TRC

Precast Solid Slab and Hollow Core

What is "Precast" generally ?

- Is an object or a material that is cast in its final shape or form.
- There are some advantages and disadvantages of Precast. People find it economically better and less of a hassle to have particular parts of a building already composed.

MuJun Chen, Jin Chen, Walkiria Cabrera

Elements of Precast

Elements

- Slabs
- Beams
- Girders
- Columns
- Wall Panels

BATE stadium in Belarus

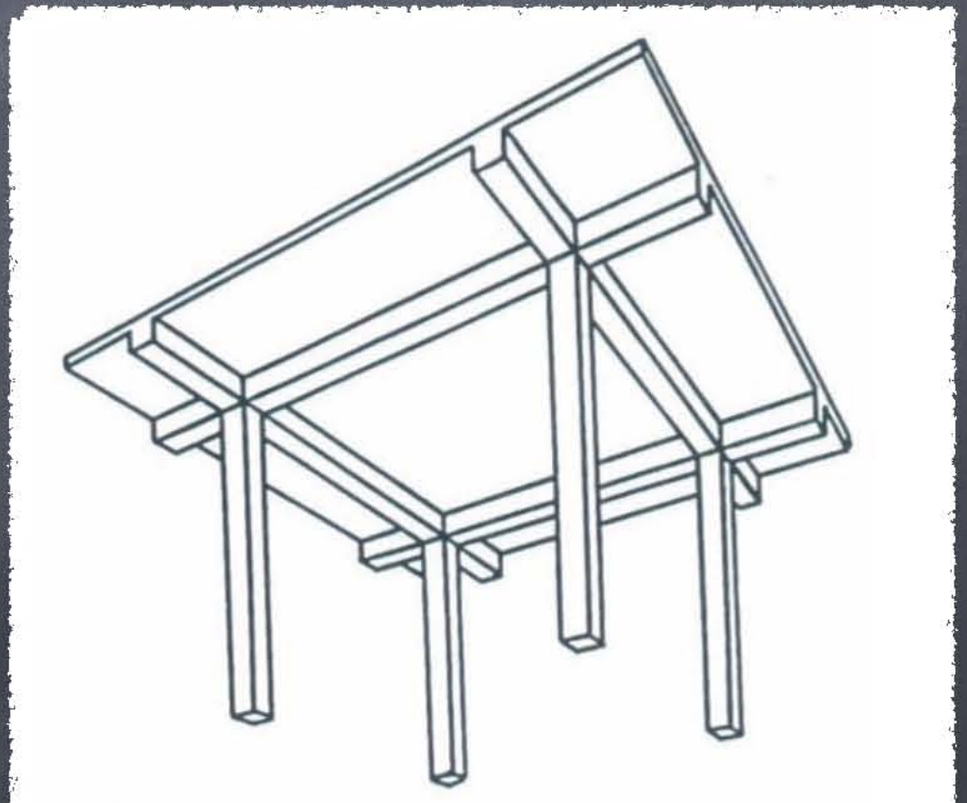
MuJun Chen, Jin Chen, Walkiria Cabrera

Spans for Solid Slab

A solid slab has two ways that help it stay stable, they are bearing walls and beams. Bearing Walls are the least expensive for slabs that are of short spans and light loads. Its popular for apartment buildings and hotels, basically uniform and regular size spacing.

Dimensions

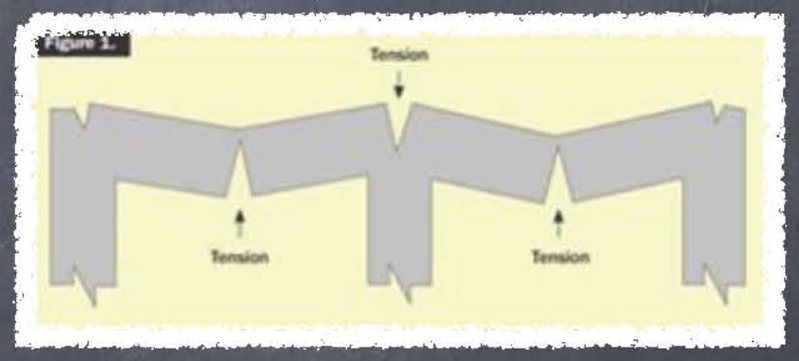
- It can span up to 22'
- Width optimum: 8"-12"
- Span/depth ration: 1/40
- Min. produced depth: 3"
- Max. produced depth: 6"

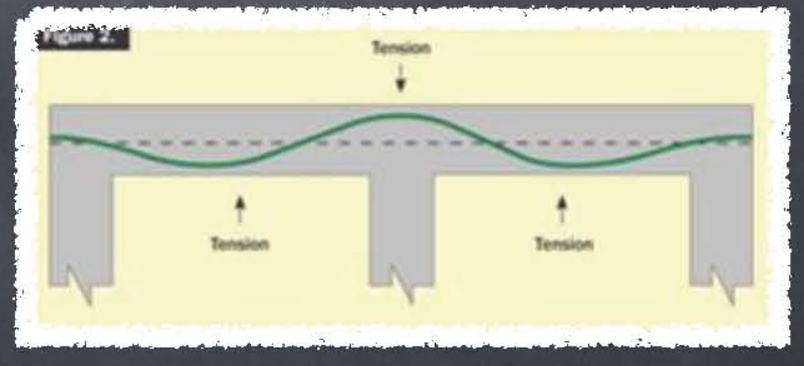


Construction of Solid Slab

The construction of a solid slab doesn't take long particularly. Usually they are used for small spans and they have very simple formwork, easy customizable shapes. The formwork is temporary for the pouring of concrete to create the floor slabs. The reinforcing system for a slab contains a large number of smaller top and bottom bars distributed evenly across the entire width.

The cost of solid slab depends on how long the structure stays up it'll be less expensive and many materials wont need to be used as much.





Flexibility of the System
Diversity of forms Available

- Customized pieces, sizes, and shapes can be created in many cases to meet specific programmatic needs.

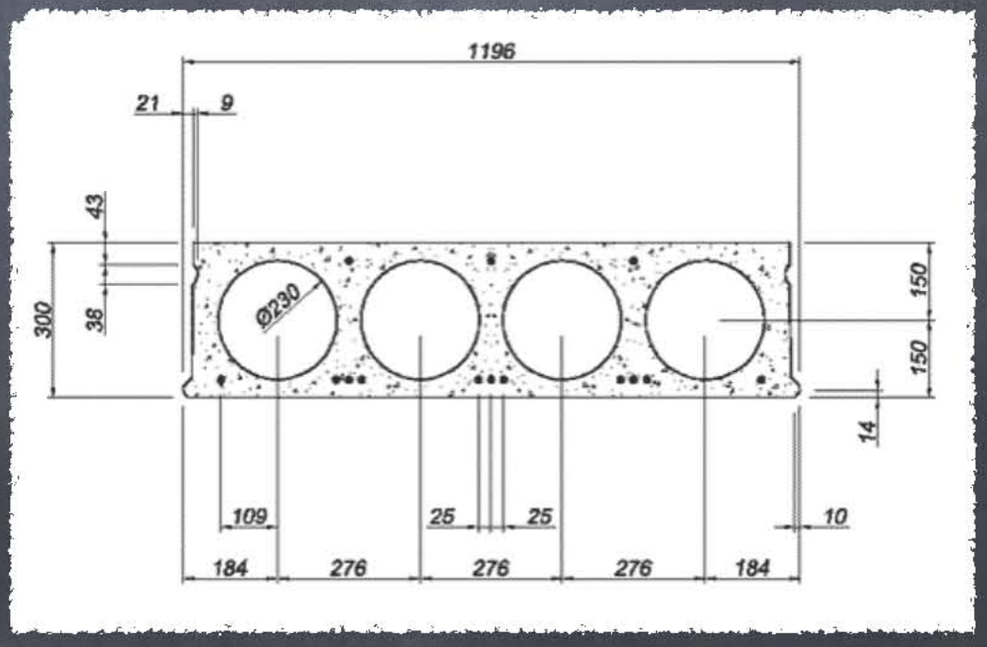
Comparison

Solid Slab

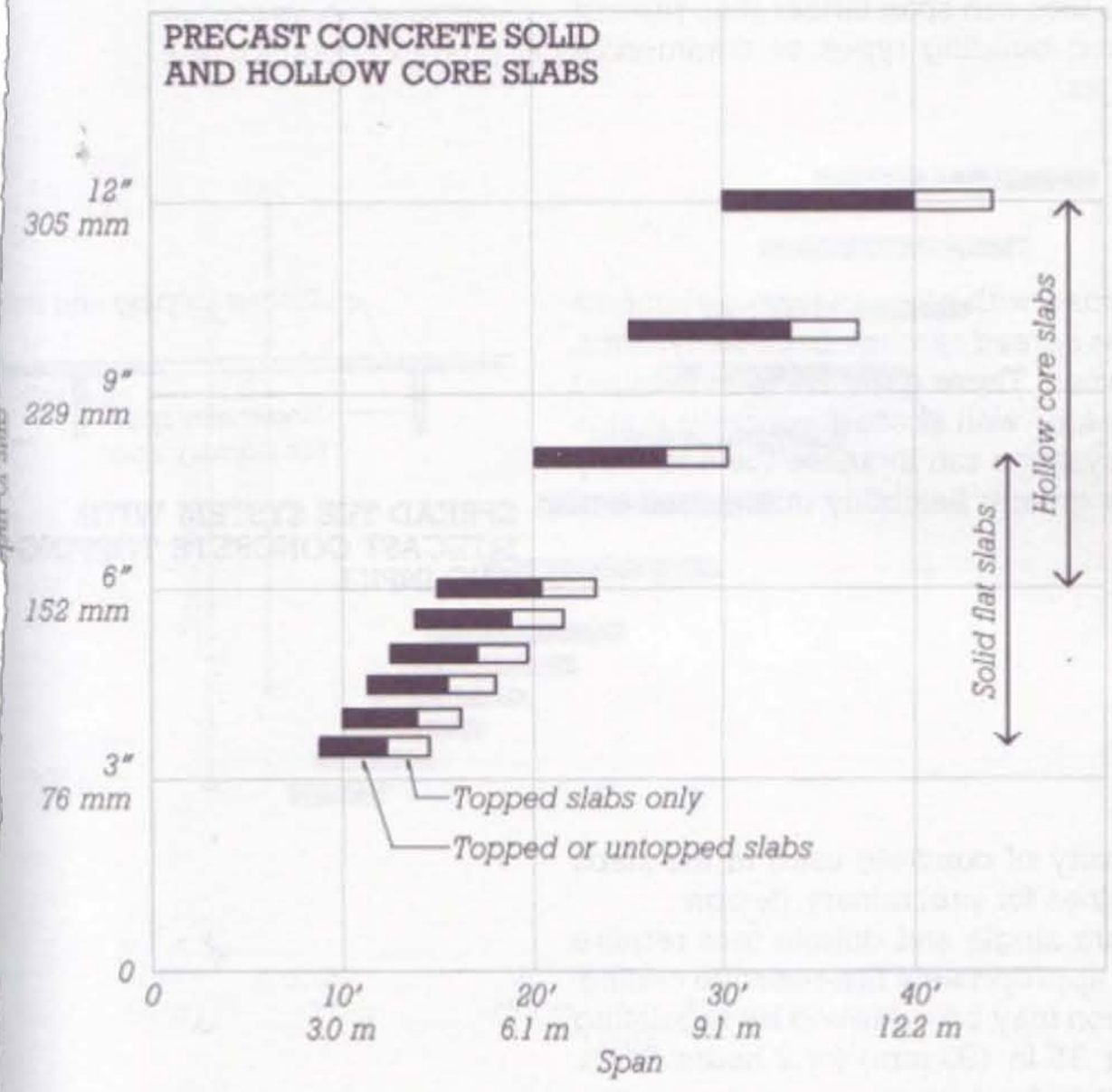
When the depth of a solid slab increases past a point that is standard the extra weight is spread against the spanning member.

Hollow Core Slab

A hollow core slab increases the efficiency of the structure. It is reinforced unlike the solid slab with what we call prestressing strands in both the top and bottom.



Solid slab vs. hollow core slab



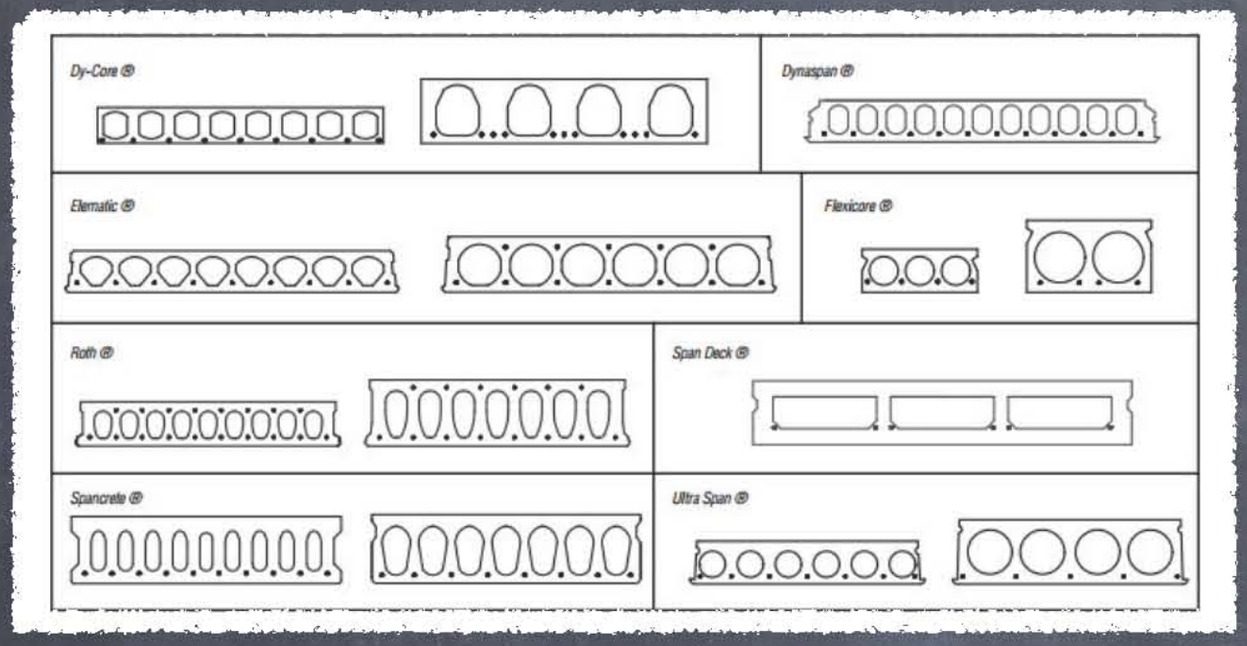
SOLID FLAT SLAB

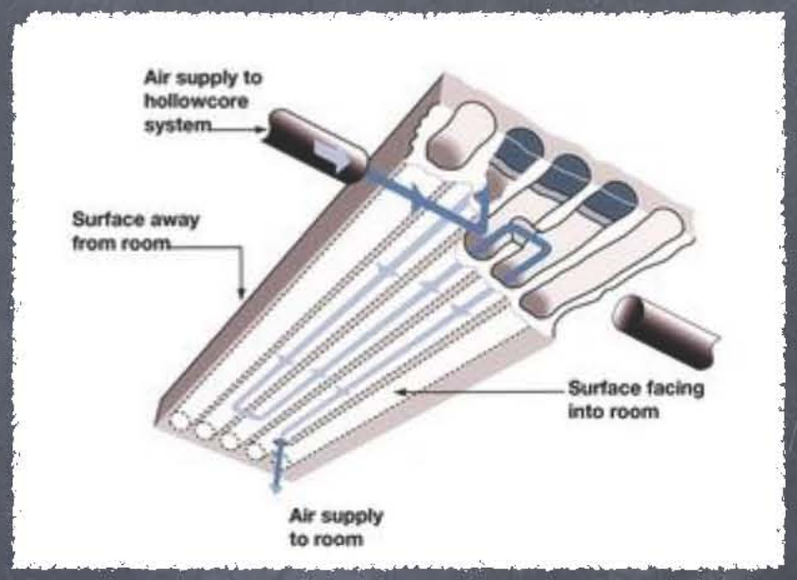
HOLLOW CORE SLAB

This chart is for precast concrete solid flat slabs and hollow core slabs. For light loads, read toward the right in the indicated areas. For heavy loads, read toward the left.

☐ The open areas indicated on the chart are for slabs with an added sitecast concrete topping only. The solid areas are for either topped or untopped slabs. The depths indicated on the chart are for the slabs alone, without any additional topping. Where a topping is used, add 2 in. (50 mm) to the indicated depths for preliminary design. See the facing page for further information on the use of concrete toppings.

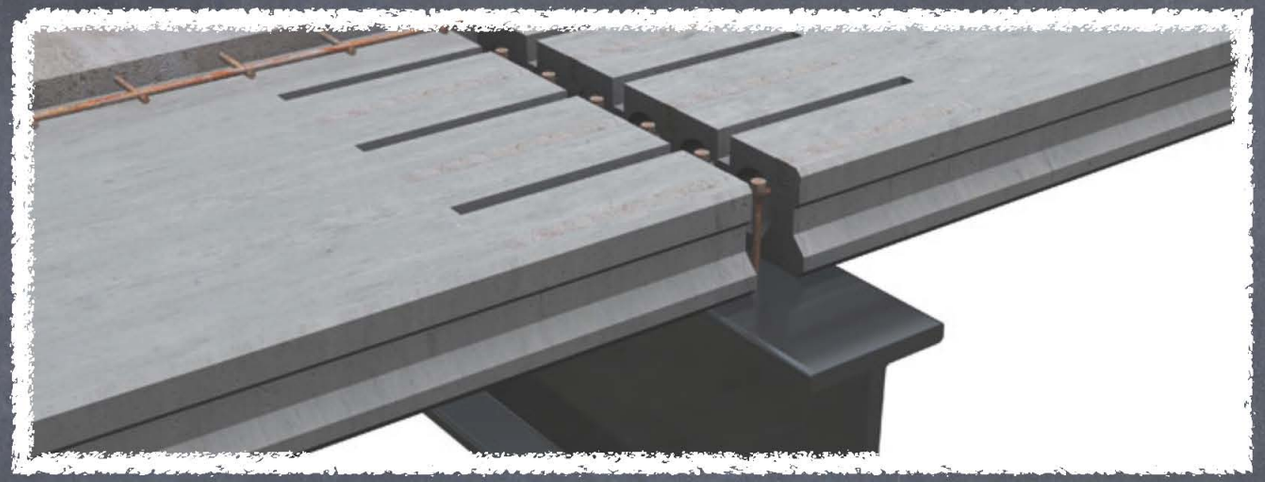
Hollow-Core Slabs





- Hollow-core slabs are used predominantly for floor and roof deck components for various structures including multifamily housing, hotel and condominiums, office buildings, schools, and prisons.

Solid Slabs



Solid slabs are used as structural deck components similar to hollow-core slabs.

They can be made in a long-line pretensioning facility and reinforced with prestressing strand or cast in individual forms with either prestressing strand or conventional reinforcing bars. They are typically cast in the same position as used in the structure.

Sizes can vary to satisfy the structural requirements.

Sizes, depth, and span

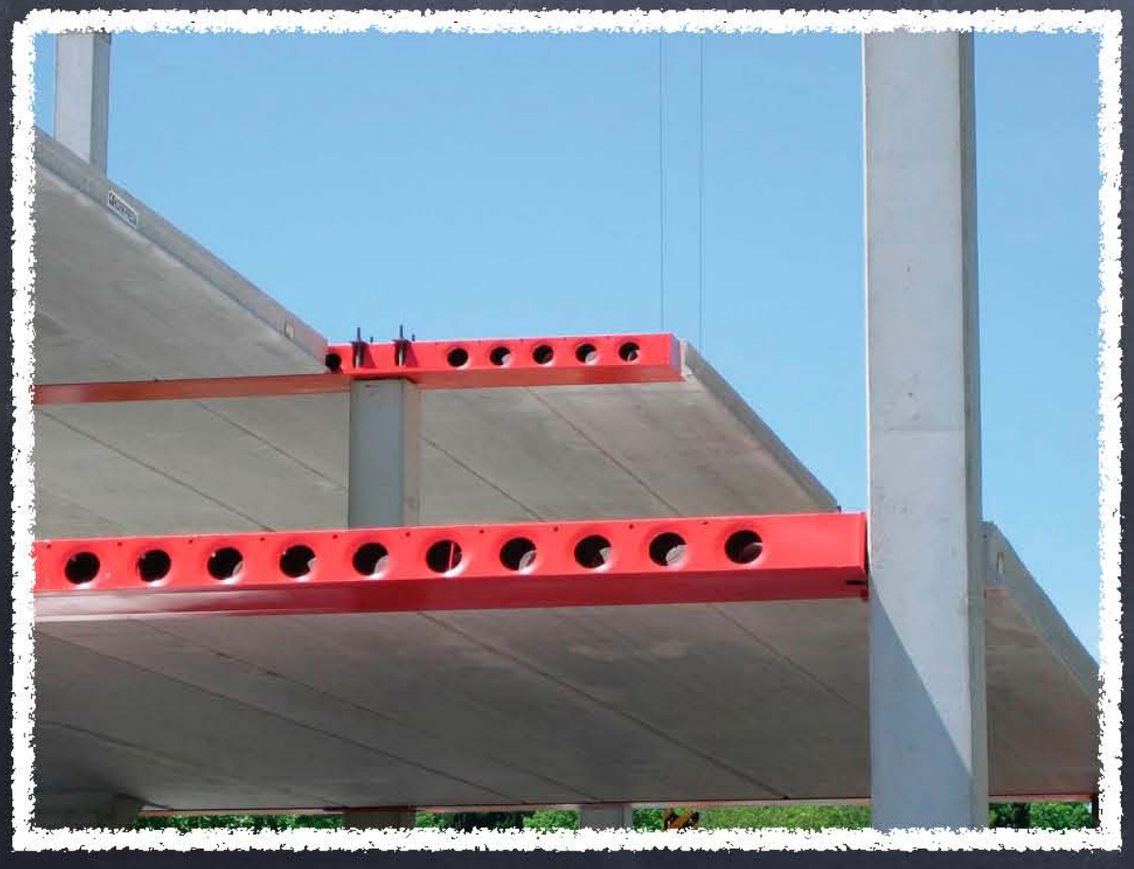
Span maximum: 45'

Widths: 2'-0", 3'-4", 4'-0", 8'-0"

Span/depth ration: 1/40

Minimum produced depth: 6"

Maximum produced depth:12"



Hollow-core plank. Photo: Molin Concrete Products Co

Construction time and Cost

For Hollow core the time of production of Hollow core is in roughly 24 hours. It is very simple to produce this slab because the same materials, workforce, and energy is being used. It is completely automated.

The Cost per square foot topped is $7.31, and the cost per square foot untapped is $5.28.

Finishes available

There is an abundance of finishes for architectural precast concrete, giving the designer a side choice. The process in adding a finishing to a precast slab of solid slab and hollow core is

- Prior to casting
- Before hardening
- After hardening

Prior to Casting

1. Smooth finishes

This process is simply used by nonporous form such as fiberglass, steel, sealed plywood, overlaid plywood, or sealed concrete.

2. Textured finishes

Liners such as rubber matting, textured fiberglass form, rough sawn wood, or anything that appears textured or patterned.

3. Special finishes

Other than a concrete finish you can also finish with ceramic tile, marble, granite, brick, or cobbles. They may be placed to complete the finish or they may be spaced so the mortar joint is formed between them.

Before Hardening

1. Chemical retardation

Retarders are applied to those surfaces of the forms which correspond to the panel faces for aggregate exposure. Upon placing the concrete in the forms, the retarders inhibit and slow down the chemical process involved in concrete hardening. The retarded cement paste is then removed by jetting with water and/or brushing. The degree of etching can result in any one of three textured surfaces: a) Light etch b) Medium etch c) heavy etch

2. Treatment of exposed face

Applied to the surfaces of the exposed face of the precast unit while it Is still in the plastic state. Such techniques consist of Booming, stippling, or using a roller with a textured surface to impart the desired texture on the exposed face.

After Hardening

1. Acid etching

Light + medium etching, may be achieved by brushing the units with acid or dipping in an acid bath.

2. Abrasive blasting

Light, medium, and heavy exposure of aggregates may be obtained by blasting the units with sand or an abrasive aggregate. Best possible appearance of a finish is by Gap grading, which is mixing results in a uniform size distribution of the exposed coarse aggregate. Abrasive blasting may sometimes result in a dulling of the aggregate, including the loss of sharp edges.

3. Bush hammering

This process is mechanically or hand-operated hammers remove the skin or hardened cement paste from the surface of the concrete.

4. Honing or polishing

The faces of exposed units are ground to the desired appearance by mechanical abraders, starting with a coarse grit and ultimately finishing with a fine grit.

Strengths and Weakness

Strength: High strength, high density quality controlled precast concrete is superior to the other building products for durability, corrosion, impact resistance, fire resistance, security and long lasting low maintenance.

Weaknesses: Handling and transporting. Concrete construction is usually-precast elements included. Precast units are often of considerable size, and the combination presents a major problem of handling and transporting the heavy and relatively fragile units. Stresses induced during handling and erecting units may be significant structural design concerns. Use of factory-cast units is usually feasible only within some reasonable distance from the factory.

Connection Detail

Design Considerations:

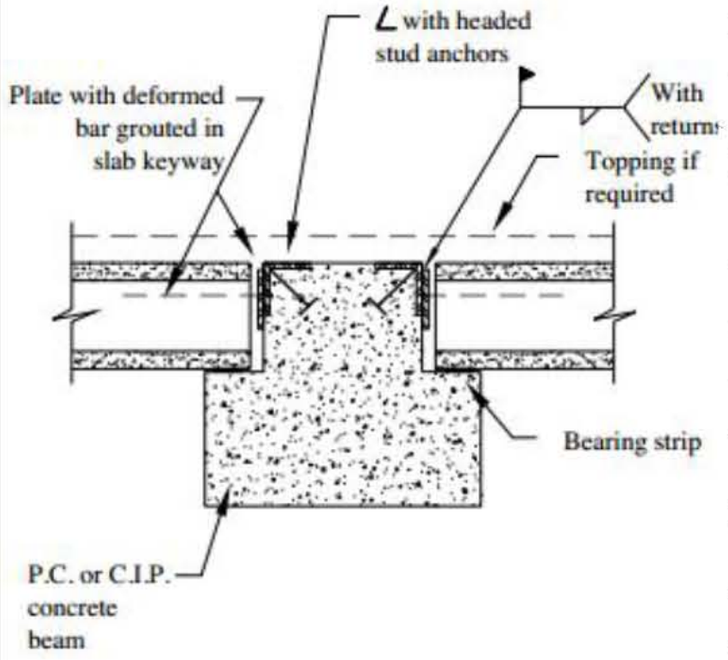
- Can transfer internal diaphragm forces
- Can be designed as structural integrity tie

Fabrication Considerations:

- Advantageous to have no hardware in slab
- Beam embedments must line up with slab joints
- Accommodates variations in slab length

Erection Considerations:

- Advantageous to have connection completed by follow-up crew
- Difficult for welder to hold loose plate in position



Design Considerations:

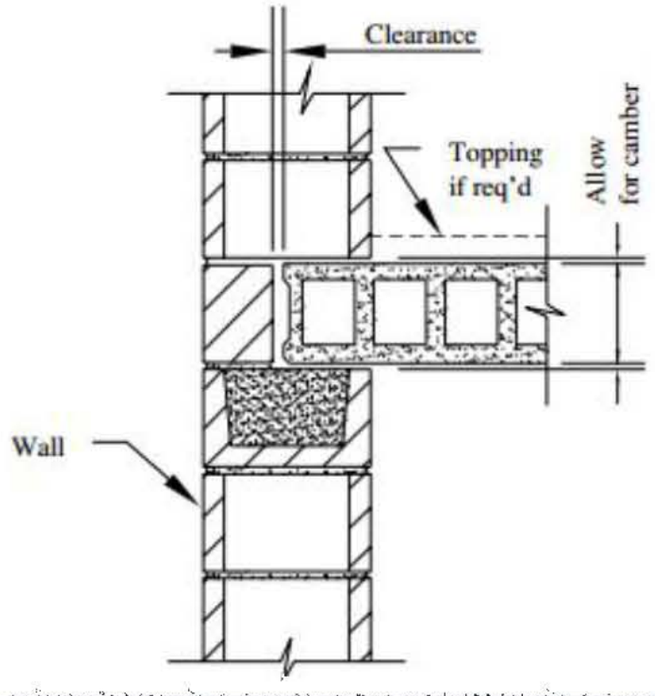
- Walls may not be laterally braced
- Consideration should be given to forces developed from deflections or camber growth
- Drypack may be required under slab for axial load transfer

Fabrication Considerations:

- Clean and simple

Erection Considerations:

- Allowance must be made for slab camber
- Wall will not be laterally braced at this level
- Small tolerance in slab layout



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Connection Detail

Design Considerations:

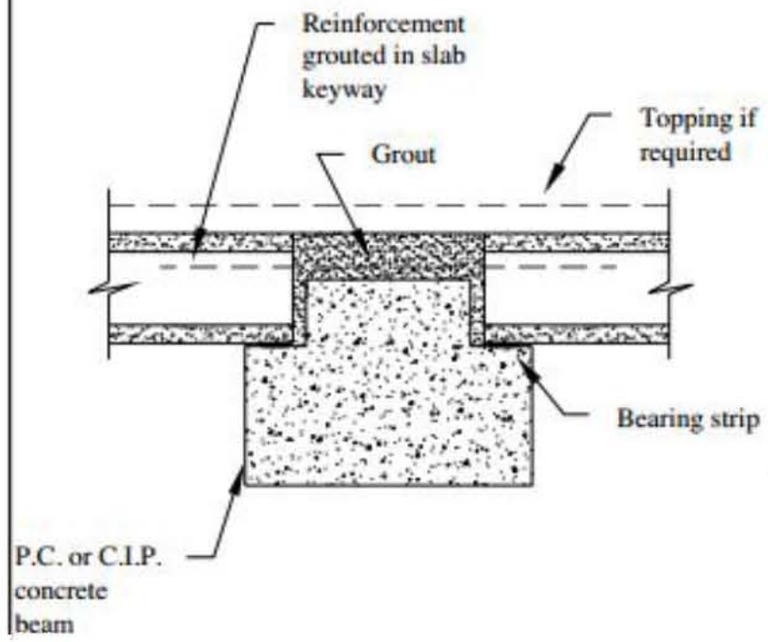
- Can transfer internal diaphragm forces
- Can be designed as structural integrity tie

Fabrication Considerations:

- May increase beam reinforcement for shallower beam
- Layout must have opposing slab joints lined up

Erection Considerations:

- Clean and simple



Design Considerations:

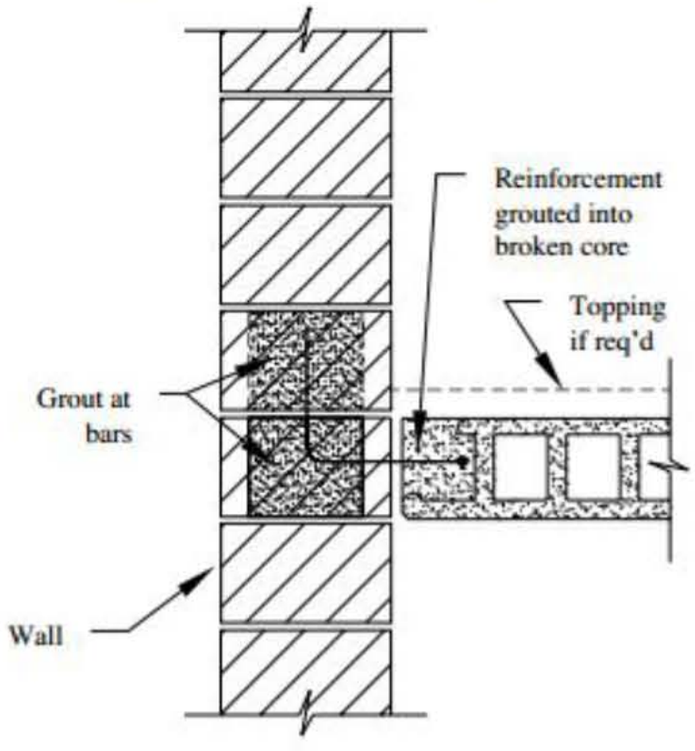
- Can transfer diaphragm shear
- Can provide lateral brace for wall
- Consideration should be given to forces developed from deflections or camber growth

Fabrication Considerations:

- If not done in field, edge core must be cut open
- In stack casting operation, holes might not be practically cut in plant

Erection Considerations:

- If not done in plant, holes must be field cut into edge core
- Mason may have to cut block to install reinforcement



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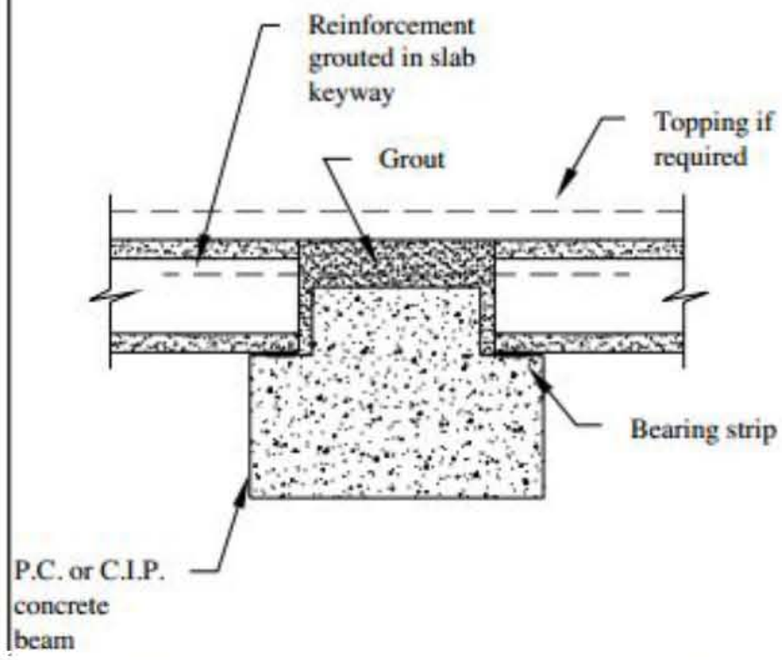


Design Considerations:

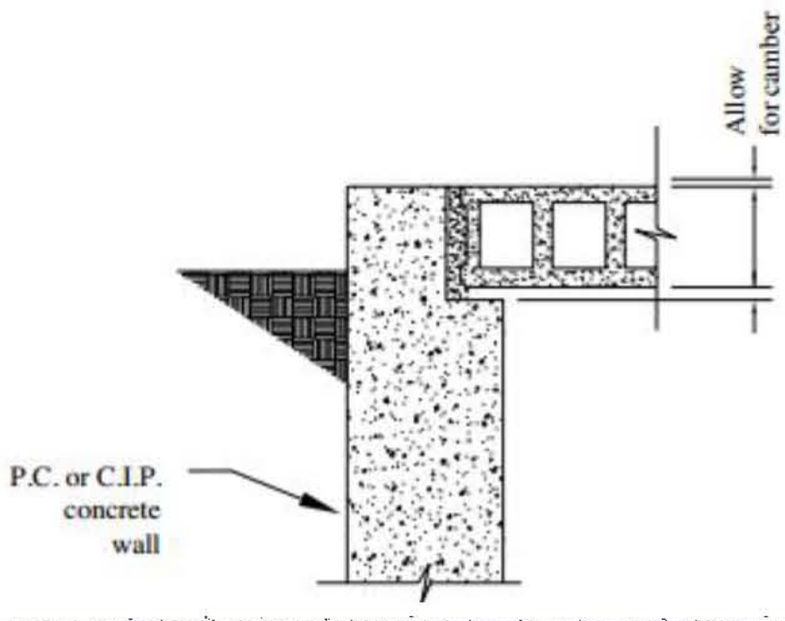
- Wall thrust from earth pressure can be resisted
- Can transfer diaphragm shear only with special detailing of keyway and reinforcement
- For long spans consider effects of restraint of vertical movement

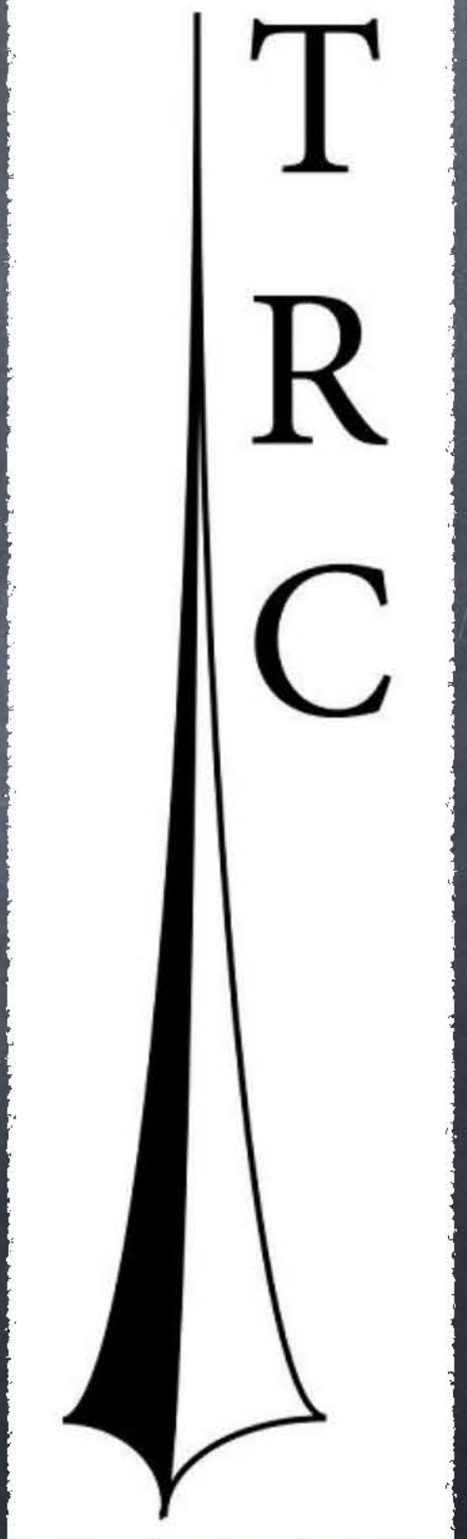
Fabrication Considerations:

- Clean and simple

Erection Considerations:

- Edge joint must be grouted which may not be standard practice





Connection Detail

Design Considerations:

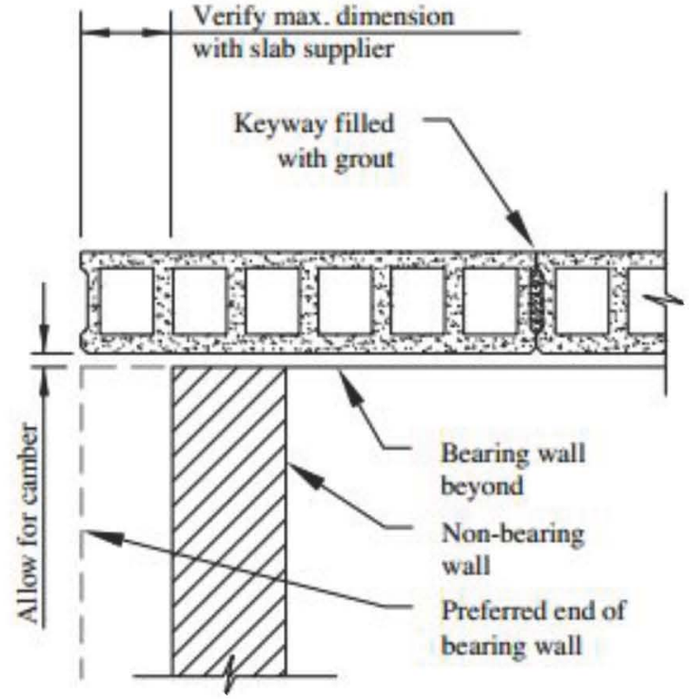
- Wall will not be braced by slabs
- Depending on end support conditions wall may have to support edge slab
- No thermal break provided between interior and exterior

Fabrication Considerations:

- Depending on bearing conditions the overhang dimension may be limited by the producer's ability to install transverse reinforcement

Erection Considerations:

- None



Design Considerations:

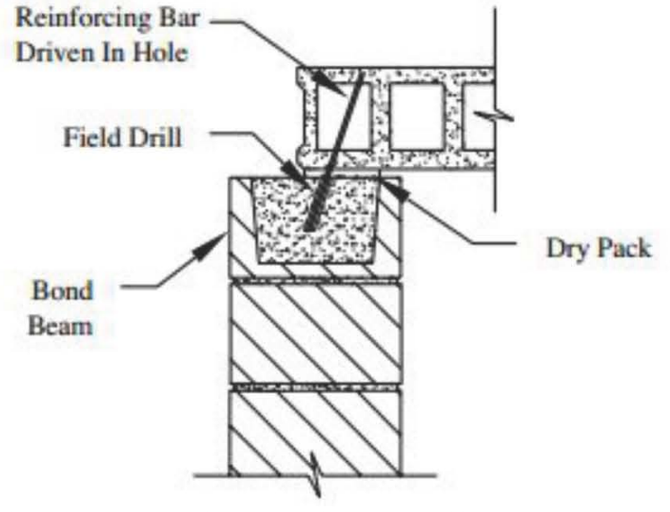
- Can transfer diaphragm shear
- Can provide lateral brace for wall
- Consider effects of vertical restraint
- Connection capacity must be verified by test

Fabrication Considerations:

- Clean and simple

Erection Considerations:

- Minimum edge distances must be maintained
- No interfacing tolerances



Source

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