

الاطروحة

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المحاضرة السابعة والثامنة
مبادئ في التصميم الانشائي لفضاءات المباني
مشروع مبنى سكني للاساتذة الجامعيين
نموذج رقم 2



جامعة المثنى

كلية الهندسة

قسم هندسة العمارة

INITIAL UNDERSTANDING

What structure is used for:

- way to organize
- give scale to the volume
- pattern the overall built volume
- Structural elements may play a visually and spatially dominant role in defining the identity of the building



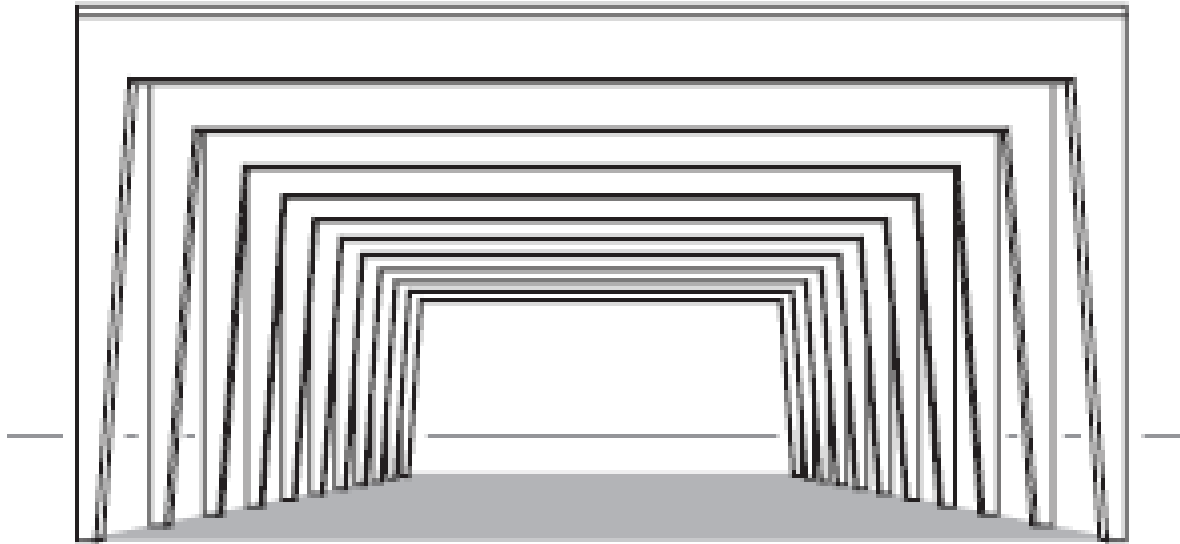
Madrid airport terminal

Why Structural System is important?

- Building design decisions are determined by decisions on the structural system level
- Structural elements may play a visually and spatially dominant role in defining the identity of the building

SPACE AND STRUCTURE

SIMPLE RECTANGULAR SPACE

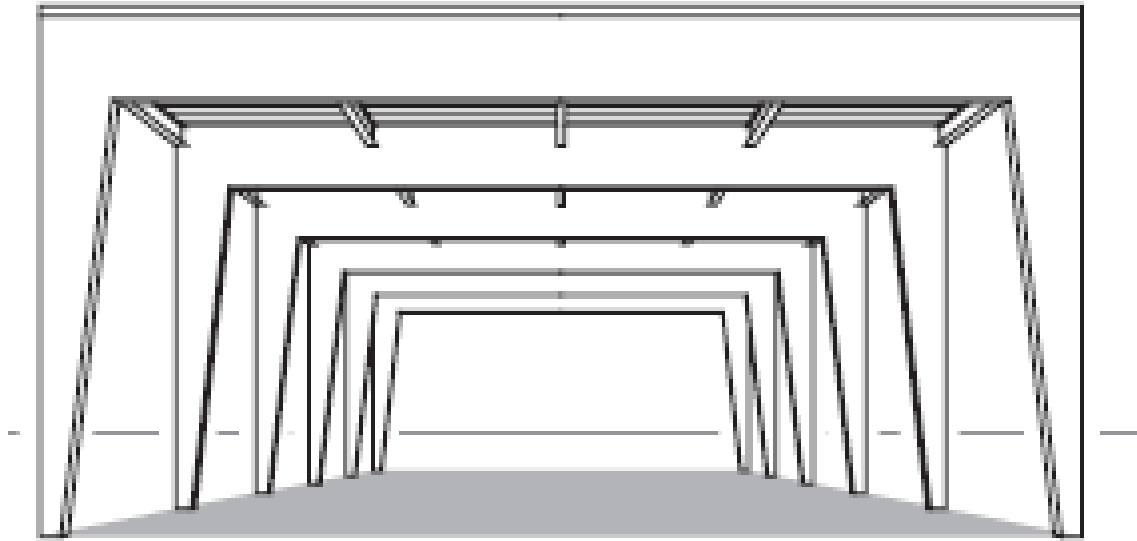


Spacing of primary elements:

- Rigid frames,
- Closely spaced,
- Create a sense of enclosure.

SPACE AND STRUCTURE

SIMPLE RECTANGULAR SPACE

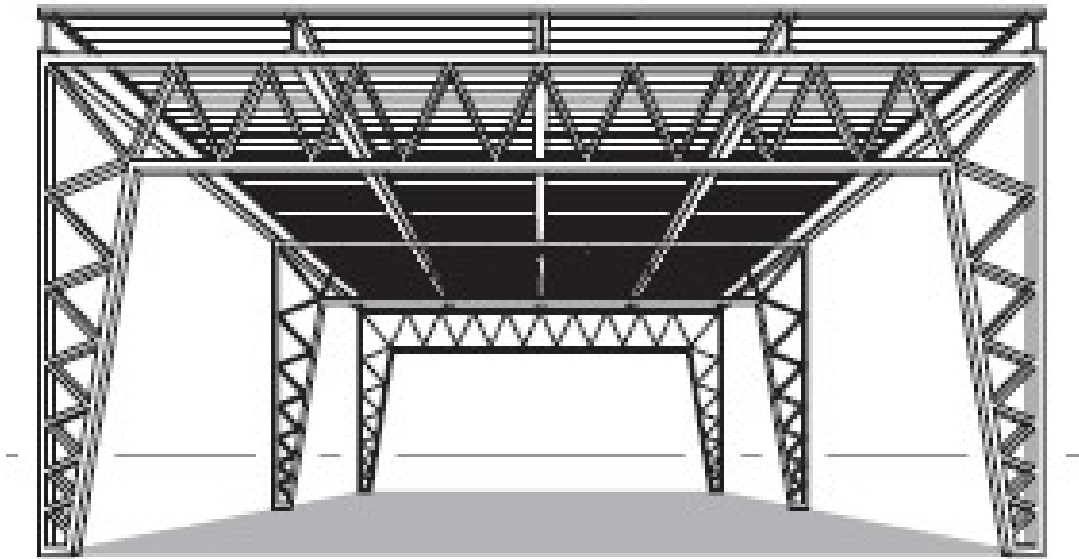


Spacing the primary frames

- Further apart
- Need for a secondary beam system
- The space feels more open

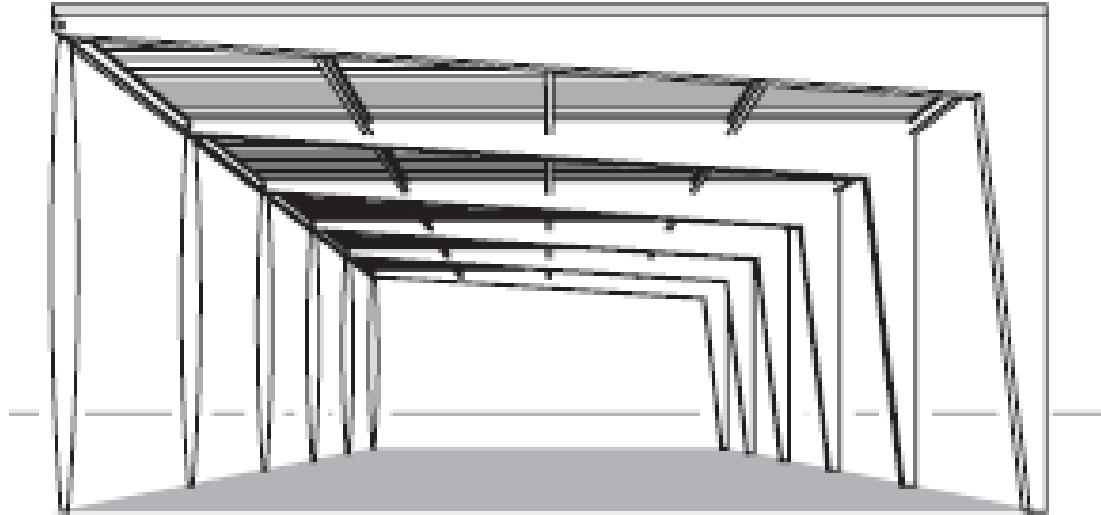
SPACE AND STRUCTURE

SIMPLE RECTANGULAR SPACE



SPACE AND STRUCTURE

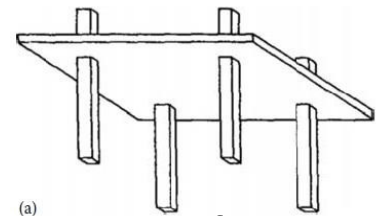
SIMPLE RECTANGULAR SPACE



HORIZONTAL SPAN

LOW-SPAN SYSTEMS

INTERMEDIATE-SPAN SYSTEMS



(a) Two-way flat plate

LOW-SPAN SYSTEMS

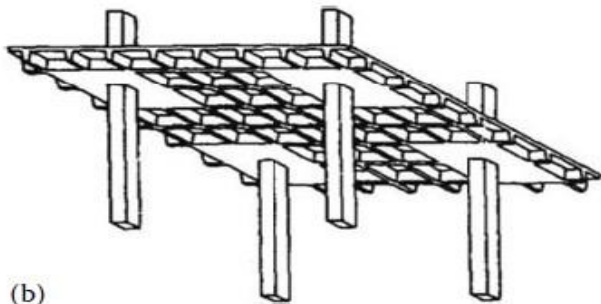
INTERMEDIATE-SPAN SYSTEMS

Other reinforced-concrete systems are possible, such as :

- waffle slabs system
- beam/slab systems

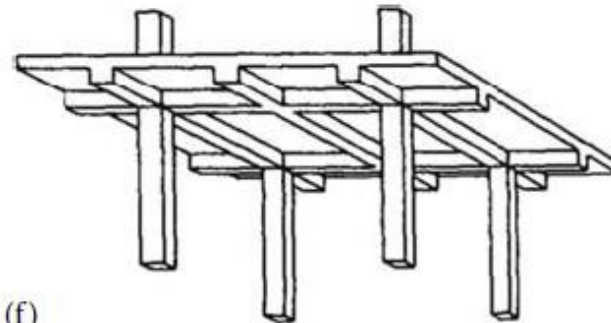
But,

- their higher span and load capacities are not needed for short spans.
- From a structural viewpoint, there is no incentive to go to the trouble and expense of creating the special formwork required to construct these more complex systems when a simple flat plate would work just as well for the conditions at hand.



(b)

Waffle Slab System



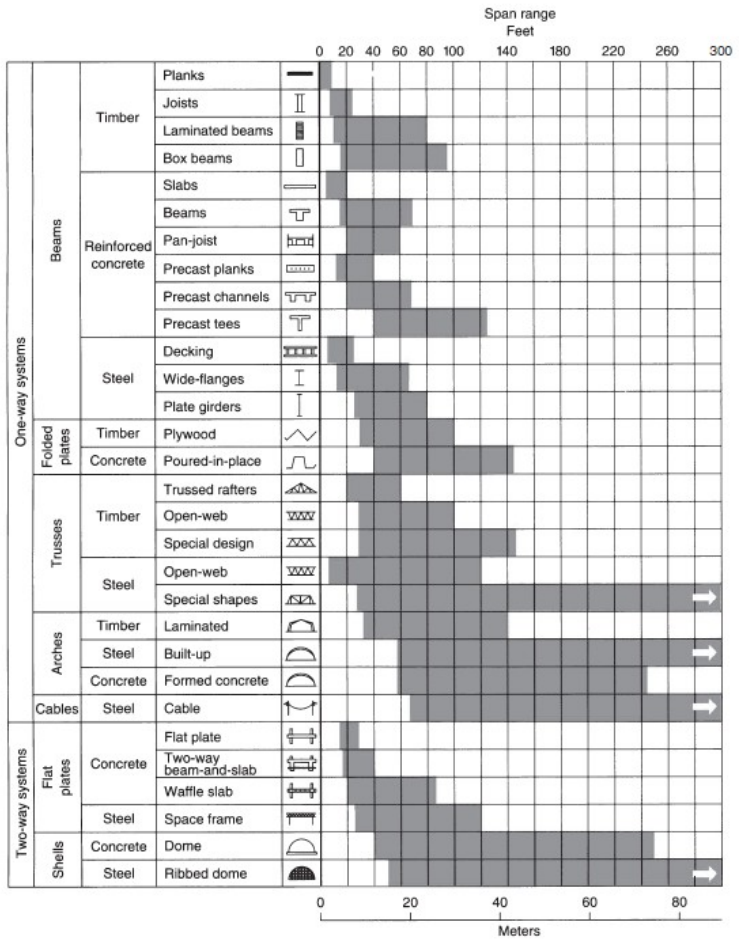
(f)

Beam-Slab System

LOW-SPAN SYSTEMS

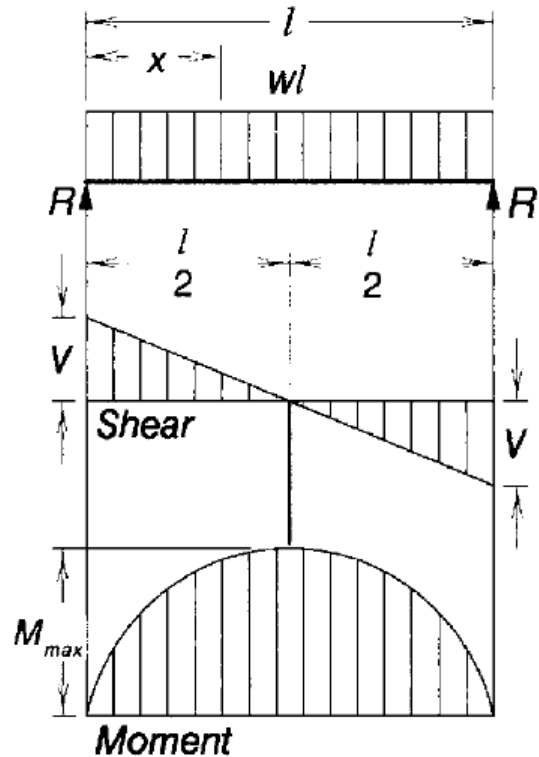
INTERMEDIATE-SPAN SYSTEMS

LONG-SPAN SYSTEMS



UNDERLYING PRINCIPLES GOVERNING SPAN LENGTHS

$$M_{max} \text{ (at center) } \dots\dots\dots = \frac{wl^2}{8}$$

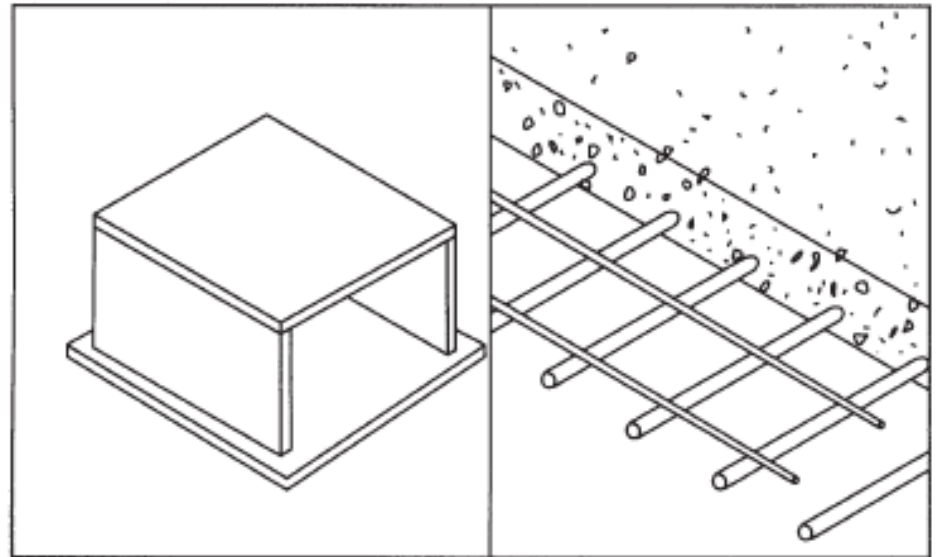


REINFORCED CONCRETE STRUCTURES

REINFORCED CONCRETE STRUCTURES SOLID

REINFORCED CONCRETE STRUCTURES SLAB SYSTEM

SOLID SLAB SYSTEM



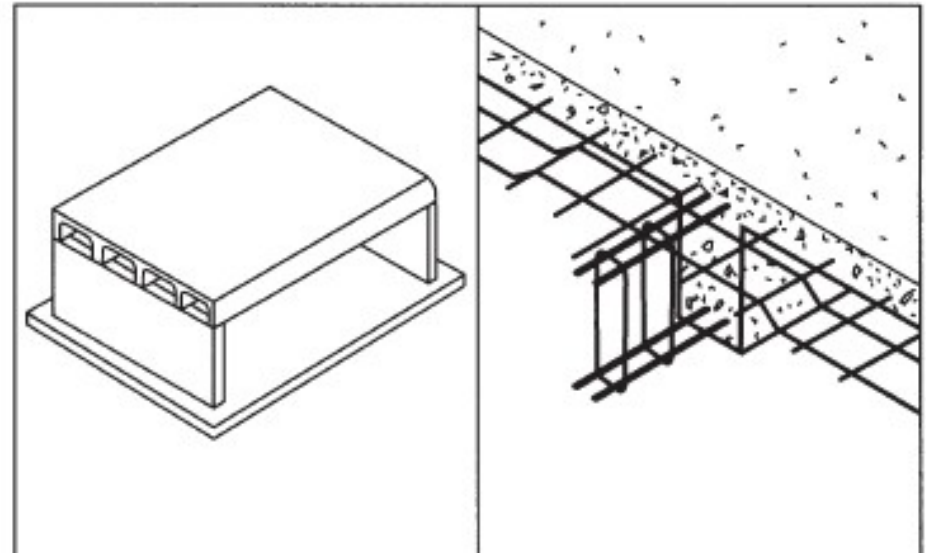
REINFORCED CONCRETE STRUCTURES RIBBED

REINFORCED CONCRETE STRUCTURES

SLAB SYSTEM

RIBBED SLAB SYSTEM

BEAM AND SLAB SYSTEM



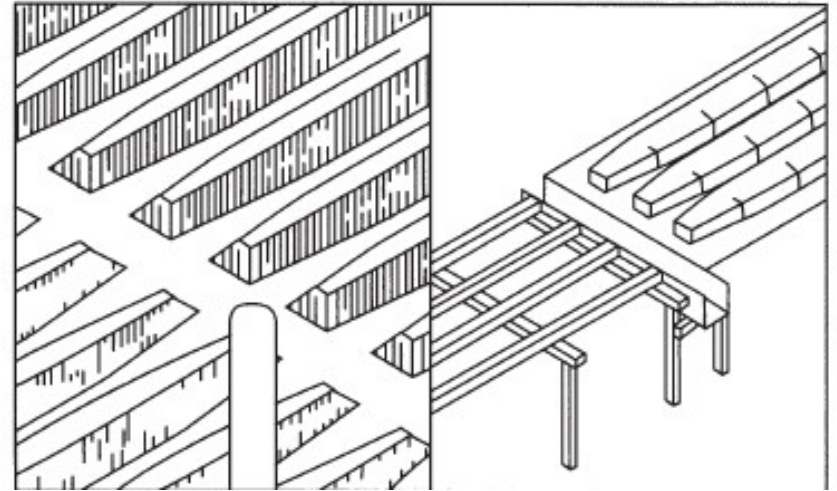
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REINFORCED CONCRETE STRUCTURES

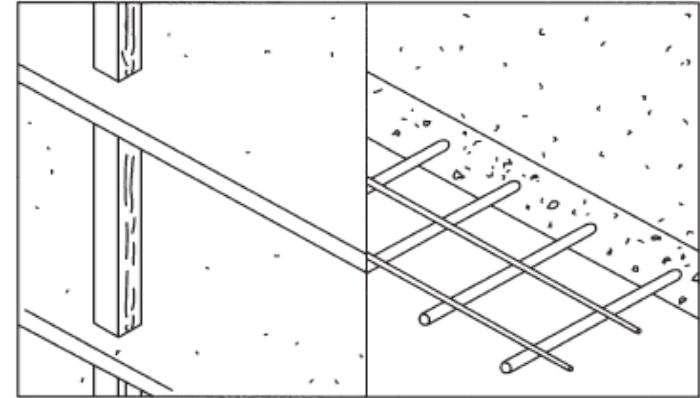
SLAB SYSTEM

RIBBED SLAB SYSTEM

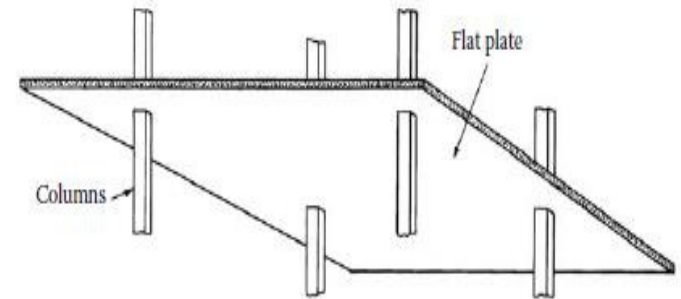
ONE WAY PAN JOIST SYSTEM



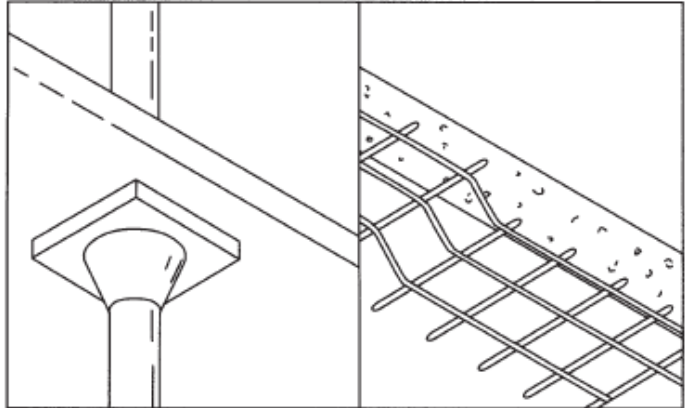
REINFORCED CONCRETE STRUCTURES FLAT PLATE SYSTEM



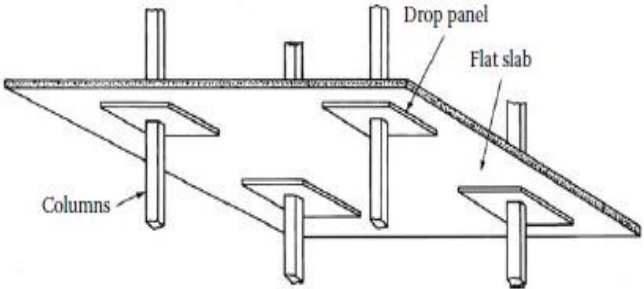
REINFORCED CONCRETE STRUCTURES FLAT PLATE SYSTEM



REINFORCED CONCRETE STRUCTURES FLAT SLAB SYSTEM

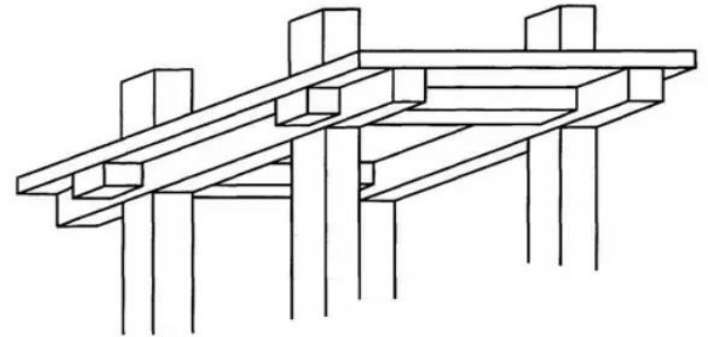
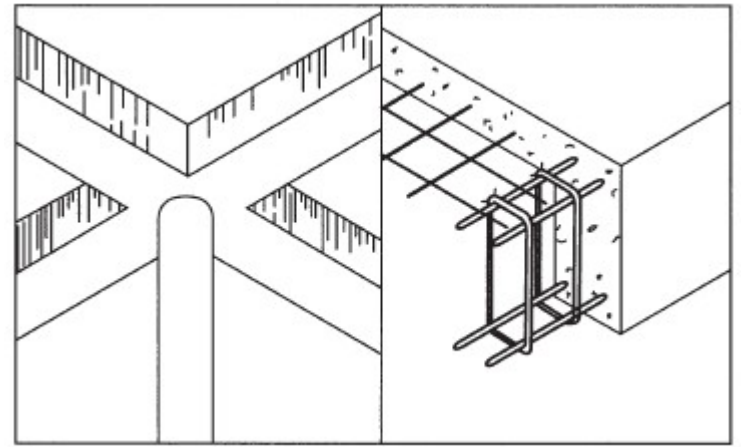


REINFORCED CONCRETE STRUCTURES FLAT SLAB SYSTEM

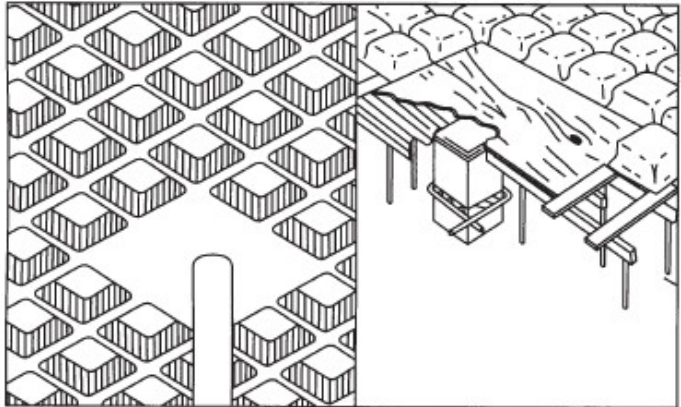


REINFORCED CONCRETE STRUCTURES

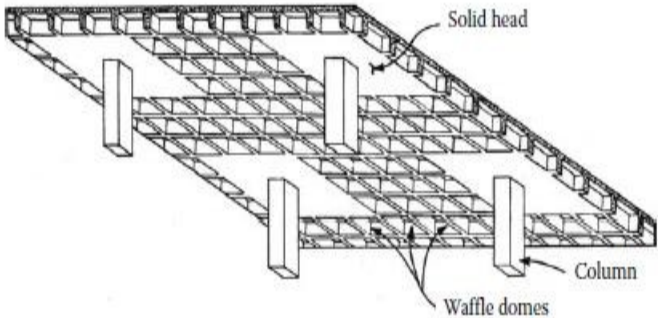
TWO-WAY BEAM-AND-SLAB SYSTEM



REINFORCED CONCRETE STRUCTURES THE WAFFLE SLAB SYSTEM



REINFORCED CONCRETE STRUCTURES THE WAFFLE SLAB SYSTEM



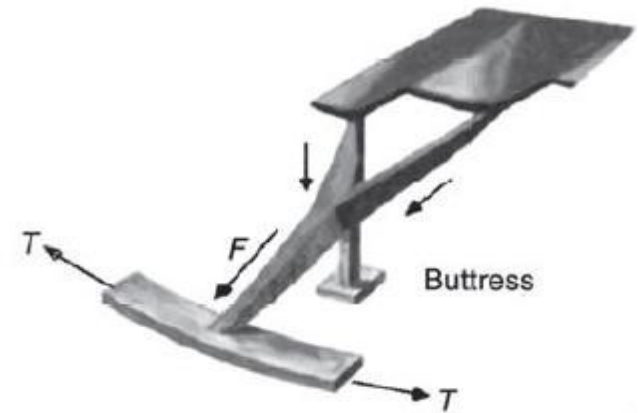
REINFORCED CONCRETE STRUCTURES CURVED SHAPES



REINFORCED CONCRETE STRUCTURES CURVED SHAPES

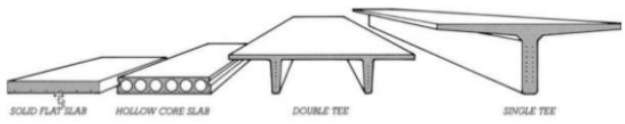
Palazzetto dello Sport, Piazza Apollodoro, in Rome, Italy, by Pier Luigi Nervi

- ❑ The dome was made of precast ferroconcrete elements supported by Y-shaped buttresses.
- ❑ A huge tension ring is buried in the ground.

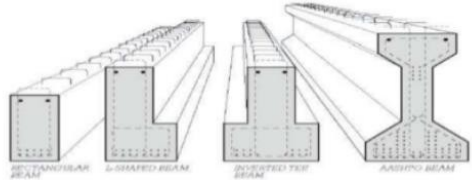


REINFORCED CONCRETE STRUCTURES PRECAST CONCRETE ELEMENTS

Precast slabs



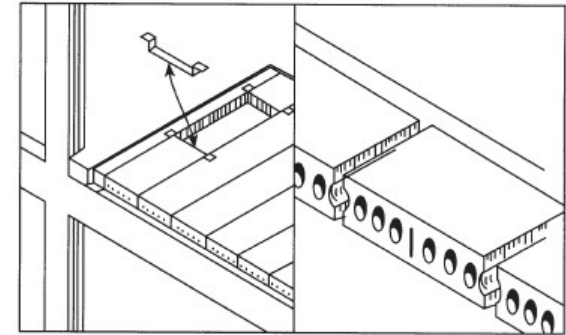
Precast Beam & Girders



REINFORCED CONCRETE
STRUCTURES PRECAST
CONCRETE ELEMENTS

REINFORCED CONCRETE STRUCTURES

PRECAST PLANKS

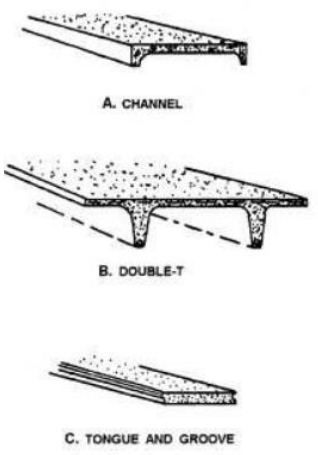


REINFORCED CONCRETE
STRUCTURES PRECAST
PLANKS

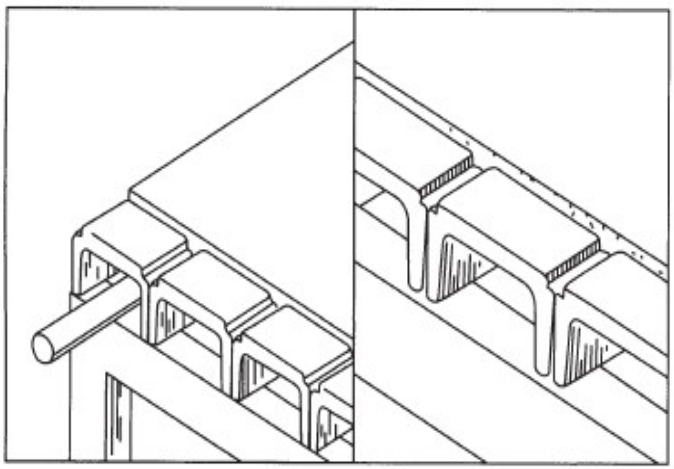
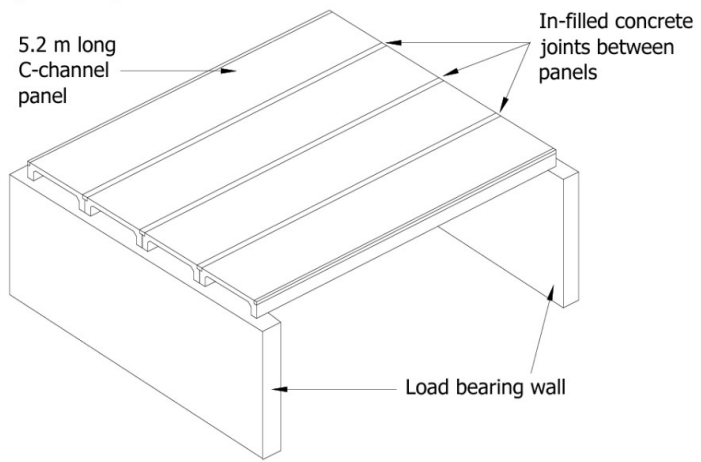


REINFORCED CONCRETE STRUCTURES

CHANNELS AND DOUBLE TEES

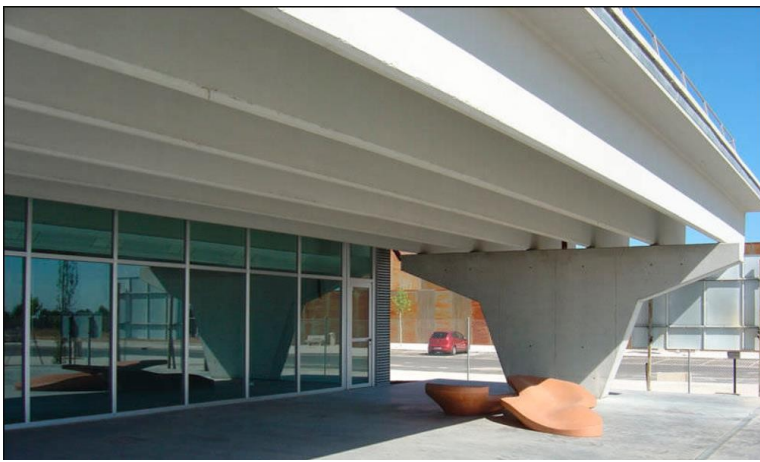
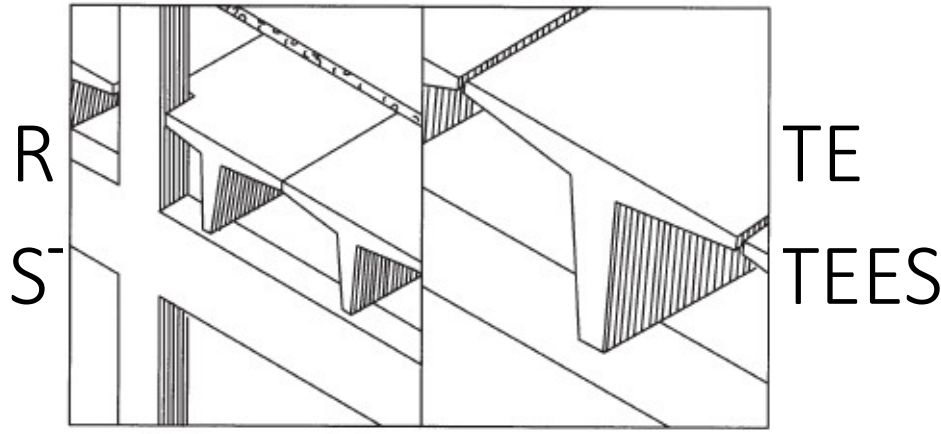


RC
UI
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REINFORCED CONCRETE STRUCTURES

SINGLE TEES





Smart Resources

Introduced by: Dr. Mona Dawood

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Smart water management opportunities



Digitally monitor **water quality** to reduce costs and minimize health risk

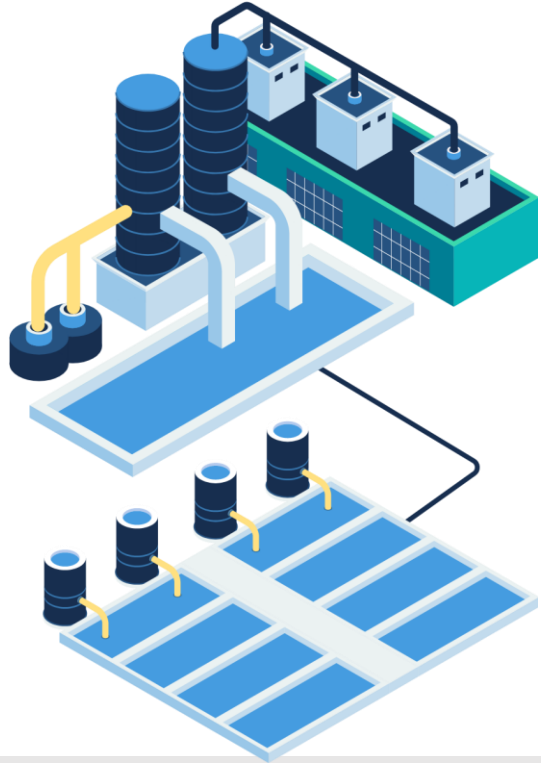
Remotely monitor and control water flow to reduce **consumption**

Use advanced analytics to accurately **predict system performance** and avoid water delivery issues



Customer story: Marriott International

Driving efficiencies to save water and energy



Marriott, the largest hotel operator in the world, and Ecolab, the global leader in water, hygiene, and energy technologies and services, share values of putting people first. Marriott has ambitious 2025 sustainability goals, but the challenge is to meet them without sacrificing guest experiences. The team adopted Ecolab's Aquanomic™ Low-Temp Laundry Program and 3D TRASAR™ Technology for Cooling Water to maintain the highest guest standards while contributing to their sustainability goals.

Drive operational efficiency

The laundry program delivers significant energy and water savings while reducing rewash and extending linen life

Conserve water

Annually, Marriott saves 3.34 billion liters of water—equivalent to annual drinking water needs of more than 3 million people

Deliver meaningful impact

Annual savings include 114 million kWh of energy, 21,500 metric tons of CO₂e, and 2 million pounds of waste



Smart waste opportunities



Repurpose
and **recycle**

Monitor waste bins and
maximize efficient **solid waste**
collection

Promote advanced **waste containment**
scenarios



Customer story: Los Angeles Bureau of Sanitation

Improving sanitation services with a mobile cloud solution



Communities from office parks and hospitals to school campuses and cities are challenged to improve sanitation services while reducing operating costs. To improve service to Los Angeles (LA) residents, the city created the MyLA311 system so that residents can easily initiate a service ticket to request waste cleanup. LA used cloud-based technologies including mobility, mapping, tracking, and dashboarding capabilities—collectively called SANSTAR—to streamline service request processing and monitor field crews' progress.

Improve responsiveness

Leverage cloud technologies to increase transparency and streamline service requests, responses, and oversight

Optimize collection

The spatially-enabled cloud-based mobile solution optimizes real-time deployment of the closest crews to collect waste

Model future efficiencies

Data collection and analysis enable the agency to identify trends and forecast waste management needs

