

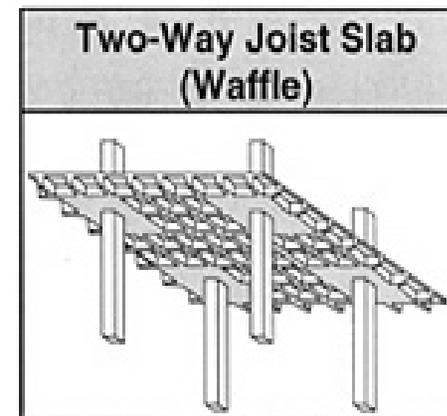
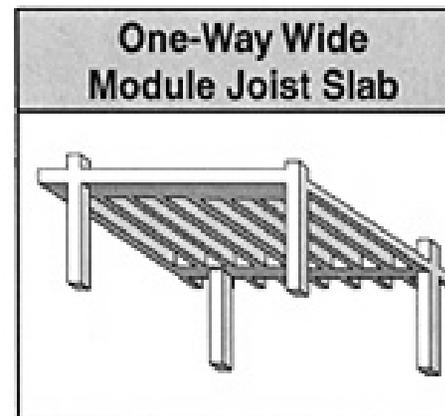
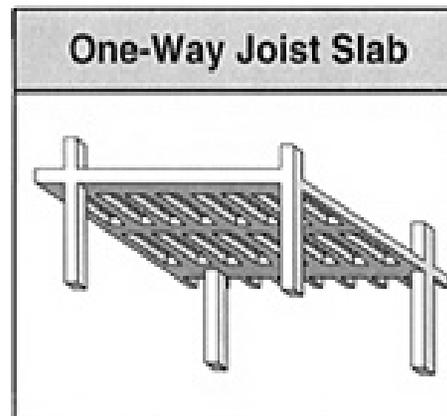
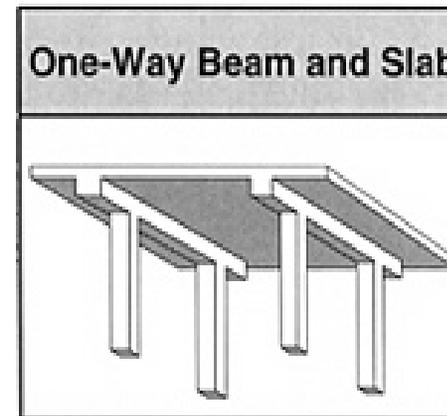
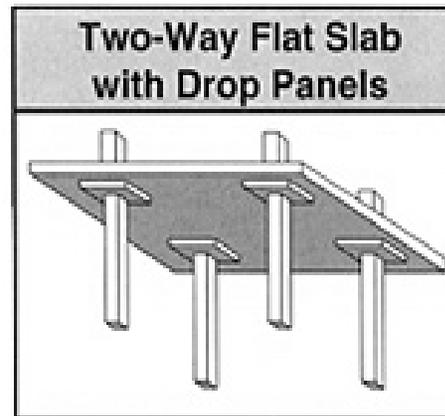
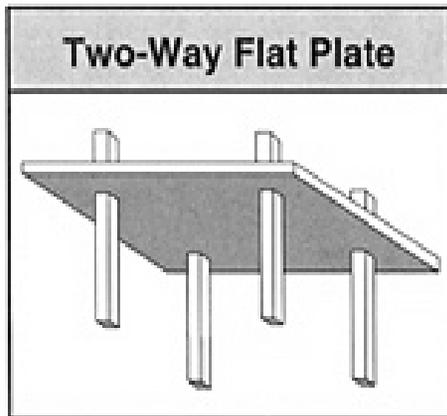
DIFFERENT FLOOR SYSTEMS USED IN STRUCTURES .

Beams and girders are often used to support building floors .In particular, a girder is the main load-carrying element of the floor , whereas the smaller element having a shorter span connected to the girders are called beams. Often the loads that are applied to a beam or girder are transmitted to it by the floor that is supported by the beam or girder.

Again, it is important to be able to appropriately idealize the system a series of models, which can be used to determine, to a close approximation, the forces acting in the member . Consider, for example, the framing used to support a typical floor slab in a building .the slab is support by floor joists located at even intervals.

Floor Systems

Basically, a building is a series of floors held up by columns and walls. There are a number of standard floor/roof structural systems used in cast-in-place reinforced concrete construction.



Project No.10

**DIFFERENT FLOOR SYSTEMS USED IN
STRUCTURES .**

Two-way flat plate system. There are no beams between the columns. Instead, the floor is slightly thicker and more heavily reinforced in both directions. There is extra reinforcing in the floor at the columns to transfer the loads properly.

Two-way flat slab with drop panels. The extra thickness around the columns is there to strengthen the column-floor connection and resist the negative moments. The floor itself can be slightly thinner with less dead weight.

One-way beam and slab. The floor loads are transferred to the beams, which are then transferred to the columns.

One-way joist slab. The joists act like small beams. This floor system is very economical because the formwork is readily available, and less reinforcing is needed. Because there's only a small span between each joist, the slab can be thinner.

One-way wide module joist slab. In the lower middle is a variation on the one-way joist slab.

Two-way joist slab, also called a waffle slab. Because there are joists in both directions, this floor system is the strongest and will have the least deflection. It's typically used when stiffness is important or if there are abnormally heavy loads



Image-GoddenF76 Typical one-way beam grid and slab system. This parking structure has columns on a rectangular grid pattern. The essentially one-way design of the system can be seen by the relative lengths and sections of the main beam, and the primary and secondary beams under the slab. The rectangular shape of the unsupported slab also indicates one-way slab action.



Image-GoddenF77 Typical waffle-slab for parking structure. With columns on a 33-ft x 27-ft pattern, the design uses 3-ft square waffles. Note the infilling of the squares at the head of the column to resist both shear and negative moments.



[Image-GoddenF78](#) Waffle-slab roof, San Diego Airport. Not heavily loaded as a roof structure, the waffle slab system could be extended into the overhang where the moments are negative. Note also the supporting columns with a built-in point of zero moment at two-thirds height. (San Diego, California)



[Image-GoddenF79](#) Typical flat slab construction for a parking structure. Note the square column capitals that increase the area of the slab resisting punching shear at the columns.



[Image-GoddenF80](#) Typical flat plate construction. This office building under construction uses flat plates for the floors and constant section columns without capitals. The shear stiffness of the building is provided by elevator shafts and stair wells. Due to the relatively small floor loading and the close column spacing, flat plate construction was possible. For heavier loading and larger column spacing, column capitals are required (GoddenF73), and for even larger spans to reduce the self-weight, waffle slabs are used (GoddenF77)

STRUCTURAL ONE-WAY/TWO-WAY CONCRETE SLAB DESIGN

(IBM & compatibles):

OT designs one-way and two-way concrete slabs under applied loads using the design procedures of Winter and Nilson, the ACI 318-77 Direct Design Method and ACI moment coefficients.

* OT computes the minimum slab thickness required by codes, flexural steel bar sizes, and design moments.

-Data inputs for two

way slabs are the short and long span lengths, minimum

desired thickness

live and dead loads, reinforcing steel yield strength, concrete density, and

compressive strength. Two-way slab design also requires the column dimensions and interior and exterior beam dimensions.

OT calculates corner position, central, longside exposed, and shortside exposed positions. Outputs are design moments, minimum required thickness actual and allowable shear stress, and the number and size of reinforcing bars for the two half-column strips and the middle strip, for the short and the long spans. Detailed inputs and outputs may be printed. The user must note that certain limiting assumptions apply to the direct design method such as the ratio of short to long side length, maximum column offset, live to dead load. etc. The program is fully prompted and interactive. Runs in English or SI Metric units.

One way slab

One way slabs are designed to transfer their loads to only two opposite support walls. Generally for spans up to 3.60 meters and with length/breadth ratio is greater than 0.60 one way slabs

.can be provided

Back to One Way Designer

:Effective Span

This is the distance between center of two opposite supports.

In the case of one way slab the pair of opposite supports with shortest distance between them are taken as the supports. (Span

.(is specified in meters

Back to One Way Designer

:Live Load

This is the load expected to come on the slab after construction excluding the self weight of the slab. This will include load of flooring material provided and any other load that will come on the slab when using it. Generally a live load of 200 to 250 Kg/m² is recommended for residential buildings and more

.for commercial buildings

Back to One Way Designer

Two way slab

Two way slabs are designed to transfer their loads to all the four support walls. Generally for spans greater than 3.60 meters and with length/breadth ratio is less than 0.60 two way slabs can be provided.

In this case main bars (referred under Part 1) are provided in both directions, mutually at right angles

Back to Two Way Designer:

Short Span

This is the distance between center of two opposite supports. In the case of Two way slab the distance between the pair of opposite supports with shorter distance between them are taken as the Short span. (Span is specified in meters)

Back to Two Way Designer

:Long Span

This is the distance between center of two opposite supports. In the case of Two way slab the distance between the pair of opposite supports with larger distance between them are taken as the long span. (Span is specified in meters)

Definition of all other terms are same as that given for part 1 above. Please note that in two way slab, separate distribution bars are not provided

Back to Two Way Designer Technical aspects

The design tried here, is based on the "Basic Elastic Theory".
Two way slab design is based on the Rankine-Grashoff Theory.

Reinforced cement concrete using 20 mm nominal size granite broken stones -M150 (1:2:4) is assumed for design.
MS bars with a tensile strength of 4200 Kg/cm² is proposed for reinforcement.
The factor of safety assumed is 3
In both types bend up the main bars at distance of 1/7th of span from supports to take negative bending

Slabs - Introduction

Reinforced concrete slabs are a common building system because they can be built economically ~~with essentially any plan geometry and supported~~ by randomly located beams, columns and walls.

Slabs must have sufficient strength to carry loads safely but must not deflect or crack excessively.

It is these two serviceability factors that provide the criteria on which the success of a slab design is ultimately judged and their importance cannot be overly emphasized

In theory, because they are highly statically indeterminate structures, the analysis of reinforced concrete slabs is complex.

Fortunately, for most slabs, a satisfactory design can be obtained by uncoupling the strength and serviceability requirements leading to relatively simple design procedures.

Since slab sections are usually lightly reinforced, they can maintain an essentially constant moment capacity after yielding of the reinforcement for large changes in curvature thereby permitting considerable redistribution of moments within the slab.

This leads to simpler moment fields and patterns of reinforcement. Deflection requirements are met by selecting appropriate slab thickness

The above steps are not independent and indeed may not be completed in the order listed. For example, it is usual to make at least a preliminary evaluation of

Shear.

capacity when selecting slab thickness

There are a number of calculations in the design of slab systems that are tedious when performed manually even with the use of electronic calculators.

Design aids in the form of charts or tables are provided to facilitate many of these calculations.

Design examples are presented to assist in interpreting the provisions of specific clauses of the Standard and to illustrate the use of the design aids. As a result, each example is an incomplete design in that only portions of the slab system are considered

The structural behaviour of reinforced concrete slab structures depends primarily on how they are supported.

Slabs supported so that they tend to deform into a cylindrical surface carry load essentially in one direction only and are referred to as one-way slabs.

Such slabs may be designed as beam strips in the direction of curvature. Slabs supported on regularly spaced columns, or walls, forming approximately square panels deform to carry load in two orthogonal directions. Such slabs are referred to as regular two-way slabs (see Clause 13.1) and may be designed for uniformly distributed gravity loads using the simplification of perpendicular design strips. Slabs supported on randomly spaced columns and/or with randomly placed beams, walls or openings are referred to as irregular slabs. With irregular slabs, the loads in different regions will be carried by combinations of either one-way or two-way action and considerable judgment is needed by the designer to ensure both strength and serviceability requirements are met

Housing with Information - (Floors)

Floors: Concrete is a natural choice for floors in homes ICF or concrete block walls. In addition to delivering benefits similar to the walls - resistance to natural forces (wind, rot and insects), sound reduction, and improved thermal performance - concrete floors are long-spanning, squeakless and can accommodate efficient, comfortable radiant heat systems.

Floors fall into four categories:

composite/steel joist concrete/steel deck concrete joists precast

Composite Concrete/Steel Joists

Light steel joists supporting concrete on a steel deck or ribbed steel pan are widely available. Typical spans = 4.5 to 9.0 m or longer using 200 - 610 mm joists plus 40 - 100 mm concrete.

"Hambro" a proprietary system, uses sheets of plywood temporarily held between joists with removable roll bars. Steel mesh is draped over the joist, then topped with concrete, bonding it to the top chord and creating a reinforced composite deck. The plywood and roll bars can be reused.

Because of the composite action between joists and concrete, this system is somewhat lighter than plain joists/steel deck combinations.

C-Floor is another unique composite system which uses cold formed C-sections at 600 to 750 mm o.c. instead of steel joists. The 200 to 250 mm deep C-sections support a 75 mm concrete slab on ribbed steel pan. Composite action is created by continuous bond bars secured to the top of the C-sections by patented shear transfer devices. Typical spans 5.5m to 7.9m support live loads up to 4.8 KPa.

Concrete/Steel Deck

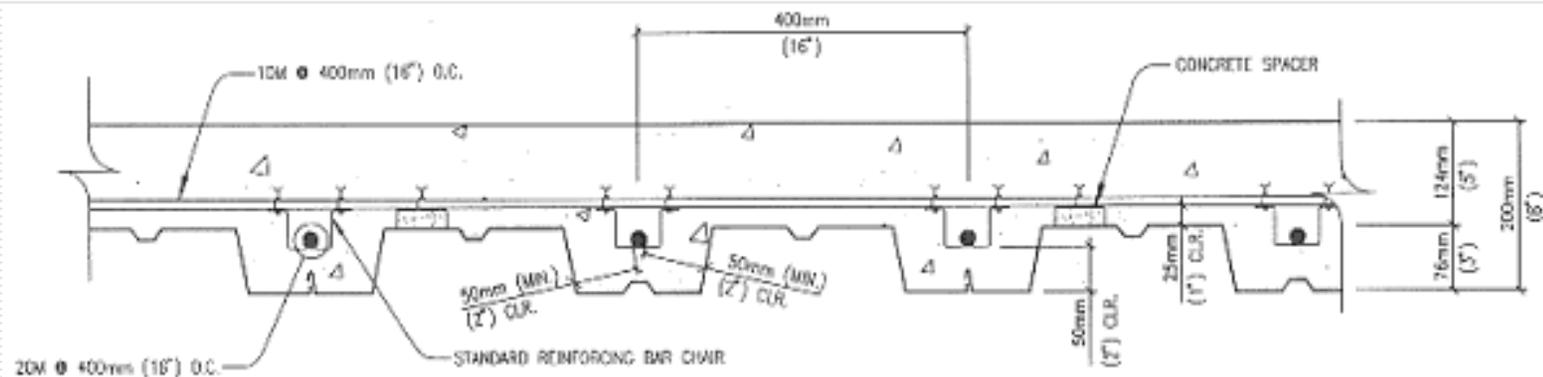
Metal deck made from plain or galvanized steel sheet rolled into ribbed profiles can be used to form concrete floor slabs. Steel deck can be used strictly as a form for the concrete deck slab or it can be used as part of a composite design where deck and concrete act together structurally. For house construction, 18 - 24 ga. (1.2 - 0.6 mm) sheets with 38 - 76 mm deep ribs is used.

When the decking is used solely as a form, steel reinforcing rods and concrete are designed to carry all loads. Two examples that have been tested for fire and sound performance are shown below:

Temporary supports installed under the deck at 1.5m before the pour must remain in place until the concrete reaches 80 percent of its design strength.

For a composite concrete/steel deck floor, a similar steel deck with "dimples" formed into the vertical flutes to create a physical bond with the concrete is used. This results in very efficient use of both materials. A 22 ga (0.75 mm) 75 mm composite deck with 75mm of 25 MPa concrete on top - total thickness 150 mm - can span up to 4.5m with no reinforcement.

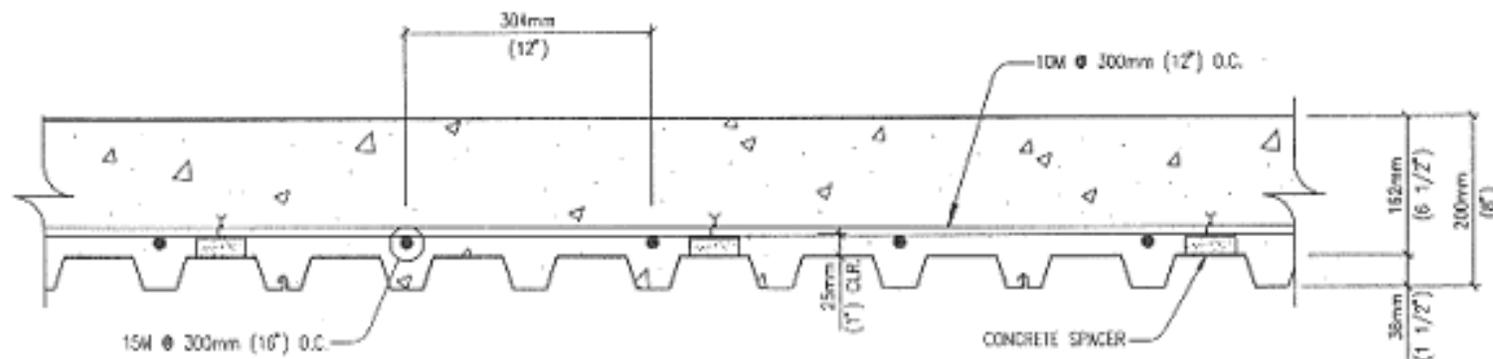
Temporary supports at 2.25m are required until the concrete develops sufficient strength. For design, either the ASCE Standard Specification for Design of Composite Slabs or the SDI Composite Deck Design Handbook should be followed. In Canada CSSBI S3-88 Criteria for the Design of Composite Slabs prepared by the Canadian Sheet Steel Building Institute or the Cement Association of Canada Concrete Housing Handbook could be used.



FIRE/SOUND SEPARATION FLOOR SLAB

200mm (8") REINFORCED CONCRETE ON 76mm (3") PLAIN STEEL DECK
 FIRE RATING - 1 1/2 hr.
 SOUND RATING - STC = 48+, IC = 29+

NOTE: IC RATING MAY BE INCREASED BY
 SUITABLE FLOOR COVERING, ETC.



FIRE/SOUND SEPARATION FLOOR SLAB

200mm (8") REINFORCED CONCRETE ON 38mm (1 1/2") PLAIN STEEL DECK
 FIRE RATING - 2 hr.
 SOUND RATING - STC = 52+, IC = 30+

Concrete Joist.

There are several systems available for casting concrete joist floors. Some use removable metal or fiberglass forms. Others use stay in place ~~composite steel or plastic forms. Typical systems~~ produce 200 mm deep ribs 600 - 900 mm on centre. With 50 - 75 mm thick topping, total floor thickness is 250 - 300 mm. One reinforcing bar is placed near the bottom of each rib and most systems require welded wire mesh in the top slab. For joist floors using composite steel forms, spans of 4.8 - 8.0m are common. Bulkheads to retain the concrete between the ribs where they meet a wall are provided as part of the forming system. Composite steel forms that stay in place are available from Canadian Steel Inc.

A method of forming concrete joist floors using foam forms is now making its way to North America from Europe where it has been used for several years. Hollow core foam planks, shaped to form concrete ribs at 460 - 760 mm centres, stay in place after temporary bracing is removed. Attachments for ceiling finishes can be incorporated into the foam floor forms.

Precast

Precast prestressed hollow core concrete slabs or planks for housing are usually 1220 mm wide and 150 mm or 200 mm thick. Although designs and widths vary somewhat, they normally have evenly spaced voids running the length of the slab with prestressing tendons in between.

~~Hollow core is machine-extruded in long continuous~~ beds and cut into planks to final dimensions at the plant. They may be cut to customized widths or shapes and reinforced for stair openings and other speciality applications. Holes for services may be cut on site if necessary. Hollow core slabs are set on ICF walls by crane and anchored with bent reinforcing bars set into the shear key joint between planks. The joints are then grouted to complete the installation.

Precast products have constant depth with a relatively flat top surface and a very smooth underside that can be exposed as a ceiling with a minimum of additional treatment. Carpet and underpad can be laid on top with a minimum of finishing and levelling. A thin cement/latex grout or a concrete topping is required under linoleum or other thin floor finishes. A 38mm concrete topping is applied where radiant heat is to be installed.

Systems that employ small concrete T joists with light autoclaved cellular panels set between them to support a cast-in-place floor slab have been used for many years in other parts of the world. As the use of concrete in low rise housing in North America intensifies, this and other concrete floor systems will likely find their way into the marketplace.

Taken by your own digital camera



Taken by your own digital camera



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