Why precast concrete ?

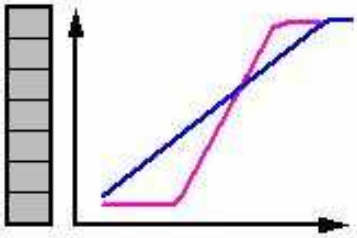
Precast concrete shares all the good qualities of in-situ concrete including:

- the ability to be formed to any shape
- inherent durability
- inherent fire resistance

Because precast concrete can be cast at ground level in factory conditions, it has these added features:

better finishes

no space needed on site for storing moulds and reinforcement



faster erection

Any shape

Concrete can be placed as a fluid, so it can take any shape:

from simple rectangles

to other shapes

which are more structurally efficient than rectangles.

Long span bridge deck

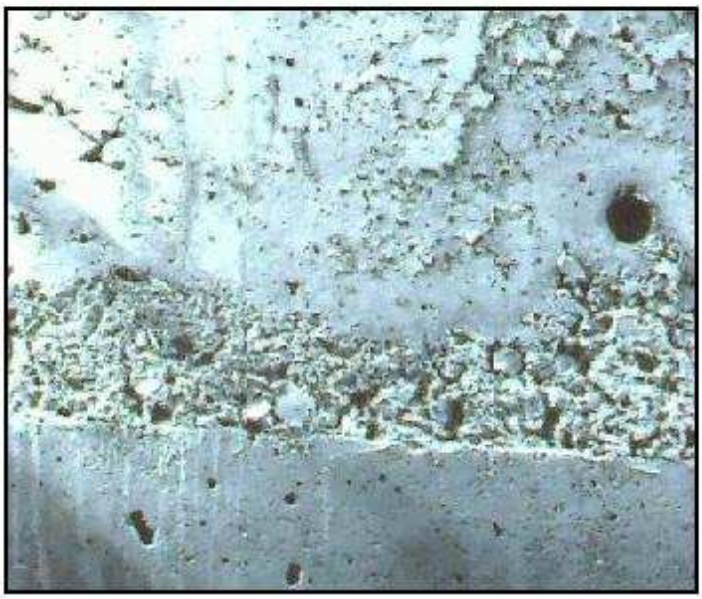
For example -

- long span bridge decks, which are large and complicated to design.

Better finishes

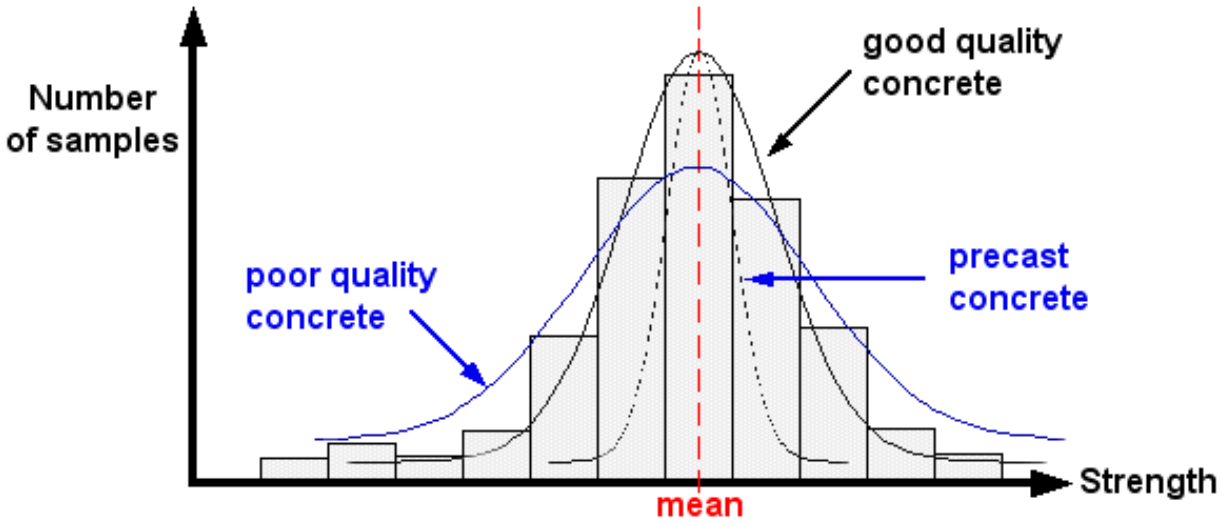
Better finishes can be obtained with precast concrete because the inside surface of the mould is kept in good condition.

There is no grout loss, such as that from badly fitting formwork, which results in poor quality concrete like this:



By careful selection of materials and finishing processes, a wide range of high quality finishes can be obtained.

Quality controle



A histogram plot of the compressive strength test results would look like:

This can be shown as a normal distribution curve.

If the quality control is poor, the margin increases.

If the quality control improves, the margin decreases.

With precast concrete, the margin is usually about 2 N/mm^2 or 5% of the mean.

The customer gets -

- a more consistent product
- a more economical product
- more reliability and confidence

Added feature – limitation of site space

No space is needed on site for storing moulds and reinforcement

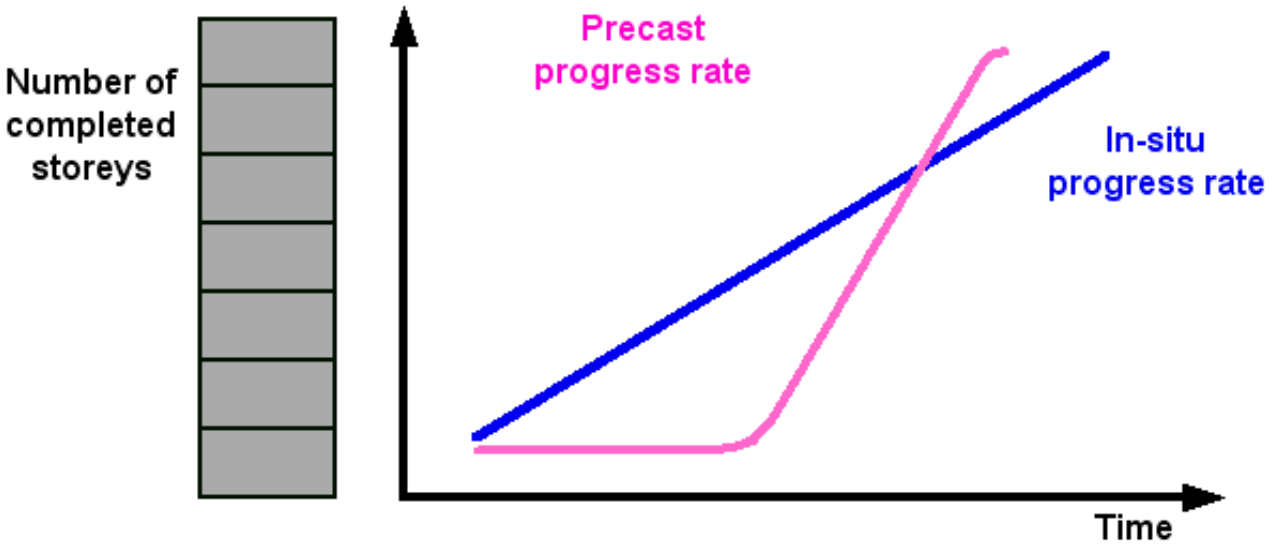
Precast components are made in a factory and delivered to site where they are lifted straight off the lorry onto the building.


Moving into position


Unloading straight onto building


Final placing

Faster erection



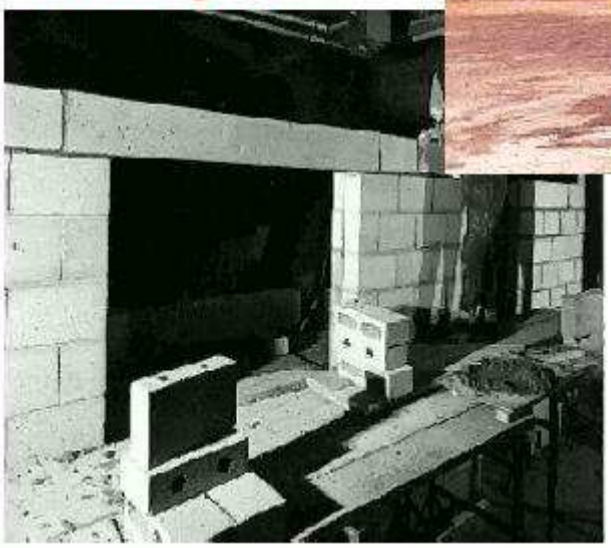
Components are erected straight from the delivery lorry. This leads to faster erection, where the difference between in-situ and precast construction is as follows:

For precast concrete there are large amounts of off-site prefabrication giving longer lead times before site construction begins.

However, once site construction begins, the progress is extremely rapid.

Wide variety of applications

...from small, simple building products, such as lintels or purlins, weighing several kilograms.....

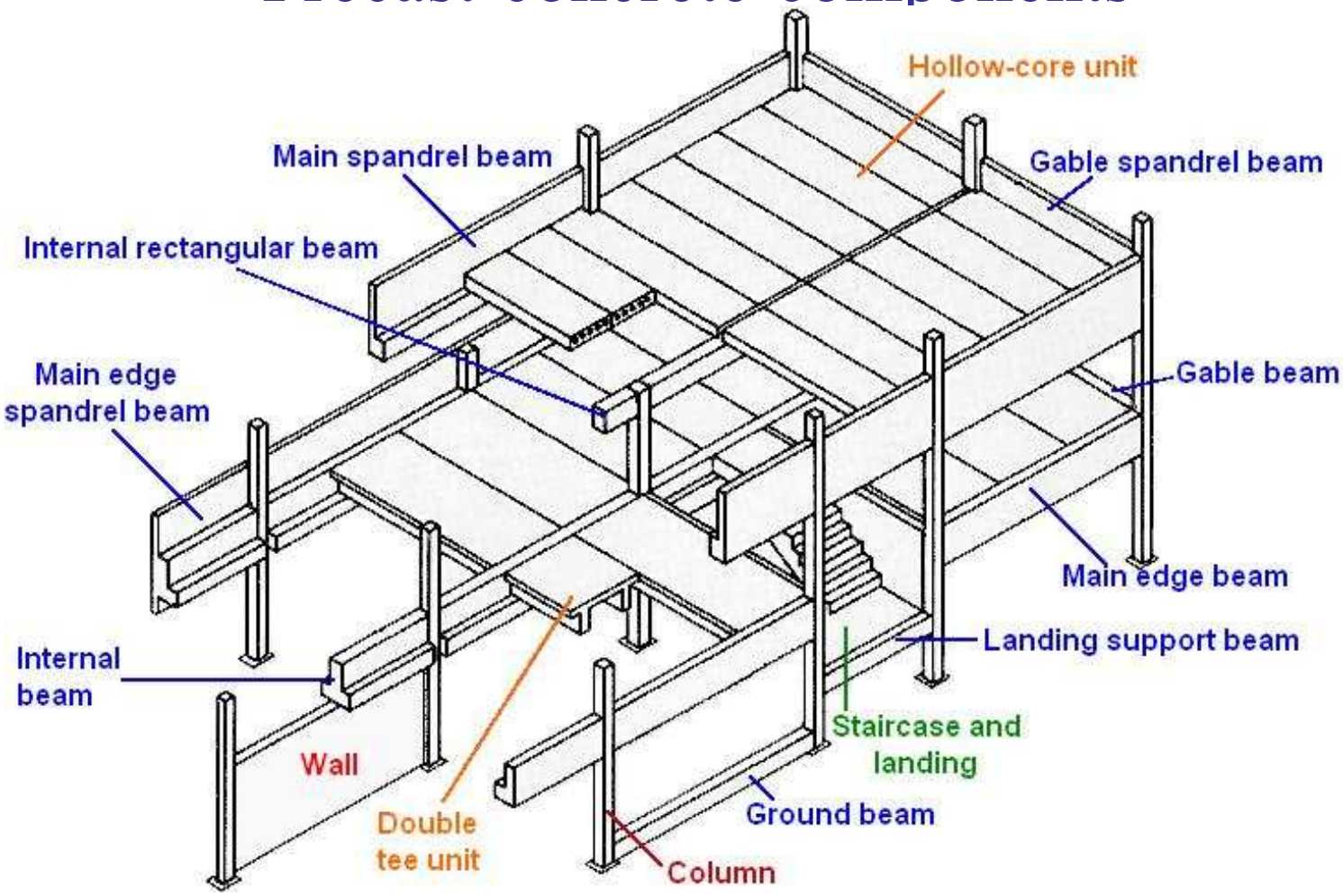


... to medium size civil engineering products such as retaining walls ...

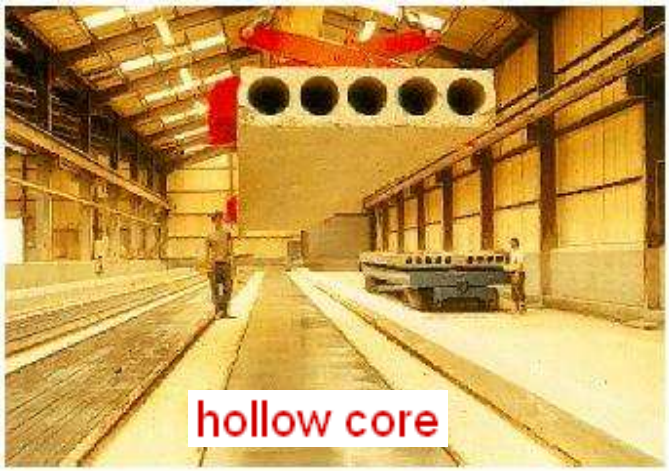
... and large products, weighing several tonnes, such as drainage culverts.

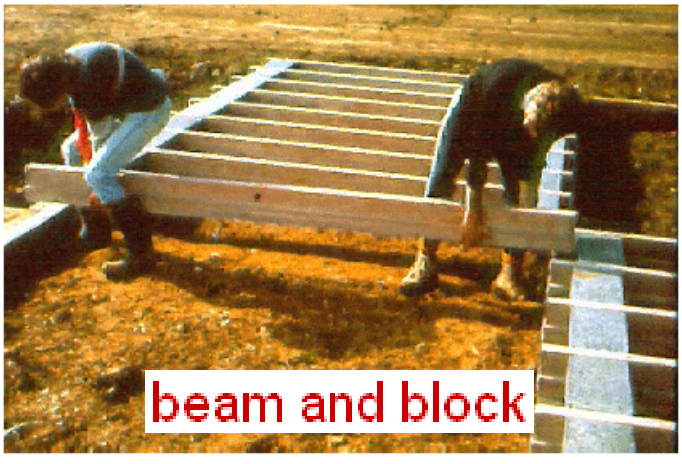
Design complexity and size

Precast concrete components

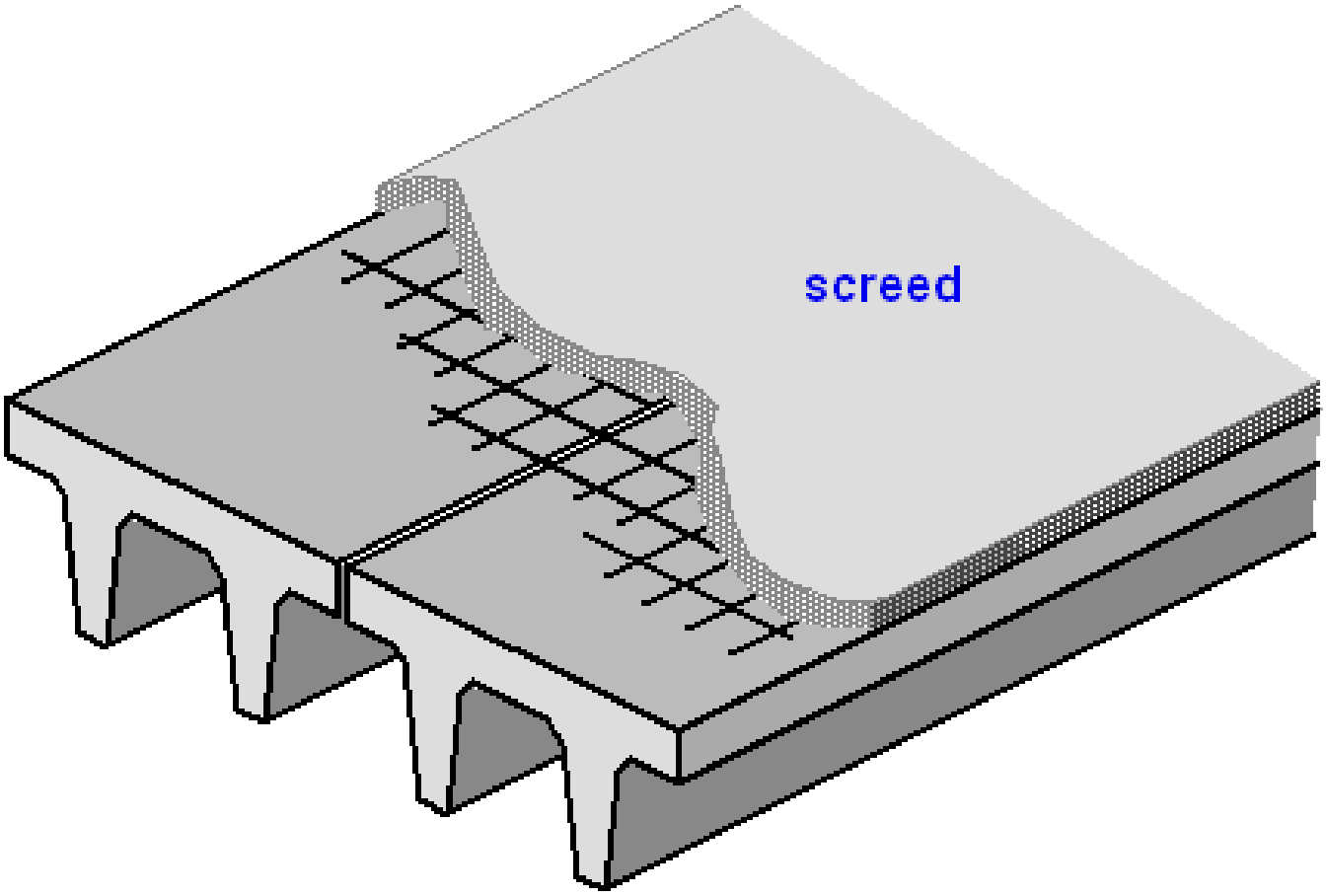


Roof and floor slabs

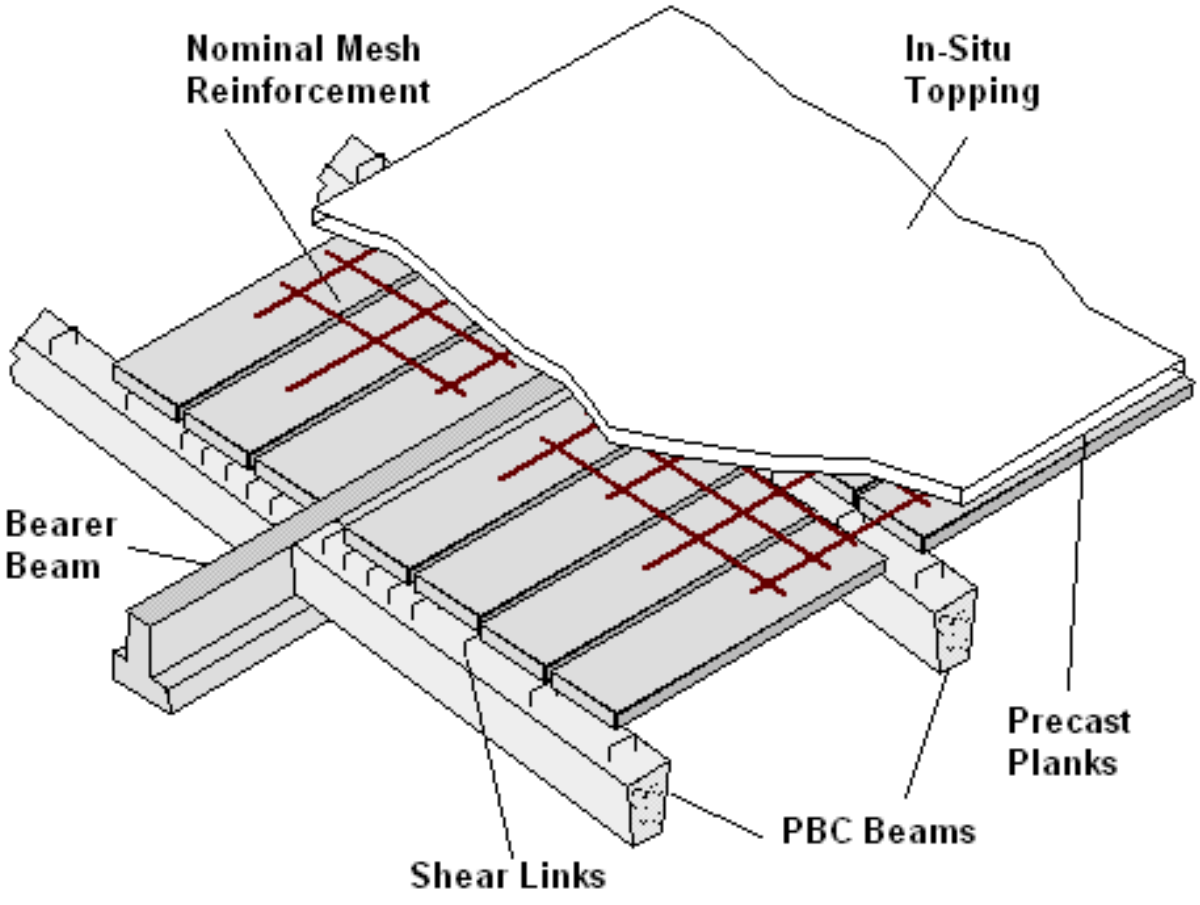




Double tee slab



Precast beam and plank flooring



Precast beams and plank flooring

The triangulated lattice girders

The lattices provide four important functions:-

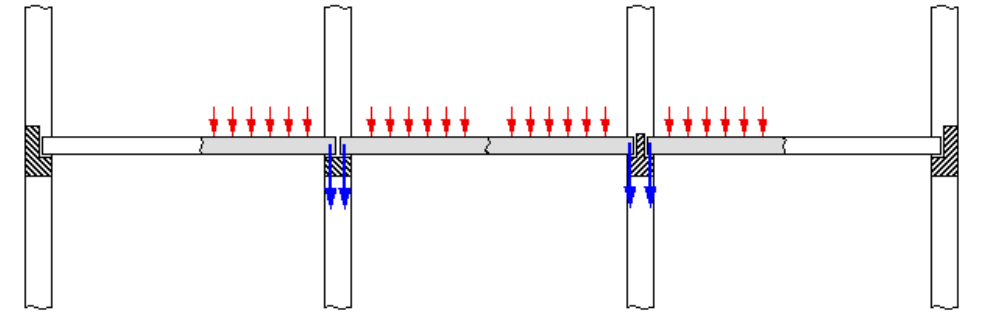
ensures mechanical bond between the precast and in-situ concrete,
provides the precast plank with vertical stiffness in the temporary condition,
the lower bars provide the flexural reinforcement,
the lattice makes a convenient lifting point.

Beams

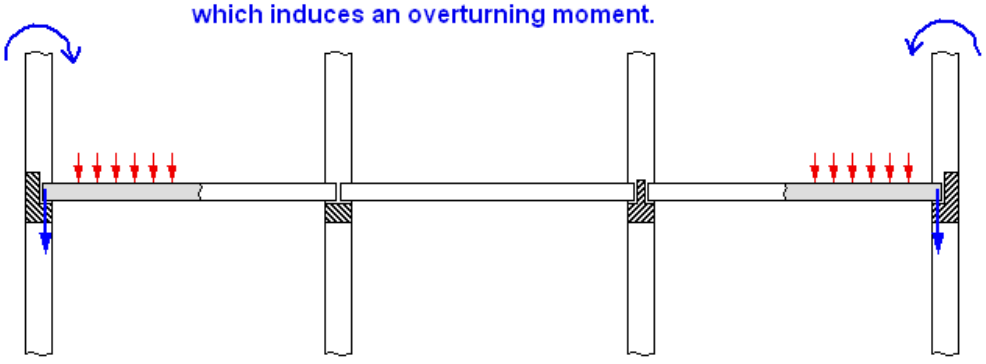
Beams may be classified either as :-

'internal', where floor loading is approximately symmetrical

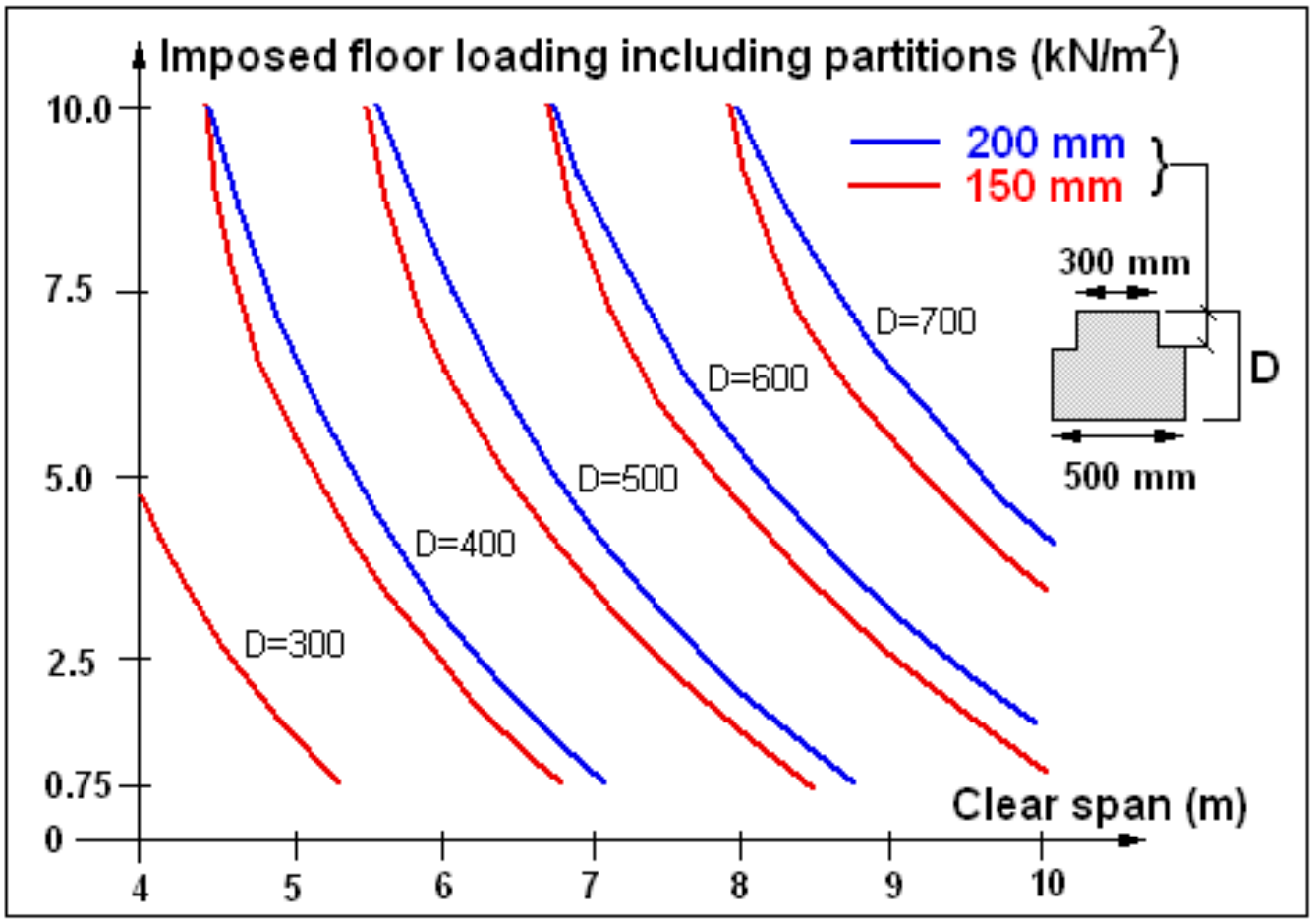
'external', where floor loading is predominantly non-symmetrical



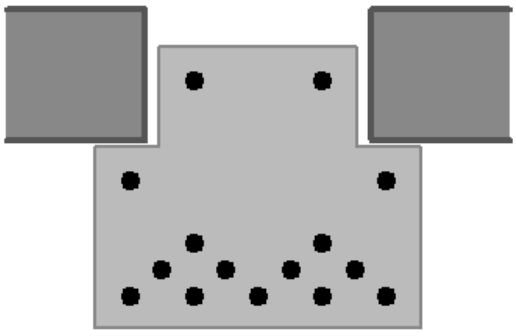
The loading on the external columns is eccentric, which induces an overturning moment.



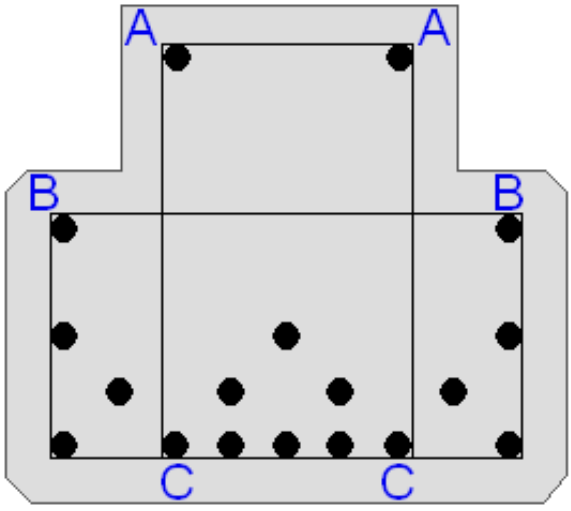
Design chart



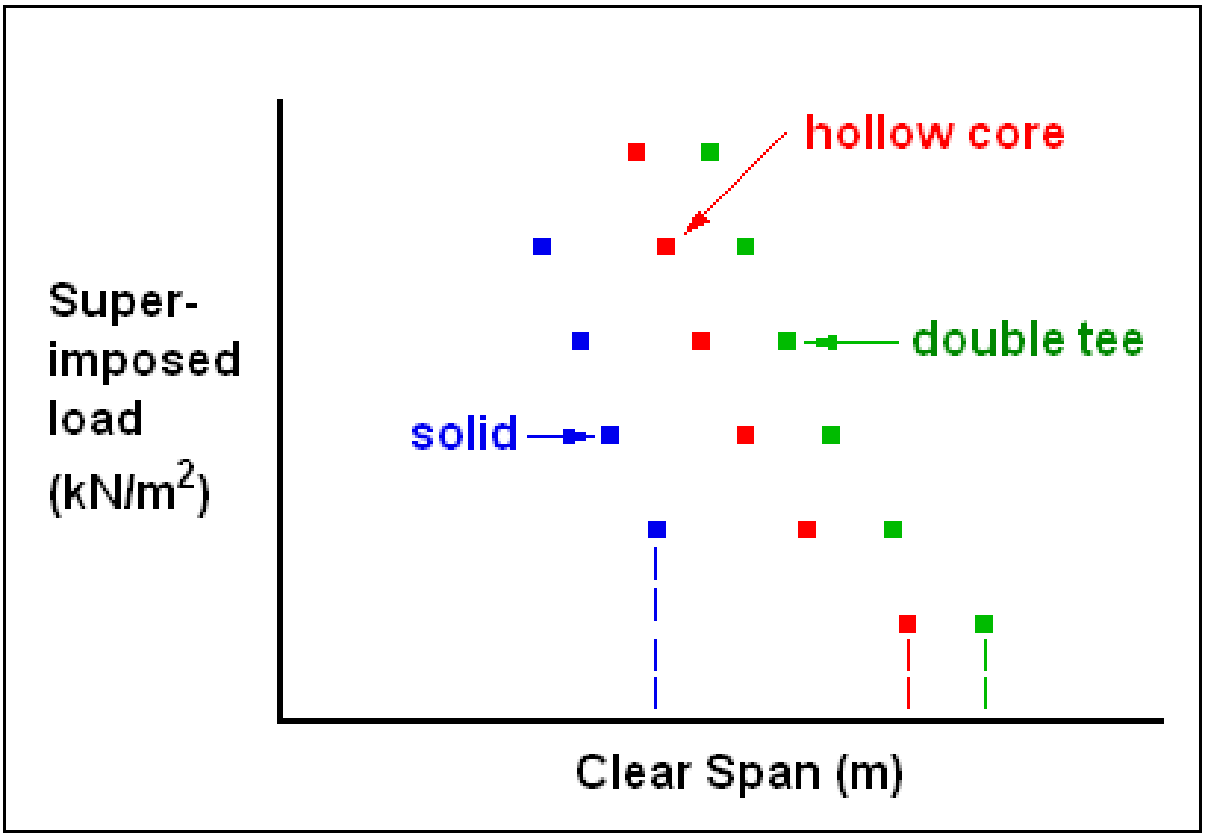
Prestressed beam



- 2 strands at A to prevent the top splitting;
- 2 strands at B to protect the corner bearing point;
- 2 strands at C to carry the links;
- and the remainder to achieve the desired eccentricity of prestress.

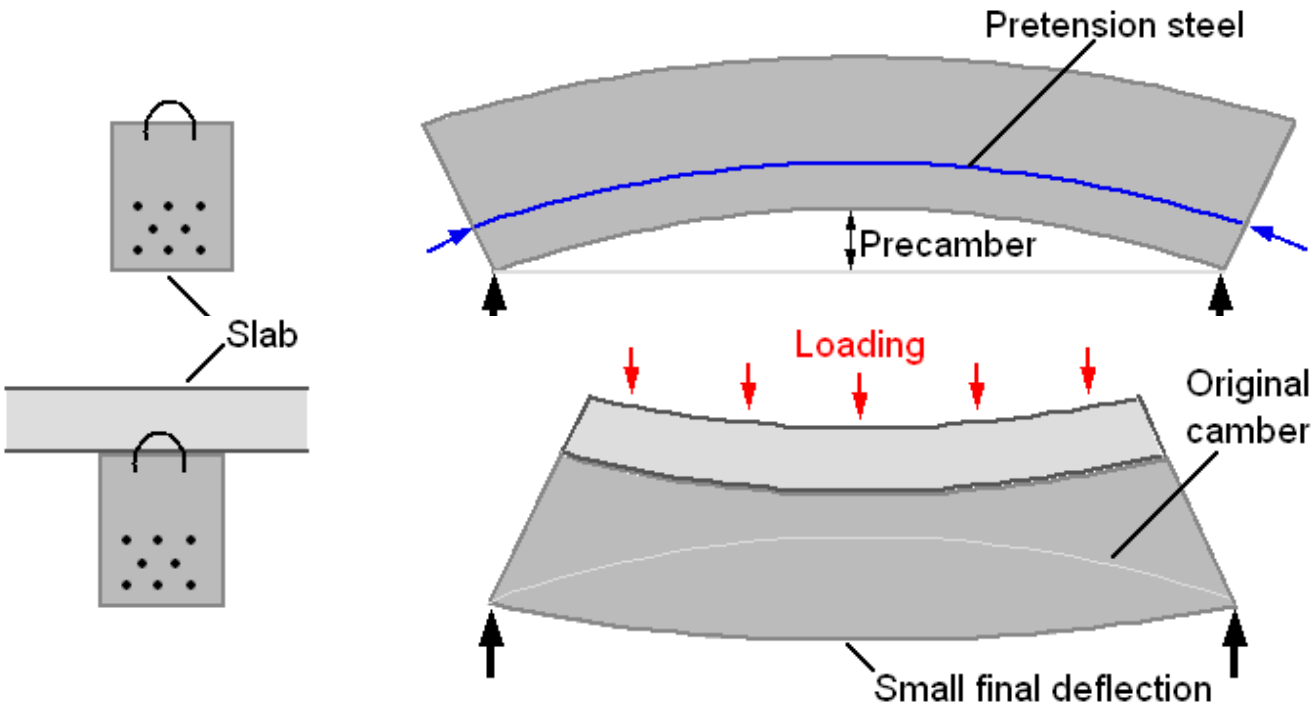


Load - span



Precast beam

- the beam may be pretensioned at the factory;
- the beam may act compositely with the floor slab;
- upward precamber (due to prestress) offsets imposed deflections.

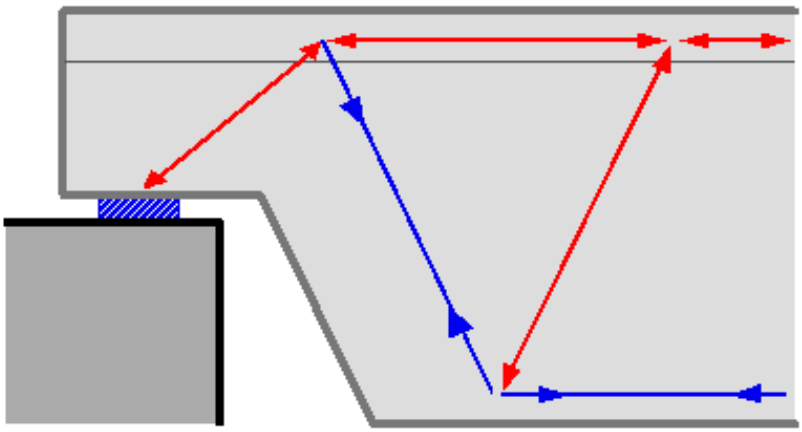


Truss analogy

A truss analysis is used:-

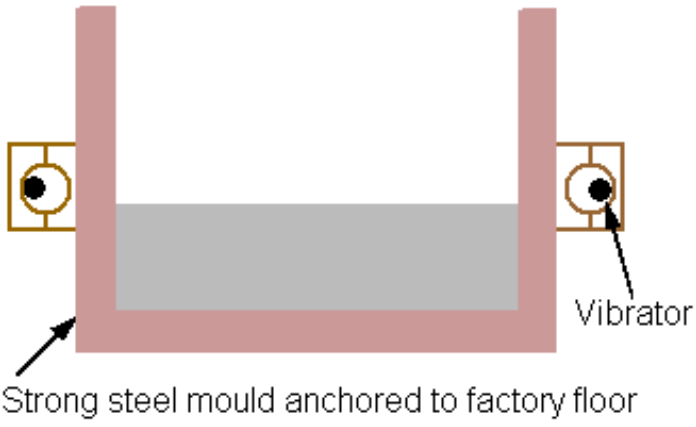
Tension provided by bars

Compression by confined concrete

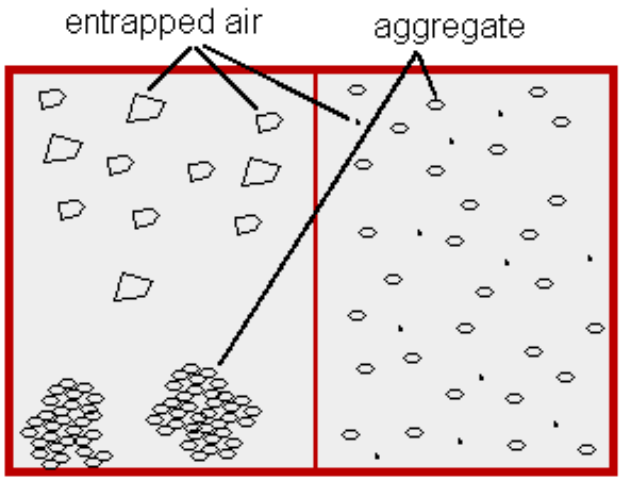


Durability

Concrete is inherently durable, providing it is produced from a correctly specified mix appropriate for its location and is fully compacted - which is achieved by controlled compaction.



Controlled Vibration

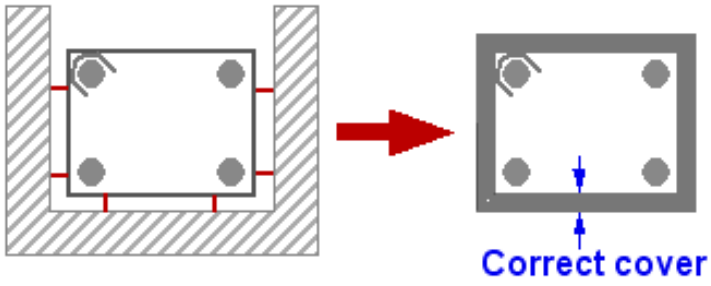


Random vibration results in variable compaction, can lead to segregation of the aggregate, entrapment of unwanted air, reduced durability and loss of strength. Controlled vibration ensures uniform compaction and assists in maximising strength and durability.

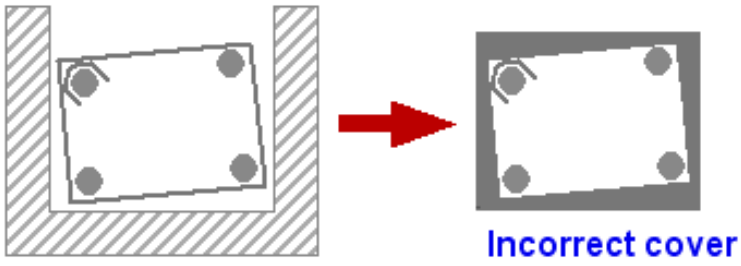
Fire resistance

Concrete is inherently fire resistant as concrete acts as an insulator, protecting the steel connections and reinforcement from excessive heat.

By precasting, the reinforcement can be accurately positioned in the mould to give the correct cover protection, thereby ensuring durability and maintaining its fire performance.



Without control, the steel may lack adequate cover, reducing durability and lowering protection in the event of fire.



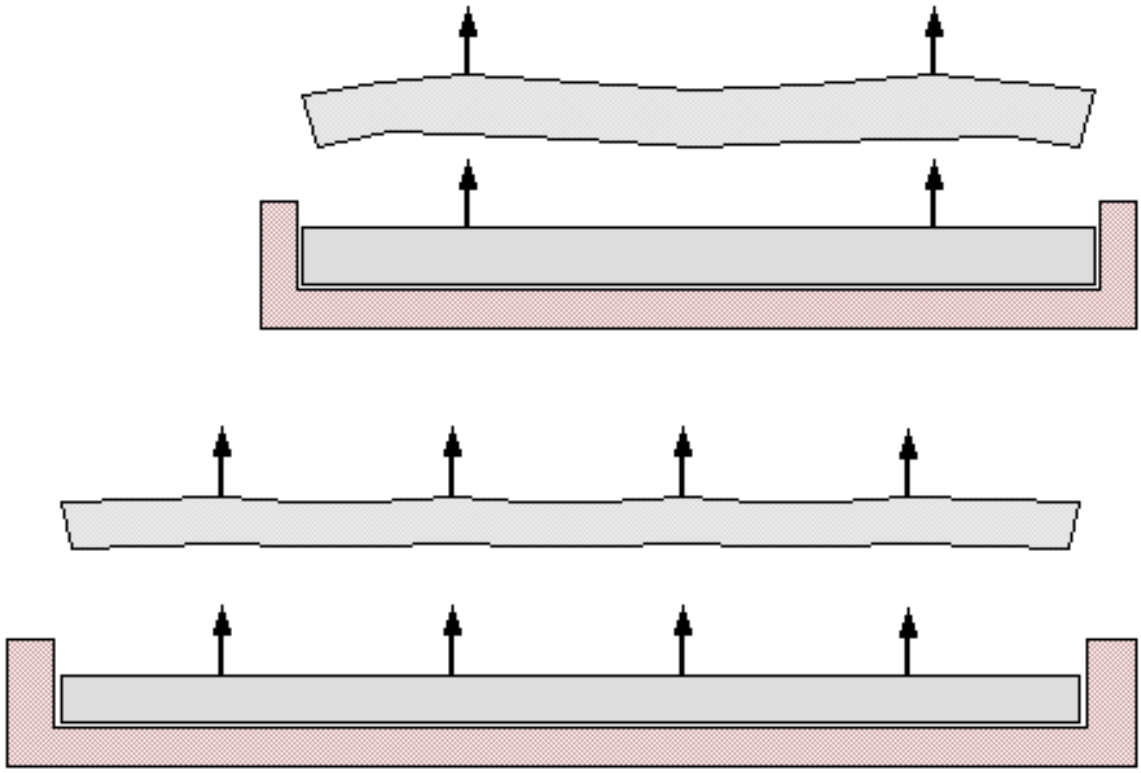
Columns

High quality visual concrete in columns has only recently been fully exploited.

Although the increase in cost in using visual concrete compared with plain concrete is between 50% and 200%, depending on the complexity of the finish, a net saving is often made.

Lifting the column

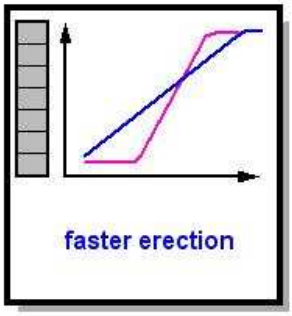
When lifting the column from its mould and when pitching the column to the vertical on site, the column behaves like a very long, thin "beam".



Exam questions: Why precast ?

better finishes

no space needed on site for storing moulds and reinforcement



faster erection

- The good qualities of concrete.
- The added advantages of precast concrete, such as quality control.
- The wide range of uses of precast concrete, from small, structurally simple components such as lintels, to large, complex structures such as bridges.
- An introduction to the structural uses of precast concrete construction such as flooring, frames and cladding.

Robustness – structural integrity

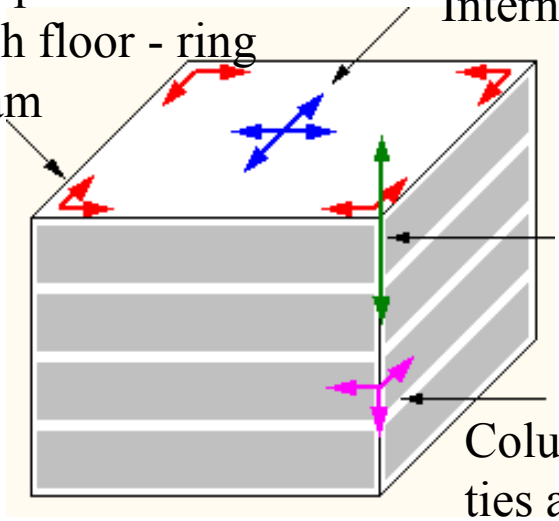
Structures should be designed in such a way that they exhibit robustness to the effect of impact or explosion.

Ronan point 1967 – explosen on the 20th storey

The measures – bonds, ties

Peripheral ties at each floor - ring beam

Internal ties



Continuous vertical ties In columns and walls

Columns and wall ties anchored into structure at each floor