending in each direction will depend on the ratio of the two spans and the conditions of restraint at each support.

If the slab is square and the restraint is similar along the four sides, then the load will span equally in both directions. If the slab is rectangular, then more than one-half of the load will be carried in the shorter direction and lesser load will be imposed on the longer direction.

If one span is much longer than the other, a large portion of the load will be carried in the shorter direction and the slab may as well be designed as spanning in only one direction.

Moments in each direction of span are generally calculated using co-efficients which are tabulated in the code.

The slab is reinforced with the bars in both directions parallel to the spans with the steel for the shorter span placed farthest from the natural acis to five the greater effective depth.

The span-efective depths are based on the shorter span and the percentage of the reinforcement in that direction