

Part 2Electrical Services →Electrical Service Requirements in High Rising Building

- (i) Electrically operated lift.
- (ii) continuous rotating grid using motor
- (iii) lighting divergent/ arrestors.
- (iv) fire fighting arising with equipment installation on.
- (v) Heavy duty 3-phase diesel generator.

Layout of Hot Water Supply:

- The sequence of units to be installed in the layout of any water supply project starting from the source of water to the distribution is as follows:
- location of intakes including pumping plant.
 - Plain sedimentation tanks.
 - Coagulation sedimentation tanks.
 - Filter unit.
 - water softening and other miscellaneous treatment plants.
 - Disinfection plant.
 - Storage of clear water in underground and overhead reservoir tanks.
 - Distribution of water.

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Wiring - A system of wires providing electric circuit for a device on a building.

Types -

- (i) C.T.G (Galvan / P.V.C toughened / sheathed)
Wiring - The conductor is protected with insulation which is not worn or heat proof. Even the insulation of the conductor and tough rubber sheath is provided for additional insulation and protection against wear, tear and moisture.

This type of wiring is suitable for damp circuits but can not sustain much heat and is not suitable for places in very hot weather. It is also not ~~not~~ suitable for places for out-door wiring. It should not be exposed to direct light sunlight areas where there are corrosive acids or alkali fumes.

- (ii) Conduit Wiring - In this system wires with single insulation are used. The wires are run in steel / P.V.C conduit giving good protection from mechanical injury or fire risks. This type of wiring is used for industries.

- (iii) Unconcealed Conduit Wiring - This system is same as conduit wiring except that the conduits are run in the chase made on

the walls. This system is used where aesthetics is the main consideration and not the additional cost of conduit.

Fuse - A safety device consisting of a strip of metal that melts and breaks an electric circuit if the current exceeds a safe level.

Types of fuses -

- (i) Rewirable Fuse - It is the simplest and the cheapest protective device. It is a self-sacrificial device. It is a simple reusable fuse used in a house, office, in the protection of outdoor distribution transformers. It is a fully enclosed type of fuse and it is available in a wide range of ratings.
- (ii) Cartridge type fuses - It is used to protect motor and branch circuit. It has entirely closed containers and hermetical contact as well. Its application includes low voltage (LV), high voltage (HV) and small fuses.
- (iii) AC fuses - The AC fuse is lighter in size and disintegrates 50 to 50 times in each and every sec from least to highest. As a result, there is no scope for arc generation between the dissolved wires.

- (i) LV fuses - The low voltage fuses are divided into 5 types such as the drop-out, strain and switch fuses.
- (i) 2-type cartridge fuse
 - (ii) link type fuse
 - (iii) Blade and bolted type fuses.
 - (iv) Striker type fuse.
 - (v) switch type fuse.
 - (vi) HV (High Voltage) fuses.

Earthing - The term earthing means connecting the neutral point of a supply system or the non-current carrying metal plates used in electrical installation (e.g.) distribution system to the general mass of earth by a conductor with a negligible resistance. If such a connection is made at all times an immediate discharge of electrical energy takes place without a damper. This brings the body of equipment to zero potential and thus there will avoid the shock to the operator.

Uses of earthing -

- (i) To save human life.
- (ii) To protect rising buildings from strikes.

- atmospheric lightning.
- (iii) to protect all the electric machineries/equipments from high voltage/short circuit.
 - (iv) to avoid risk of fire due to earthen leakage current through unplanned path.

Systems and problems in Ventilation -
The method of ventilation may broadly be divided into the following two categories:-

- (i) Natural Ventilation: In this system of ventilation, the use is made of doors, windows, ventilators and sky lights to make the room properly ventilated. The system is useful for smaller buildings and cannot be adopted for big colleges, offices, theatres, auditoriums, etc. The only advantages of this system are that it is economical in the sense that no special equipment is necessary for making the room adequately ventilated and that it affords living under natural conditions.

The important points to be remembered in connection with natural ventilation system are:

- (i) The location, size and type of windows play a great role in imparting natural ventilation to the room. The windows also supply light and afford protection against weather. All these functional requirements should be properly correlated while deciding the location of windows in a room.

(ii) The efficiency of roof ventilators depends on their location, wind direction and height of building.

(3) Artificial Ventilation -

In this type of system of ventilation some mechanical arrangement is adopted to provide enough ventilation to the room. This system has become popular due to recent advance in motion regarding ventilation. The system is costly but it results in considerable increase in the efficiency of the persons under the command of the system. This system is adopted for big offices, banks, industrial plants, libraries, auditoriums, etc. Following are the four systems of the artificial ventilation:-

(i) Exhaust system:- In this system, the partial vacuum is created inside of the room by exhausting the utilized inside air by fans or blowers. are installed at the extraction of fresh air from outside to inside and thus it becomes possible to provide fresh air to the room through doors and windows.

(ii) Supply system - This system is just the reverse of the above system and it consists in supplying fresh air to the room by installing input fans in outside walls. This system is used for ventilating rooms

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Ventilation :- This is the removal of all vitiated air from a room and replacement with fresh air.

Different methods of Ventilation :-

Generally ventilation involves providing a building with relatively large quantities of outside air in order to improve the overall environment of the building. This may be achieved by in one of the following ways :-

- (i) Natural supply and natural exhaust of air.
- (ii) Natural supply and mechanical exhaust of air.
- (iii) Mechanical supply and natural exhaust of air.
- (iv) Mechanical supply and mechanical exhaust of air.

Escalator :-

- It is a power driven, inclined continuous stairway used for raising and lowering passengers.
- It consists of (i) escalator (ii) the track (iii) the main guide (iv) balustrading (v) steps (vi) ~~comp~~ components (vii) landing.
- It saves the effort required for ascending and descending the stair cases.
- It also expedites the traffic and is very suitable when the volume of traffic exceeds so is beyond the capacity of the longest lift.
- It being a continuous and unending as is required in case of lift is eliminated hence it is commercially very beneficial for large traffic.

Planning and selection of constⁿ equipments:

Various types of constⁿ equipments are available in the market in standard form. They can be used for a variety of constⁿ operations without any difficulty and they are easily available in standard commercial sizes. It is known as planning constⁿ equipment.

Equipment selection factors:

Most constⁿ operations can be performed by more than one kind of equipment or combinations of kinds of equipment. The best choice of equipment for a given job is the one that can complete the work according to the plan and specifications within the time allowed for the least total cost. The equipment selected must satisfy several constraints imposed by the job and the contractual obligations. The factors include the following -

- Specific constⁿ operation
- Job specification requirement
- Condition of the job site
- Location of the job site
- Time allowed to do the job
- Balance of independent equipment
- Monthly requirement of the equipment
- Versatility of the equipment

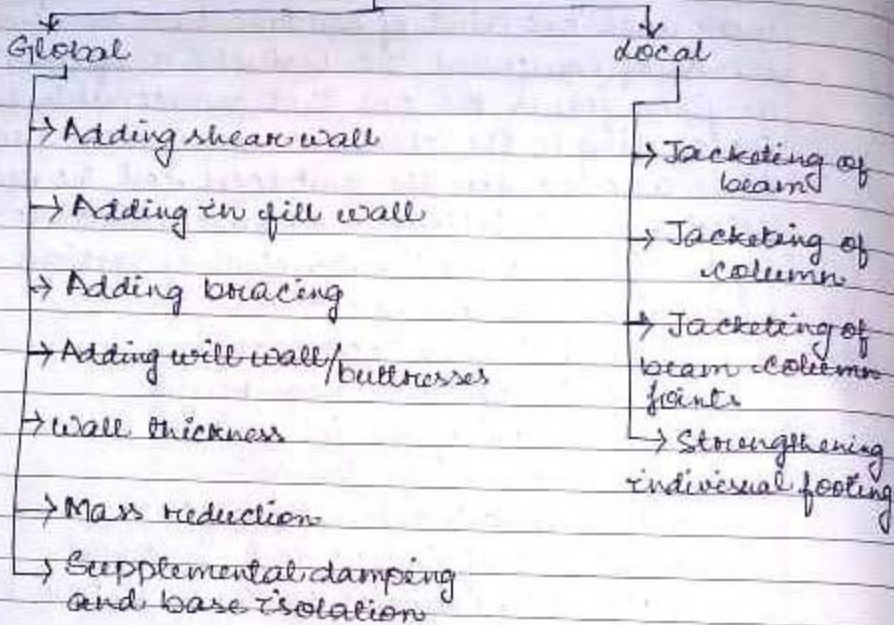
A feasibility solⁿ of the equipment selection problem for actual field condition requires that a nos of these factors be considered. In fact it would be an unusual constⁿ if the choice dependent on only one factor.

Retrofitting of structures :-

It is defined as the process of increasing of the seismic resistance of damaged or weak building by appropriate techniques.

Classification of retrofitting techniques and their uses :-

Retrofitting techniques



There are two ways to enhance the seismic capacity of existing structures :-

- The first is a structural level approach of retrofitting which involves global modifications to the structural system.
- The 2nd is a member level approach of retrofitting which deals with an increase of the ductility

Local or member retrofitting:-

- These are typically used either when the retrofit objectives are limited or direct treatment of the vulnerable components is needed.
- The most popular frequently used method in local retrofitting is jacking or confinement by the jackets of R.C., steel, fibre reinforced polymer, carbon fibre etc.
- Jacking around the existing member increases its lateral load capacity of the structure in a uniformly distributed way with a minimal increase in loading on any single foundation with no alternative in the basic geometry of the building.

Jacking:- It is the most popularly used material for strengthening of building columns.

The most common types are steel jacket, R.C. jacket, fibre reinforced polymer composite jacket, jacket with high tension materials like carbon fibre, glass fibre etc.

Purpose:-

- To increase concrete confinement by transverse fibre/reinforcement, especially for circular cross sectional columns.
- To increase shear strength by transverse reinforcement.
- To increase flexural strength by longitudinal fibre.

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of components with adequate capacities to satisfy their specific limit state

Structural level global retrofitting :-

i) Adding new shear walls :- One of the most common methods to increase the lateral strength of the R.C.C buildings. It is the last simple method

Limitations :-

- Increase in lateral resistance but it is concentrated at a few places.
- Increase dead load of the structure

ii) Adding steel bracing :- Higher strength, stiffness can be improved. Opening for natural light can be made easily. It have much less cost.

Limitations :-

- A moderate to high level of skilled labour is necessary.
- Lack of information about the seismic behaviour of the added bracing.
- Undesirable changes takes place.

iii) Adding in fill wall :- It is an effective economical method for improving strength reducing drift of existing frames.

Limitations :-

- Some columns in the frame are subjected to large axial tensile forces which may exceed the capacity.
- A strong masonry in fill wall may result in a failure of the columns of existing frame.

Design mix concrete - It involves selecting suitable ingredients of concrete and determining their proportion which would produce concrete as ~~possible~~ economically as possible that satisfies the job requirements i.e. the concrete having a certain min^m compressive strength, workability and durability.

Quality control of concrete as per I.S. 456?

Concrete is produced in batches at site with locally available materials of variable characteristics. It is thus likely to be variable from one batch to another. The magnitude of this variation depends upon several factors such as variation in the quality of constituent materials, variation in mix proportion due to batching process, quality of workability and supervision at site. Moreover concrete undergoes a no. of operation such as transportation, placing, compacting and curing due to quality of plant available and partly due to differences in the efficiency of techniques used. Under such a situation concrete is generally referred to as good, fair or poor quality.

Therefore aim of quality control is to reduce the above variations & produce uniform material providing the characteristics desirable for the job at hand. This quality control is a corporate, dynamic program to assume that all aspects of materials, equipments and workmanship are well looked after. The task and goals in there are properly set and defined in the specifications & control requirements.

A quality control plan shall define the tasks & responsibilities of all persons involved, adequate

Fibre Reinforced Polymer (FRP) Jacketing:-

- Carbon fibre is flexible and can be made of in contact the surface tightly for a high degree of confinement.
- Confinement is of high degree, because carbon fibre is of high strength and high modulus of elasticity.
- It has light wt & rusting does not occur.

Shear wall :- R.C.C walls in buildings are required to carry vertical loads as well as lateral loads. The lateral loads due to wind or earthquake may be acting normal to width or thickness of the wall. If the lateral loads are acting normal to the smaller dimension of the wall in plan, it is referred to as a shear wall. It resist major portion of the lateral shear in buildings through flexure deformation and not through shear deformation.

Nominal mix concrete :- The concrete mixes of fixed proportion which ensure adequate strength are known as nominal mixes. Under normal circumstances these mixes have a margin of strength above that specified. However these mixes don't account for the varying characteristics of the constituents and may result in under or over rich mixes. Generally it is expressed in terms of aggregate/cement ratios by volume.

Example :-

M₁₅ grade of concrete proportion is 1:2:4.

Tractor:- It is a versatile earth moving equipment that finds many uses at a const. site. While its primary purpose is to pull or push loads. It is also used as a mount for many types of accessories such as front end shovels, bulldozers and others.

Bulldozer:- A bulldozer is a tractor equipped with a substantial metal plate used to push large quantities of soil, sand, rubble or other such materials during const. or conversion work & typically equipped at the rear with a claw like device to loosen densely compacted materials. It is usually a crawler tractor.

Power Shovel:- It is a bucket equipped machine usually electrically powered used for digging and loading earth or fragmented rock and for mineral extraction.

Compaction of soil:- It is the compression of soil particles which reduces total pore space of a soil.

Requirement of soil compaction:-

- To increase soil strength
- To improve the stability of soil
- To reduce soil permeability
- To reduce erosion damage

control & checking procedures & maintaining adequate documentation of the building process & its results. Such documentation generally include:-

- Test reports & manufacturer's certificate for materials concrete mix design.
- Record of site inspection of workmanship, field tests
- Non-conformance reports, change orders
- Quality control charts
- Statistical analysis

Curing of concrete:- The process of, certain of an environment during a relatively short period immediately after the placing and compaction of concrete favorable to setting and hardening of concrete is known as curing.

Methods of curing of concrete:-

- Ponding of water over the concrete surface after it has set.
- Covering the concrete with wet straw or damp earth.
- Covering the concrete with wet burlap.
- Sprinkling of water.
- Covering the surface with water proof paper.
- Membrane curing of the concrete.
- Chemical curing

Dragline:- A dragline is a piece of heavy equipment used in civil engg and surface mining. Dragline falls into two broad categories those that are based on standard lifting cranes & the heavy units which have to be built on site. It is used primarily for open pit operation to dismantle & transport materials.

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v) Vibrating rollers:- Similar to smooth wheel roller with the modification of rotating drums. Very expensive but have high output and performance.

vi) Vibrating plate compactors:- These equipments are used for small areas. The usual weights of these machines vary from 100 kg to 2 tonnes with plate areas betⁿ 0.16 m² & 1.6 m².

Rammers:- Rammers are used for compacting small areas by providing impact load to the soil. This equipment is light & can be hand or machine operated. The base size of rammers can be 15 cm x 15 cm or 20 cm x 20 cm or more.

Earth moving equipment:-

- The process of cutting or loosening and removing earth from its original position, transporting & dumping it as a fill or spoil bank is known as excavation.
- It may be required for soil, soft rock or even hard rock before preparing the subgrade.

Equipment for compaction of soil :-

- Smooth wheel rollers
- Pneumatic rollers
- Grid rollers
- Tamping rollers
- Vibrating rollers
- Vibrating plates
- Vibratory compaction

i) Smooth wheel rollers:- These are one of the most common types of compaction equipment used. Weighing from 5 to 15 tonnes. They are suitable for compacting sand, gravel, broken stones etc. They are used for compacting highway base courses.

ii) Pneumatic rollers:- Machines consist of a number of rubber tires, highly inflated. The rear of which has one more wheel than the front. Most suitable for compacting fine grained soil and well graded sands.

iii) Grid rollers:- As the name suggests, these rollers have a cylindrical heavy steel surface consisting of a network of steel bars forming a grid with square holes. The weight of this roller can be increased by ballasting with concrete blocks.

iv) Tamping rollers:- These rollers are similar to sheep foot rollers with lugs of larger area than sheep foot rollers. It have static weight in the range of 15 to 40 tonnes. It is best suitable for compacting cohesive soils.

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where unusual quantity of heat or odours is not produced.

(iv) Combination of exhaust and supply systems- This system is the combination of the above two systems. The exhaust fans and input fans are installed at suitable suitable places in the outdoor outside walls so as to cause a current of fresh air from outside to inside of the room.

(v) Fresh Air Process- This system is mostly used in cold countries and comprises a complete ventilation and heating unit. It includes:

- (a) A filter of air washer.
- (b) A water warmer by hot water, electricity, steam or gas.
- (c) A centrifugal fan for forcing the warm air.
- (d) A system of distributing duct connecting every room to the building.

(v) Air-Conditioning- This is the most effective system of artificial ventilation and as it involves many other aspect, a separate discussion must follow. The term air-conditioning is used to indicate the science of controlling or conditioning air with respect to humidity, temperature, movement of air, odour, bacteria content, dust content, etc.