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COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

19CET302-DESIGN OF RC STRUCTURAL ELEMENTS

III YEAR / V SEMESTER

UNIT III - LIMIT STATE DESIGN OF SLABS AND STAIRCASE

Introduction to slabs

What is Slab?

Slabs are flat, horizontal structural elements made of reinforced concrete that receive the load and transfer it through the beams to the columns and to the footings to the soil below. Slabs are used in both load-bearing structures and framed structures.

Types of slab

1. Conventional Slab

- The slab which is supported by beams and columns, is called conventional slab.
- In conventional slab the thickness of the slab is small but depth of the beam is large. The load is transmitted from slab to beam and then from beam to column.
- These types of slabs are provided with reinforcement where the horizontal bar is called main reinforcement and vertical bar is called distribution bar.

Conventional slabs are two types.

- One way slab
- Two way slab

- **One way slab**
- One way slab is a conventional horizontal slab rectangular in shape and supported by beams on two of its four sides.
- The slabs are supported on beams opposite to each other.
- In one way slabs the longer span is more than twice of the shorter span. The ratio of longer span to the shorter span is greater than two. As a result, the shorter span is subjected to bending.
- The main reinforcements are provided in the shorter directions to resist the bending and the secondary reinforcements are provided in the longer direction.

- **Two Way Slab**

- Two-way slabs are also conventional slabs mostly rectangular in shape and supported on all four sides of a beam. In two-way slabs, the longer span is less than twice the shorter span.
- The ratio of longer span to shorter span is lesser than two. The deflected shape of the slab is like a dish or saucer shape.
- In this case, both the shorter and longer directions are subjected to bending. Therefore, the main reinforcements would be provided in both directions based on the magnitude of bending. The two-way slabs are economical to a size of 6m x 6m.
- Also, the quantity of steel used in two-way slab is more than the one-way slab.

Application

Most apartments, multi-storeyed buildings.

2. Flat Plate

Unlike conventional slabs, in flat plates, the loads are not transferred from the slabs to the beams. In flat plates, the loads are transferred directly to the columns. The flat plate system may be one-way or two-way depending on the design plan.

Applications

Underground parking, multi-storey buildings

Flat plate floor system

4. Flat Slab

- Flat slabs are the modified version of flat plates with a column head and/or a drop panel cast monolithically with the slab. There are no beams present in the flat slabs but the drop panels and column heads will transfer the loads smoothly to the columns.
- The drop panels are square or rectangular in shape and increase the shear capacity of the slab. The drop panels add deflection to the slab and thus minimize the deflections.
- The flat slabs are mostly popular in unconventional structures without column symmetry. The column heads and drop panels act as a special beam confined to that particular space. However, the formworks become complicated due to the need for column heads and drop panels.

Applications

These types of slabs are used in underground parking and unsymmetrical buildings.

4.Waffle Slabs Or Grid Slabs

- Waffle slabs are lightweight slabs with hollow grid-like systems on their soffit. The hollow grid system reduces the self-weight of the slab without compromising its structural stability.
- The grids are spaced at equal intervals and they transfer the load from above to the beams. The space between the ribs is sometimes treated as a beam and reinforced to increase the flexural rigidity of the slab.
- Due to their lightweight, they can span long distances with ease. The waffle slabs may have a grid system or a girder system where the bands of beam run throughout the slabs. The grids can be or any shape – square, rectangular, triangular etc.,

Application

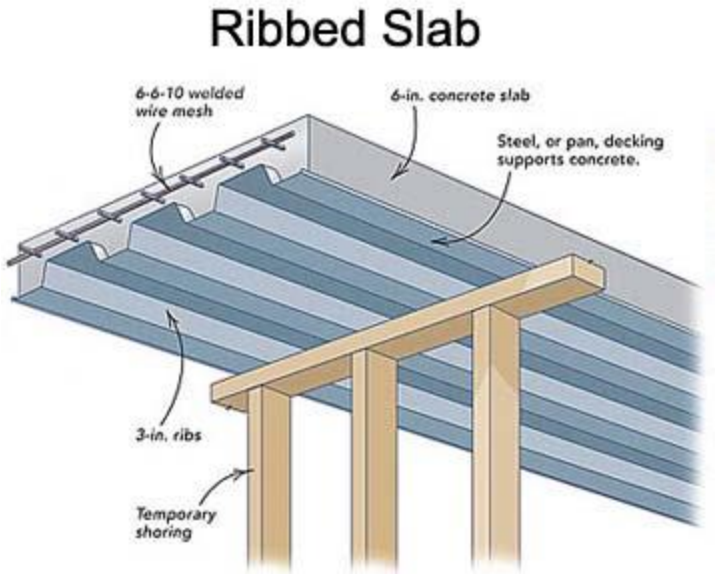
These types of slabs are used in public buildings, museums, airports, etc.,

5.Ribbed Slab

- Ribbed slabs are very similar to waffle slabs but often mistaken for being the same. A ribbed slab has wide grids or bands of beams in the soffit of the beam whereas a waffle slab has deeper corresponding parts.
- The ribbed slabs like waffle slabs are flexible, light in section, economical and can be constructed for longer spans. They have the same advantages and disadvantages as the waffle or grid slab.

Applications

Public buildings, museums, galleries.



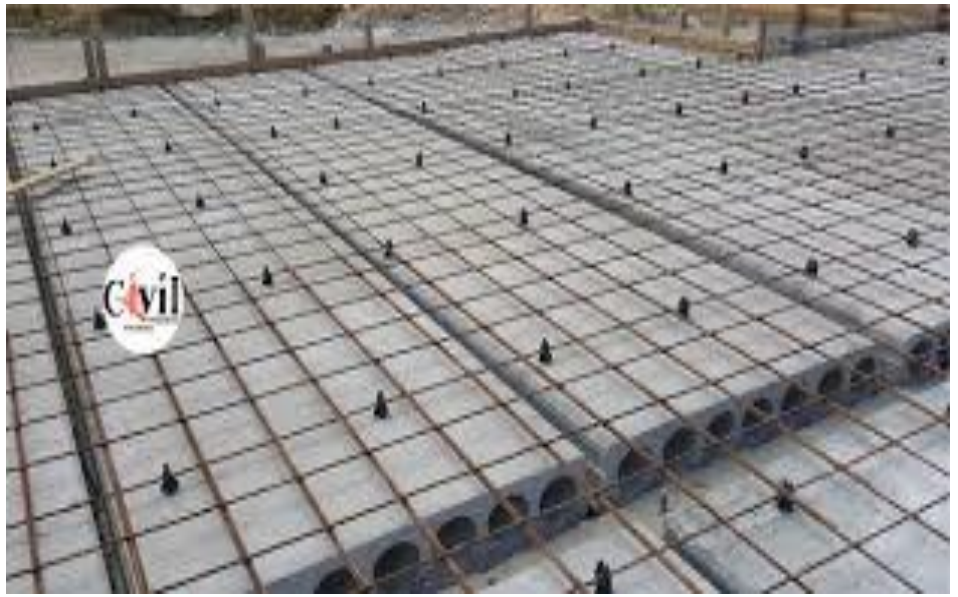
6. Hollow Deck Slab

Hollow deck slabs are special types of prefabricated concrete slabs that use the fundamentals of the stress developed in a section for the design. The concrete takes care of the compression while the steel takes care of the tension. There is no specific use for the concrete in the tension zone other than to provide a solid section.

Taking this principle into account, the hollow deck slab does not provide concrete in the tension zone. It is provided with minimum concrete to hold the steel reinforcements in place. The hollow deck slab can be prestressed or non-prestressed.

Applications

Bridges, wall panels, multi-storey prefabricated buildings.



7.Bubble Deck Slab

- Bubble deck slabs are hollow slabs where the concrete in the tension zone is replaced by recycled high-density polyethylene or HDPE plastic balls. Bubble deck slabs use the same principle as the hollow core slab. The concrete in the tension zone of a section has no structural importance.

- The removal of that concrete will not affect the performance of the structure in resisting the loads acting on it. Bubble deck slabs can reduce the amount of concrete in a slab from 40% to 60%. This reduces the dead weight of the structure and also saves on costs.

Application

Bubble deck slabs are mostly used in public buildings, high rise buildings.

THANK YOU