MATERIALS FOR REPAIR

SPECIAL CONCRETES AND MORTAR:

Cold weather concreting

Hot weather concreting

Effects of cold weather concrete:

Delay in setting and hardening

Freezing of concrete at early age

Freezing and thawing

Following conditions may be discussed:

Low temperature but 0◦c at the time of concreting and later during hardening period.

Low temperature at the time of concreting but below 0◦c during the hardening period.

Temperature below 0◦c at the time of concreting and during hardening period.

Hardened concrete subjected to alternate freezing and thawing.

Low temperature but above 0◦c:

If the temperature is only low but always above the freezing point.

There is no other bad effect on the fresh concrete or hardening concrete.

Low temperature at the time of concreting but below 0◦c after concreting:

Temperature falling below 0◦c when the concrete is still green.

Temperature prevailing below 0◦c when the concrete is sufficiently hardened.

The formation of cement gels the capacity cavities also will have been very much reduced.

Concreting methods at sub-zero temperature

Utilisation of the heat developed by the hydration of cement and practical methods of insulation.

Selection of suitable type of cement.

Economical heating of materials of concrete.

Admixtures of anti-freezing materials.

Electrical heating of concrete mass.

Use of air-entraining agents.

Hot weather concreting (above 40◦c)-(special problems are usually encountered):

Rapid rate of hydration of cement, quick setting and early stiffening.

Rapid evaporation of mixing water.

Greater plastic shrinkage.

Less time for finishing.

Reduced relative humidity.

Absorption of water from the true concrete by the sub-grade and formwork.

Difficulty in continuous and uninterrupted curing.

Difficulty in incorporation of air entrainment.

Ready mixed concrete.

Production and delivery:

Temperature of aggregates water and cement shall be maintained at the lowest practical level temperature of concrete is below 40◦c at the time of placement.

Reinforcement, formwork and subgrades should be sprinkled with cooled water just prior to placing the concrete.

More number of masons is required to be employed. (hard, setting time)

Concrete is placed in comparatively thin layer.

Prevent loss of moisture from the concrete.

Grouting methods: (packed concrete)

Grout mixture is poured on the packed aggregate and allowed to penetrate downwards.

This method is normally adopted for thin concrete member such as pavement, slab and floor slabs.

Concrete chemicals:
Admixtures:

Plasticizers (water reducers)

Super Plasticizers (high range water reducers)

Retraders and Retrading Plasticizers (RMC)

Accelerators and accelerating Plasticizers (early strength)

Air-entraining admixtures (plastic concrete)

Pozzolanic or mineral admixtures (arch, bridge, aqueducts).

Damp-proofing and water proofing admixtures (powder, paste).

Gas forming admixtures (aluminium powder).

Air-detraining admixtures.

Alkali-aggregate Expansion inhibiting admixtures.

Workability admixtures.

Grouting admixtures.

Corrosion inhabiting admixtures.

Bonding admixtures.

Fungicidal, insecticidal admixtures.

Colouring admixtures.

Constructional chemicals:

Concrete curing compounds.

Polymer bonding agents.

Polymer modified mortar for repair and maintenance.

Mould releasing agents.

Protective and decorative agents.

Installation acids.

Floor hardeners and dust-proofers.

Non-shrink high strength grout.

Surface retarders.

Bond-air for plastering.

Ready to use plaster.

Guniting aid.

Construction chemicals for water proofing. a) Integral water-proofing compounds. b) Membrane forming coatings.

c) Polymer modified mineral slurry coatings. d) Protective and decorative coatings.

e) Chemical OPC.

f) Silicon based water-repellent materials.

g) Water proofing adhesive for tiles, marble and granite. h) Inject grout for cracks.

i) Joint sealants.

Expansive cement:

Concrete made with opc shrinks while setting due to loss of free water.

Concrete also shrinks continuously for long time. This is known as dry shrinkage.

The cement used for grouting anchor bolts or grouting machine foundation.

The cement used in grouting the pre-stressed concrete duck

Type of cement which will not shrink while hardening.

A slight expansion with time will through to advantages for grouting purpose.

This type of cement which suffers known over all change in volume on drying is known as expansive cement.

This type of cement as been developed by using an expanding agent and a stabiliser very carefully.

8-20 part of the sulpho-aluminate clinker are mixed with 100 parts of the

Portland cement and 15part of the stabiliser.

Expansion takes place only so long as concrete is moist, curing must be controlled.

The use of expanding cement requires skilled and experiences.

One type of expanding cement is known as shrinkage compensating cement.

Sulphur In Filtrated concrete:

Sulphur having strength impregnation as shown great improvement in strength.

Physical properties have been found to improve by several 100% and large improvement in water impermeability.

Resistance to corrosion have also been achieved.

Some attempts sulphur as a binding material instead of cement.

Sulphur is heated to bring it into molten condition to which coarse and fine aggregate are poured and mixed together.

This mixture give fairly good strength, acid resistance and other chemical resistance.

It proved to be costlier than ordinary cement concrete.

The quantity of sulphur used is also comparatively less and the process is made economical.

Its compressive strength of about 100mpa could be achieved in about 2 day time.

Commercial sulphur of purity 99.9% are used.

A large number of trial mix are mode to determine the best mix proportion.

The water cement ration of 0.7 or over as been adopted in all the trial.

After 24 hours of moist curing the specimen is dried in heating cabin ate for 24 hours in 121^0c.

Then the dried specimen are placed in a container of molten sulphur at

121^0c for 3 hours.

The sulphur infiltrations can be employed in the precast industries.

This method of achieving high strength can be used in the manufacture of precast roofing element, fencing post, sewer pipes and railway sleeper.

Sulphur infiltrated concrete should find considerable use in industrial situation.

High corrosion resistant concrete is required.

This method cannot be conveniently applied to cast in place concrete.

Sulphur infiltrated precast concrete unit is cheaper than commercial concrete.

The techniques are simple effective and in expansive.

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Fibre reinforced concrete:

The plain concrete possesses a very low tensile strength limited ductility and little resistance to cracking.

Internal micro cracks are present in the concrete its poor tensile strength is due to propagations of such micro cracks.

Impart improvement in tensile property of concrete members by using reinforced steel bar by restraining technique.

This method provide tensile strength to the concrete member.

In plain concrete and similar brittle material structural cracks develop even before loading.

The width of the initial crack exceed few micron.

The structural cracks proceed slowly or by tiny jumps because they are retorted by various obstaves.

The development of such micro cracks is the main cause of in elastic deformation is concrete.

It has been recognised that the addition of small closely spaced and

uniformly dispersed fibres to concrete would act as crack arrested and would substantially improve its static and dynamics properties.

This type of concrete is known as "fibre Reinforced concrete"

The fibre reinforced concrete can be defined as composite material consisting of mixture of cement mortar or concrete and discontinuous. Described uniformly dispersed suitable fibbers, continuous mesh.

Fibres used:

Every type of fibre has been tried out in cement and concrete. Not all of them can be effectively and economically used.

The fibres that could be used are steel fibre, poly propylene, nylon, Asbestos, Glass and carbon.

Fibre is a small piece of reinforcing material possessing certain characteristic properties.

Steel fibre is one of the most commonly used fibre generally round fibre

are used the dia varies from 0.25 to 0.75mm.

The steel fibre is likely to get rusted and lose of its strength.

Use of steel fibre makes significant improvement in flexural, impact and fatigue strength of concrete.

It has been extensively used in various types of structure particularly for over lay of roads air field pavements, bridges.

Thin shells and plates have also been constructed using steel fibres.

Polypropylene and nylon fibres are found to be suitable to increase the impact strength.

Asbestos is a mineral fibre and has proved to be most successful of all fibres as it can be mixed with Portland cement.

Glass fibre is a recent introduction in making fibre concrete. It has very high tensile strength 1020-4080 N/mm^2.

The alkali resistance fibre reinforced concrete shows considerable improvement in durability.

Carbon fibre posse's very high tensile strength 2110-2815 N/mm^2.

Carbon fibre as reinforcement will have high modulus of elasticity and flexural strength.

The uses of carbon fibres for structures like panels and shells will have promising future.

Factors affecting fibre reinforced concrete:

Transfer of stress between matrix and fibre.

Types of fibres.

Fibre geometry.

Fibre content.

Distribution of fibre mixing.

Compaction technique.

Size and shape of aggregate.

Polymer concrete:

Continuous research by concrete technologist to understand, improve and develop the properties of the concrete as resulted in a new type of concrete is known as "polymer concrete".

The porosity is due to air voids, water voids due to porosity of gel structure itself.

The strength of the concrete is naturally reduced.

It is concaved by many research workers that reduction of porosity results in increase of strength of concrete.

The process like vibration, pressure application spinning etc., has been practiced mainly to reduce porosity.

Polymerisation is the latest technique adopts to reduce the porosity

of the concrete. To improve the strength and other properties of the concrete. The development of concrete polymer composite material is directed at producing the new material by combining the ancient technology of cement with the Morden technology of polymer chemistry.

Types of polymer concrete:

Polymer impregnated concrete(PIC)

Polymer cement concrete (PCC)

Polymer concrete (PC)

Partially impregnated and surface coated polymer concrete

Polymer impregnated concrete (PIC):

PIC is one of the widely used polymer composite. types of monomer used

Methyl-metha-cry late

Styreme, acrylo nitrate, T-butyl styrene

Other thermo plastic monomer

The amount of monomer that can be loaded into a concrete specimen is limited by the amount of water & air that as occupied the total voids space.

The concrete by vacuum or thermal drying the later being more practicable for water removable because of its rapidity.

The specimen prior to soaking in monomer the application of the pressure is another technique to reduce monomer loading time.

Polymer cement concrete:

PCC is made by mixing cement, aggregate, water and monomer such plastic mixture is cast in mould, cured, dried and polymerised.

Monomer used (polyester styrene, epoxy styrene, furnus, vinylidene chloride)

It have shown relatively modest improvement of strength and

durability.

Pcc+furly alcohol and aniline hydro chloride in the wet mix to have high corrosion resistance to vibration.

Polymer concrete:

PC is an aggregate bond with a polymer binder instead of Portland cement.

The main technique is producing PC is to minimum voids volume in aggregate.

To reduce the quantity of polymer needed for binding the aggregate.

Properly grading and mixing the aggregate attain the maximum density and min voids volume.

A silence coupling agent is added to the monomer to improve the

bond strength between polymer and aggregate.

Polymer can be made compact with min voids and resistance to chemical attack.

The strength obtained PC can be as high 140Mpa with a short

curing period.

PC tends to the brittle and it is reported that dispersion of fibre reinforcement would improve the toughness and tensile strength of the material.

The polymer concrete may relax duration long term loading.

Partially impregnated and surface coated polymer concrete:

The specimen is liquid monomer like methyl cry late minimise loss due to evaporation.

The depth of monomer penetration is dependent upon

I. Pore structure of harden and dried concrete

II. The duration of soaking

III. The viscosity of the monomer.

The potential application of polymer impregnated concrete surface treatment is in improving the durability of concrete bridge deck.

It gives increases in the tensile & compressive strength, modulus of elasticity and resistance to acid attack have been achieved.

Surface treatment in the field:

The surface is dried for several days with electrical heating blanket.

Remove the heating blanket and cover the slab with 0.64 m^3 oven dried light weight aggregate per 100 m^2.

Apply initially 2000-3000 ml of monomer system per square meter.

Cover the surface with polyethylene to retired evaporation.

Add periodically additional monomer to keep the aggregate moist for minimum soak time of 8 hrs.

Promising Monomer System:

1. Methyl methacrylate + 1% Benzoyl Peroxide + 10% Trimethylopropane.
2. Isodiayl methacrylate + 1% Benzoyl Perxide + 10% Trimethylopropane.
3. Isobutyl Methacrylate + 1%Benzoyl Perxide + 10% Trimethylopropane.

Durability:

1. Freezing and thawing resistance.
2. Resistance to sulphate attack.
3. Acid resistance.

4. Water absorption.
5. Coefficient of thermal expansion.
6. Resistance to abrasion.
7. Wear and skid resistance.

Application of PIC:

1. Prefabricated structural element.
2. Pre stressed concrete.
3. Main work.
4. Desalination plant.
5. Nuclear Power plant.
6. Sewage works.
7. Ferro cement products.
8. Water proofing of structure.
9. Industrial application.

Ferro Cement: (skeleton steel and wire mesh)

In the present form Ferro cement may be considered as a type of this reinforced concrete construction.

Cement mortar matrix is reinforced with many layers of continuous and relatively small diameter wire mesh.

The wire mesh imparts tensile strength and ductility to the material.

The many other engineering properties such as toughness, fatigue resistance, Impermeable etc., are considerably improved.

The Ferro cement composite is arch cement water matrix of 10-60mm thick.

In form of one or more layer of very this wire mesh.

Portland cement and fine aggregate matrix is used in Ferro cement.

The choice of cement depends on the service condition to maintain the quality of cement, in should be fresh of uniform consistency and free lumps.

Cement should be stored under dry condition and as for as short duration as possible.

Plasticizer and other admixture may also be added for achieving increase in strength, reduction in permeability, water proofing, increasing durability prevent galvanic corrosion of galvanised steel.

The reinforcement used in Ferro cement is of two types' skeleton steel and wire mesh.

Welded wire fabric of 3 to 4mm dia wire welded 80 – 100m c/c.

The reinforcement should be free from dust loose rust coating of paint oil or similar undesirable substance.

Reinforcing bars may be used in combination with wire messes for relatively thick Ferro cement element.

Advantages:

Ferro cement structures are thin and light.

Considerable reduction in the self-weight of structure.

Precast unit which can be easily transported.

Does not require skilled labour.

Partially or complete elimination of form work in possible.

Ferro cement construction is easily amenable to repair in case of local damage due to abnormal load.

UNIT-5

TECHNIQUES FOR REPAIR

Mortar and dry pack:

Dry pack is suitable for filling holes whose depth is at least equal to the smallest surface dimension of the repair area.

The holes should be at least 25mm deep.

Dry pack is not suitable for shallow depressions.

The holes that go right through concrete section where the filling cannot be properly rammed.

Dry pack mortar is usually a mix of one part of Portland cement to 2.5 part of fine sand.

The proper amount of water will produce a mortar which is at the point of becoming rubbery when it is solidly packed.

Any less water will not make a sound pack as it cannot be properly rammed.

Any more water lead to shrinkage and a loose repair.

The holes should prepare so that they are sharp and square at the surface edge.

The internal surface should be roughed and if possible under cut slightly.

All repairs and defective concrete must be removed and the surface of the hole left clean.

Dry should be packed in layer which has a compacted thickness of about 10mm.

The compacting efforts should be directed at a slight angle towards the sides of the hole.

The holes should not be overfilled and can be finished by hammering on a piece of hardwood laid on the surface.

The most repairs have only a small volume of filling material and moisture is likely to be in old concrete.

Holes are vertical or overhead surface or not likely to be repaired successfully by this method and epoxy mortar is probably needed.

The area to be repaired should be cleaned and roughened and kept wet for several hours.

The repair mortar should be mixed to a plastic consistency.

A small quantity of cement mortar should be scrubbed into the dam surface with a wire brush.

The repair mortar compacted thoroughly should be tight filling around the edges of holes.

Curing should be applied as soon as possible and kept in place for at least 7days.

There should be good bond between old concrete and repair.

The expansive cement or admixtures have been advocated for replacement mortar repair.

Any admixture used should not be relies on the corrosion of iron fillings.

Expansive admixtures used to grouting purpose.

Epoxy method is used for repair jobs but its properties and performance are very much dependent on the skill of crews.

Types of equipment used and the conditions under which placing is carried out.

It is more cost, availability of equipment and crews and on operation features.

Possible admixture is an effective material for replacing defective concrete.

The durability is highly dependent on the preparation of the bonding surface and skill of nozzle man.

Air entraining admixture with dry mix shot Crete in the hope that will provide additional insurance of durability.

Two major modifications shot Crete have are introduced in the addition of fibres and more recently the addition of silica fume.

The addition of silica fume to shot Crete has produce extraordinary benefits in the properties of the plastic and the hardened materials.

Dry mix silica fume shot Crete commonly has a 28days compressive strength of up to

60Mpa.

The addition of silica fume to fibre shot Creteproduce more flexural strength.

Necessary of demolition:

The building is very old and that cannot be put in use for further period.

Structural changes whenever required.

Due to modernisation, old building may require demolition for new construction.

Development of city were horizontal explain not possible they adopt for multi-story flat construction.

Structural failures of building were repair works may not be possible.

Expansion or extension of buildings over existing building.

Precautionary Measures:

Whenever possible windows, doors etc. should be taken out to avoid damage being caused by broken glass.

Window frame should be left in to help to maintain the strength of walls.

Windows and doors opening should be broad up.

Internal entrance to lift shaft should be barriguards.

The approaches to all area where flooring has been removed barricade.

To indicate the need for special care and the possibility of danger.

Balconies and cantilever, masonry projection should be cut down and the debris removed before the main demolition commence.

Many metal staircase or ladder should be inspected before use and access to them should be closely controlled.

Neither stone nor concrete staircase should be used once they have been disturbed as in many case Bering areas are very small and even a small movement can lead to collapse.

Stair case should be kept free rom debris.

Any timber removed from the building being demolished should be carefully stacked and projecting nails and screws should be removed.

The condition of any adjacent property which may affected by the demolition and the relation of these two buildings being demolished should be pointed out operatives.

Operatives should not be allowed to stand on the brick work which they are demolishing or any member supported by that brick work.

On completion of each day work, the building being worked on should be left in stable condition without any overhanging brickwork or timber.

Sequence of demolition:

The first task to be carried out on site is to be ensure that service have been disconnected and made safe over the whole old site to be cleared.

Demolition proceed reverse order of construction.

The primarystripping out process such as roof covering, fittings, pipework and generally all non-structural parts of the building have been removed.

Roof trusses and timber should be lifted down and as for as possible only steel, concrete or between should remain.

All rubble and debris should be lowered ground and constantly. Cleared so as to avoid builders

Methods of types of demolition:

1. Demolition by hand.
2. Pulling down by rope.
3. Mechanical demolition
    - **a.** demolition ball
    - **b.** Pusher harm machinery
4. Deliberate collapse (some part to be demolished)
5. Explosives.

Demolition by hand:

This method is usually used for highest and most inaccessible section.

The work period breaking down by machinery for complete buildings were access may not possible for machinery.

Operatives use tools of the portable variety long chisel, hammer, crower bar, pneumatic drills, hand saw, power saw etc.

a. This method is suitable for small buildings. b. This method not required skilled supervisor.

c. This method is very difficult to remove concrete structure like column, beam, roof etc.,

Pilling down by wire rope:

This method of demolition is probably widely used for masonry structures. If it is all possible all timbers, pipes, beams and lintel should be removed prior to the pulling down operation.

In no case should this method be used were long member are present in the buildings.

A wire bond is set around a portion of the brickwork and is them dragged vehicle.

As a result it cut into brickwork causing into collapse.

Mechanical

demolition:

This method is used in the main for fairly large brick structure and reinforced concrete buildings.

As well as for breaking up mass concrete and reinforced concrete slab and floors.

The ball which initially weight of half – ton is dropped vertically on to the structure to be broken.

Sideways motion is important to it by swelling the jip of the crane so the ball hits the side of the structure

This method requires a higher standards of site supervisor.

The crane operator has to work at some distance from the structure being demolished.

Considerable stresses are important to the crane jip and the supervisor maintenance standard must be high.

The structure being demolished should be detached from any other buildings.

If necessary by partially hand demolished before this method is used.

Pusher arm machinery:

It involves the use of an extended arms and steel pad fitted to a tracked vehicle in place of the excavated bucket.

It is considered that this type of machine is more controllable and in some ways more versatile then the other machinery mentioned above.

The pusher arm is placed on the top most section of the brickwall and forward motion is applied either by the hydraulic thrust mechanism or by driving the excavator

forwar
d.

Deliberate collapse:

This method is used in some case where removal of certain key structure member will causes collapse of the old or part of the building being demolished.

Very special attention must be paid.

To ensure that every one on site is conversant with procedure being used.

It is removed to a safe distance when they collapse is imminent.

Explosives:

The use of explosive is consider by many exposure.

This method is most economic and quickest method of demolition.

The basic principles is that holes are bored into various supporting section of the structure and explosive inserted.

When the charges are exploded the structure collapse, breaking up on impact with the ground.

Gunite of shotCrete:

Gunite can be defined as mortar conveyed through a hose pneumatically protect at a high velocity on to a surface.

The method as ben further developed by the introducing of small size coarse aggregate into mix.

This process economical by reducing the cement content.

The force of jet impacting on the surface compact the material.

Use of accelerator to assist over kneadhacking ispracticed.

The newly developed ready set cement can also be used for shortening process.

The process is mostly used for application of mortar of less thickness.

Similar principle of Guniting for achieving greater thickness with small coarse aggregate.

Dry mix Process;

Cement and sand are thoroughly mixed. The cement and sane mixer is feed into

special air pressurised mechanical feeded as
'gun'

The mixer is melted into delivery hose by a distributor within the gun.

This material is carried by compressed air through the delivery hose to a special nozzle.

The water is spayed under pressure and intimately mixed with sand cement jet.

The wet is jetted from the nozzle at high velocity on to the surface to be gunited.

Wet mix Process:

To produce a high nozzle velocity about 90-120m/s. This result in exceptional good compaction.

The lower velocity gunite is produced using large diameter hose for large output.

The compaction will not be very high.

Use of Shortcrete:

The high cost to shotCrete limits is application to certain special circumstance.

It does not have to be asstronger as the shuttering for policed concrete.

The saving in shuttering cost makes it particularly applicable for this section.

It will bond extremely well to the existing concrete to masonry and to exposed rock.

Suitably prepared steel surface also can be covered with gunited concrete.

It is difficult to removes rebound materials as it tends.

Defects of this types can result in porous concrete and also contribute to high permeability.

It is difficult to obtain a satisfactory surface finish with shorterete.

The application of the shotCrete process is limited to exception areas.

When good nozzle man having required skill are available.

Admixtures can be used in shotCrete to produce the same effects as in ordinary concrete.

The drying shrinkage will depend on the water content and may.

Shrinkage and creep of wet shotCrete is likely to be high.

The durability or resistance to frost action and other agencies of dry shotCrete is good.

Stiff, well compacted concrete of the type used in shotCrete is a good structural material.

A well designed and well executed job makes a satisfactory work.

One of the strong point of shotCrete is its excellent bond with old concrete, rock

(face) phase, metal sheet.

The use of shotCrete is frequently adopted for tunnelling operation.

Generally it should have quick setting properties.

This properties are usually obtained by the use of powerful accelerator in the mix.

This accelerator should be compactable with the cement and concrete with respect to durability and stability.

Use of fibre reinforced shotCrete is one of the recent innovation.

Fibre reinforced shotCrete process increase the tensile strength of the shotCrete.

Another important innovation made is the polymer shotCrete aggregate and monomer are mixed together.

Vacuum Concrete:

Removal of excess water and air.

In concreting this section like slab and voids.

A fluid mix with water cement ratio of 0.5 to 0.65 is required to facilitate placing and compaction.

Fluid mix

Plasticizer (water reducer)

Super-plasticizer (high range water reducer)

Low water cement ratio will gives alround improvement in the quality of concrete.

It requires form work in the form of channels, internal vibrator, and double beam screed board vibrator for the fall width, bull float, and filter pad. Vacuum pump, disc floater and power trowel.

First concrete with relatively higher water cement to facilitate full compaction with needle vibrator is poured.

Then the concrete is further compacted double screed vibrator these makes the surface smooth.

Filter mat is placed and its pressed on all the four sides and effectively sealed within hour and 30mins.

The vacuum pump is started which suck the unwanted water, what could better med as coater of workability from the concrete.

Vacuum pump is run for 20 to 30 mints depending upon thickness of concrete floor.

Vacuum dewater concrete become stiff and workable.

The top surface may undergo the depression of above 3% with loss to about 20% of original water.

This concrete is kin floated and further power trowel finish.

Often surface hard water used in conjunction with dewatering process.

The vacuum treatment of concrete involving the removal of excess water and air by sing section can be helpful.

An arrangement for vacuum treatment of concrete section through a surface mat connected to a vacuum pump.

The duration of treatment depends upon the water cement ratio and the quantity of water to be removed.

The vacuum treatment is not very effective for water cement ration below 0.4.

The vibration of concrete before vacuum treatment can assist the process.

The application of vibration simultaneously with vacuum treatment after initial vibration is very effective.

Continue vibration beyond 90sec may damage the structure of concrete and hence the vibration should be stopped.

Only vacuum needs to be applied for the remaining duration of the treatment total shrinkage is reduced.

Vacuum treated concrete provides good bond with the under lying concrete.

The vacuum processed concrete has been extensively used for factory production of precast plain and reinforced concrete unit.

Vacuum treatment can also be effectively used is the resurfacing and repair of road pavement.

Foam Concrete (or) Gas Forming Concrete:

Gas forming agent is used in production of cement grout and light weight concrete.

Gas forming are also known as foaming agent.

This concrete also known as gas concrete, cellular concrete, foamed concrete, aerated concrete, and porous concrete.

Gas or air bubble or used aggregate in gas concrete air bubbles are different from those formed in air entrained agent.

This agents are used to form foam during mixing of concrete (mixing in the truck).

The proportion of gas forming agent can control the density of concrete.

The gas in confined spaces in grouting ducts.

There are variety of gas foaming agents such as aluminium powdered zinc, and hydrogen peroxide, soaps and resins.

This admixture are used in amount less than 0.2% by mass of cement.

When this admixture are used in large quantity this produce gas or cellular concrete.

Appropriate use of gas forming agent can produce light weigh concrete with unit weight varies from 4 to 20kn/m^3.

Gas foaming agents are mixed first with cement sometimes certain quantity are

performed foam is added to freshly prepared concrete to achieve desired density.

Hydrogen peroxide breaks into water and oxygen when added to cement to produce light weigh concrete of mortar.

Aluminium of zinc powder is used for production of cellular or gas concrete.

In hot weather the action of aluminium powder may occur too quickly cold weather, the action will be slower.

Aluminium powder is also used as an admixture in the production of light weight concrete.

Epoxy Injection:

The injection of a low viscosity epoxy is a possible repair method for cracks.

The crack between about 0.02mm and 6mm in width.

It is necessary to choose carefully to match the individual job requirement.

The capability of bonding to moist concrete, shrinkage thermal and elastic properties of hardened resins and other special needs such a fire resistance high temperature stability.

The epoxy injection to be effective the crack must be free of dirt grease or other contaminations.

It is relatively new work, satisfactory cleaning can often be achieved by vacuum cleaning a head of the sealing operation.

Acid have been used but or not recommended.

Compressed air or blasting with water or air/water mix have been suggested but the process tends to drive dust and contaminations into the bottom of cracks.

Repair by injection may the before by difficult or impossible if any of the faces at which the cracks appears cannot be reached.

Three methods of providing entry ports:

-Drilled holes with fitting inserted and bonded in with the adhesive used for sealing.

-Bonded flush fitting attached by means of the sealing adhesive.

-Interrupted seal using a gasket that covers the unsealed portion.

Injection should start at the lowest post and be continued until resin appears at the next higher port.

The injection nozzle is then removed the port seal and the nozzle moved upto the next port.

If the pumping pressure cannot be maintained in a cracks that appears full (resin is leaking).

The action to be taken if this happen can only be decide on site.

Finally when the injected resin as cured the sealing adhesive must be removed by grinding cutting and at port must be made good with epoxy.

The width of about 20mm and filling with dry pack or epoxy mortar.

Very fine crack less than 0.15mm in width the entry ports should be spaced no more than 150mm apart.

Shoring:

Shoring is the means of providing support to get stability of structure.

The stability of the structure is endanger due removal of a defective portion of the structure.

Types of shoring:

- Raking or inclined shoring (10m building)
- Flying or horizontal shoring (space between tow building 9m)
- Bead or vertical

shoring. **Mortar for Repair**

Cracks: Symptoms of defects:

Surface and body of concrete.

Spalling, Rust and dampness stain on the surface.

Corrosion of reinforcement, porous concrete near surface.

Non-conformation of surface, shape and size of member.

Repair Materials:

Patching Material:

Plain cement mortar epoxy resin mortar.

Polymer modified mortar, polyester resin mortar.

Bonding Aids:

Cement slurry, polymers, epoxy. Polymer modified cement slurry. Anti-corrosive coating:

Epoxies zinc rich epoxy coating Bitumen.

Fusion bonded epoxies interpenetrating polymer coating.

Grouts:

Cement grout, cement sand grout, and epoxy grout.

Cement sand grout with admixtures, polymer modified cement grouts.

Gunite and shotCrete:

Over lays and topping

Protective Coating:

Convention coating, Zinc rich coating.

Bitumen coating, Silicon coating.

Vinyl coating.

Rubber coating.

Preparation for Repairs:

Removal of damaged and loose concrete.

Cleaning of concrete surface with water/air jet.

Removal of all oil/grease from the surface.

Cleaning and sealing of cracks.

Roughening of surface to enhance bonding of repair materials.

Crack Repair Methods:

Epoxy injection grooving and sealing, grouting.

Flexible sealing, Polyimpregnation, dry packing.

Overlays and surface treatment.

This process of natural crack repair is called auto generous sealing. Healing depends upon the calcium Hydroxide in cement paste carbon-di-oxide present is the atmosphere presence of moistures.

Steps involved:

Preparation of crack, drilling holes, clearing and drying of cracks.

Sealing of cracks surface, Fixing of injection port in holes.

Mixing of epoxy resin the injection of mixed epoxy resin.

Removal of ports and plugging the lopes removal of surface sealing and finishing the surface.