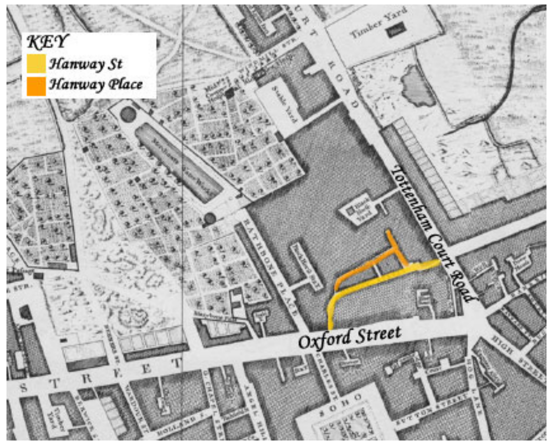
Elizabeth Low
TS TERM 2, 2015 - MATERIALS

Hanway Street Construction Site
[26-48 Oxford Street, London, W1C 2DZ]

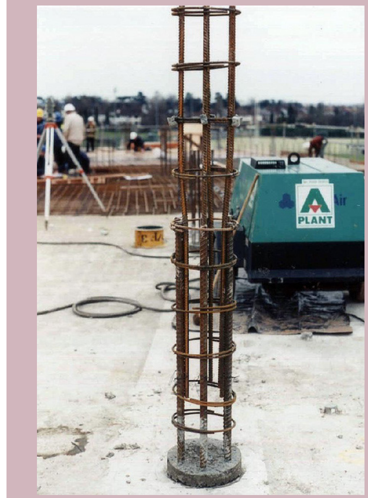
The existing uses on the site are a mix of shops, a bank, restaurant/bar, offices and a private language school. The application proposes the retention and alteration of the listed buildings on the site and the retention of the most attractive facades on Oxford Street and Hanway Street around which would be constructed a new development providing shopping at basement, ground and first floor levels and 18 residential flats on the upper floors.

Client: Oriana GP Ltd
Architect: ESA

Proposed visuals



Site plan



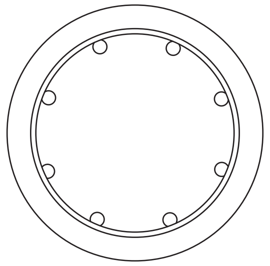
MATERIAL STUDY:
Reinforced concrete column

Concrete column design is highly complex with a large number of variables making it impractical to design by hand calculation; so most design is done through the use tables or a computer-aided procedure to determine the dimensions and reinforcing. The provisions relating to the design of columns in the ACI Code are different from those of the working stress method. The current code does not permit design of columns by the working stress method, but it requires that the service load capacity of columns be determined as 40% of that computed by strength design procedures.

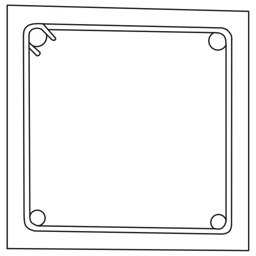
Concrete is a mixture of coarse stone (stone or brick chips) and fine (generally sand or crushed stone) aggregates with a paste of binder material (usually Portland cement) and water. When cement is mixed with a small amount of water, it hydrates to form microscopic opaque crystal lattices locking the aggregate into a rigid structure.

TYPES OF REINFORCED CONCRETE COLUMNS

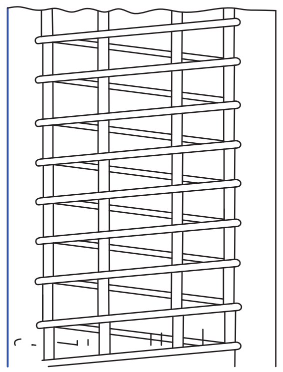
1) Round spiral columns
2) Columns of other geometries (hexagonal, L-shape, T-shape) with either ties of spiral
3) Square tied columns
4) Rectangular tied columns

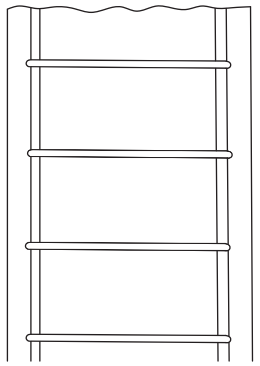


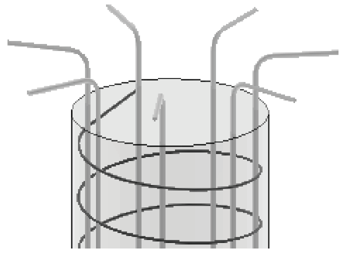
Longitudinal rods and spiral hooping

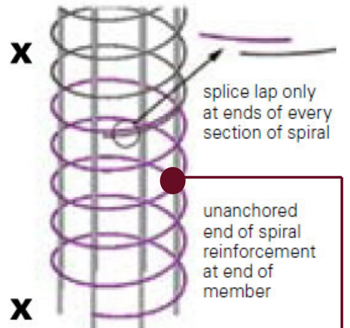


Longitudinal rods and lateral ties



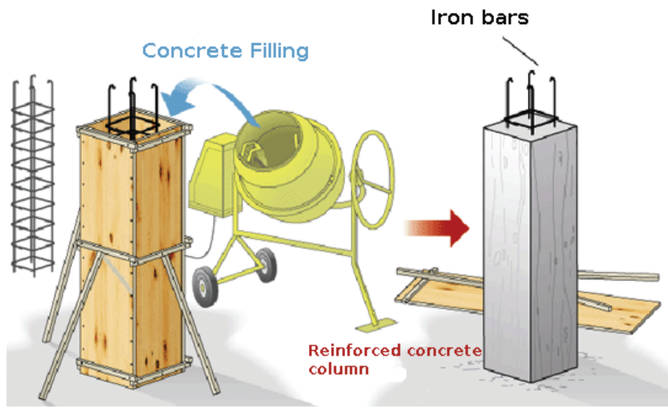






A material with high strength in tension (steel) is placed in concrete to resist not only compression but also bending and other direct tensile actions. This resistance in compression and tension results in a component that can be made into almost any shape.

Steel spiral wire frame that acts as reinforcement for future concrete column. Reinforced columns are cast on site.



1) Reinforced concrete columns is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength and/or ductility.
2) The reinforcement is usually, though not necessarily steel reinforcing bars (rebar) and is usually embedded passively in the concrete before the concrete sets.
3) Reinforcing schemes are generally designed to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure.
4) Reinforced concrete columns may also be permanently stressed (in compression), so as to improve the behaviour of the final structure under working loads.

KEY CHARACTERISTICS OF REINFORCED CONCRETE COLUMNS

1) The coefficient of thermal expansion of concrete is similar to that of steel, eliminating large internal stresses due to the differences in thermal expansion or contraction.
2) When the cement paste within the concrete hardens, this conforms to the surface details of the steel, permitting any stress to be transmitted efficiently between the different materials. Usually steel bars are roughened or corrugated to further improve the bond or cohesion between the concrete and steel.
3) The alkaline chemical environment provided by the alkali reserve (KOH, NaOH) and the portlandite (calcium hydroxide) contained in hardened cement paste causes a passivating film to form on the surface of the steel, making it much more resistanto corrosion that it would be in neutral or acidic conditions. When the cement paste is exposed to the air and meteoric water reacts with atmospheric C02, portlandite and the Calcium Silicate Hydrate (CSH) of the hardened cement paste become progressively carbonated and the high pH gradually decreases from 13.5 - 12.5 to 8.5, the pH of water in equilibrium with calcite (calcium carbonate) and the steel is no longer passivated.