CONCRETE PREPARATION CONTINUED

TRANSPORTATION AND PLACING

The concrete, as it comes out of the mixer or as it is ready for use on the platform, is to be transported and placed on the formwork.

The type of equipment to be used for transport of concrete depends on:

- Nature of work
- Height above ground level
- Distance between the points of preparation and placing of concrete.

For Ordinary building works:

Human ladder is formed and concrete is conveyed in pans form hand to hand.

For important works:

Various Mechanical devices such as

- Dumpers
- Truck mixers
- Buckets
- Chutes
- Belt conveyors
- Pumps hoist.etc. may be used

Two important precautions necessary in the transportation of concrete:

1. The concrete should be transported in such a way that there is no segregation of the aggregates.
2. Under no circumstances, the water should be as added to the concrete during its passage form mixer to the formwork

Precautions to be taken during the placing of concrete:

- ✓ The formwork or the surface which is to receive the fresh concrete should be properly cleaned prepared and well-watered.
- ✓ The large quantities of concrete should not be deposited at a time.
- ✓ It is desirable to deposit concrete as near as practicable to its final position.

- ✓ The concrete should be dropped vertically form a reasonable height.
- ✓ The concrete should be deposited in horizontal layers of about 150mm height.
- ✓ As far as possible, the concrete should be placed in single thickness.
- ✓ The concrete should be thoroughly worked around the reinforcement and tapped in such a way that no honeycombed surface appears on removal of the formwork.
- ✓ The concrete should be placed on the formwork as soon as possible . But in no case, it should be placed after 30 minutes of its preparation.

Testing of Concrete (Including NDT)

Testing of hardened concrete plays an important role in controlling and confirming the quality of cement concrete works.

- ❖ Compression Test
- ❖ The flexural strength of concrete
- ❖ Test cores

Non –Destructive Testing methods

- ✓ Have been in use for about four decades
- ✓ Powerful method for evaluating existing concrete structures with regard to their strength and durability apart from assessment and control of quality of hardened concrete.
- ✓ In certain cases, the investigation of crack depth, micro cracks and progressive deterioration are also studied by this method.
- ✓ Though non-destructive testing methods are relatively simple to perform, the analysis and interpretation of test results are not so easy.
- ✓ Therefore, special knowledge is required to analyze the hardened properties of concrete.

- ✓ In the non-destructive methods of testing, the specimen are non loaded to failure and as such the strength informed or estimated cannot to expected to yield absolute values of strength.
- ✓ These methods, therefore, attempt to measure some other properties of concrete form which an estimate of its strength, durability and elastic parameters are obtained.

Some such properties of concrete are

- Hardness
- Resistance to penetration of projectiles
- Rebound number
- Ability to allow ultrasonic pulse velocity to propagate through it

- ❖ The electrical properties of concrete, its ability to absorb scatter and transmit X-rays and Gamma – rays.

- ❖ Its response to nuclear activation and its acoustic emission allow us to estimate its

- Moisture content
- Density
- Thickness
- Cement content

Based Upon the above, Various Non-Destructive methods of testing Concrete have been developed

NDT methods	Equipment used	Used to find
Surface hardness test	Williams testing pistol and impact hammers	Concrete strength
Rebound test	Rebound hammer	Concrete strength and for comparative investigations
Penetration and pull out techniques	Simbi hammer, split pins, the Windsor probe, and the pullout test	Strength estimations and for comparative studies
Dynamic or vibration tests	Resonant frequency and mechanical sonic and ultrasonic pulse velocity methods	Durability ,uniformity of concrete strength and elastic properties
Combined methods	Ultrasonic pulse velocity and rebound hammer	Strength of concrete
Radioactive and nuclear methods	X-rays and Gamma-rays penetration test	Measurement of density, thickness of concrete, neutron scattering and neutron activation
Radioactive and nuclear methods	Neutron scattering and Neutron activation method	Moisture and cement content determination
Magnetic and electrical methods	Magnetic method	Determining cover of reinforcement in concrete
	Electrical methods(microwave absorption techniques)	Measure moisture content and thickness of concrete
Acoustic emission techniques	-	To study the initiation and growth of cracks in concrete
Surfaces hardness methods	William testing pistol, frank spring hammer and Einbeck pendulum hammer	Measuring the surface hardness

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Admixtures (Chemical, Mineral)

Defined as materials, other than cement, water and aggregates, that is used as ingredient of concrete and is added to the batch immediately before or during mixing.

Admixtures can be classified by function as follows:

- Air-entraining admixtures
- Water-reducing admixtures
- Plasticizers
- Accelerating admixtures
- Retarding admixtures
- Hydration-control admixtures
- Corrosion inhibitors
- Shrinkage reducers
- Alkali-silica reactivity inhibitors
- Coloring admixtures
- Miscellaneous admixtures such as workability, bonding, damp proofing, Permeability reducing, grouting, gas-forming, ant washout, foaming, and pumping admixtures

The major reasons for using admixtures are:

- To reduce the cost of concrete construction
- To achieve certain properties in concrete more effectively than by other means
- To maintain the quality of concrete during the stages of mixing, transporting, placing, and curing in adverse weather conditions
- To overcome certain emergencies during concreting operations

Construction chemicals

- Construction curing compounds
- Polymer bonding agents
- Polymer modified mortar for repair and maintenance
- Mould releasing agents
- Protective and decorative coatings
- Installation aids
- Floor hardeners and dust-proofers
- Non-shrink high strength grout
- Surface retarders
- Bond – aid for plastering
- Ready to use plaster
- Grunting aid

- Construction chemicals for water-proofing
  - Integral water-proofing compounds
  - Membrane forming coatings
  - Polymer modified mineral slurry coatings
  - Protective and decorative coatings
  - Chemical DPC
  - Silicon based water-repellent material
  - Waterproofing adhesive for tiles ,marble and granite
  - Injection grout for cracks
  - Joint sealants

Concrete and Environment

There is increasing concern now that the choice of construction materials must also be governed by ecological considerations.

General: Introduction

Choice of construction materials must also be governed by ecological considerations.
At the beginning of the 20th Century, the world population was 1.5 billion; by the end of the 20th Century it had risen to 6 billion. Considering that it took 10,000 years - last ice age for the population to rise to the 1.5 billion mark, the rate of growth from 1.5 to 6 billion people is remarkable.

At the beginning of the 20th Century, approximately ten percent of the people lived in cities; in the year 2001 nearly three of the six billion inhabitants live in and around the cities.
Unfortunately, our technology choices have turned out to be wasteful because decisions are based on short term and narrow goals of the enterprise rather than a holistic view of the full range of consequences from the use of a technology.
Only 6% of the total global flow of materials, some 500 billion tons a year, actually ends up in consumer products whereas much of the virgin materials are being returned to the environment in the form of harmful solid, liquid, and gaseous wastes

The greatest environmental challenge today is that of the human-made climate change due to global warming caused by steadily rising concentration of green-house gases in the earth's atmosphere during the past 100 years
In a nature-centered capitalism, the environment will no longer be treated as a minor factor of production but rather an envelope containing, provisioning, and sustaining the entire economy
Ordinary concrete, typically, contains about 12 percent cement, 8 percent mixing water, and 80 percent aggregate by mass.

This means that, in addition to 1.5 billion tonnes of cement, the concrete industry is consuming annually 9 billion tonnes of sand and rock together with one billion tonne of mixing water.

Challenge I:

Environmental Impact World demand/year

- •11.5 billion ton of concrete
- •1.5 billion ton of cement
- •1 billion ton of water
- • 9 billion ton of aggregate

1.5 billion ton of cement - Generates 1.5 billion ton of CO_2 Responsible for 5% - CO_2 production in the world

1 billion ton of water - 110,000 times the amount of water in the SF Bay

9 billion ton/y of aggregate Depletion of natural resources

Challenge II:

Long-term durability Civil Infrastructure quickly deteriorating of the 597,340 bridges in this country, 73,784, or about 12.4 percent, are structurally deficient.

Major deterioration Corrosion of reinforced concrete

- Sulfate attack
- Alkali silica reaction
- Hot weather

Future Demand for Concrete:

The 11.5 billion tonnes-a-year concrete industry is thus the largest user of natural resources in the world. The demand for concrete is expected to grow to approximately 18 billion tons (16 billion tonnes) a year by 2050. The mining, processing, and transport of huge quantities of aggregate, in addition to billions of tons of raw materials needed for the cement manufacture, consume considerable energy and adversely affect the ecology of virgin lands

Both in developed and developing countries, gigantic construction projects are underway in the metropolitan areas not only for new construction but also for rehabilitation or replacement of existing structures.

Reducing the Environmental Impact of Concrete Portland cement is a product of an industry that is not only energy-intensive but also responsible for large emissions of CO_2 -- a major green-house gas. The manufacture of one ton of Portland-cement clinker releases a ton of CO_2 into the atmosphere. The world's yearly cement output of 1.5 billion tonnes of mostly Portland cement, accounts for nearly 7 percent of the global CO_2 emissions.

Industrial ecology the waste product of one industry is recycled as a substitute for virgin raw material of another industry, thereby reducing the environmental impact of both.

Opportunities Over a billion tons of construction and demolition wastes are being disposed of in road-bases and landfills every year, in spite the fact that cost-effective technologies are available to recycle most of it as a partial replacement for coarse aggregate in concrete mixtures.

Most waste-waters and undrinkable natural waters can be substituted for municipal water for mixing concrete unless proven harmful by testing

Blended Portland cements containing fly ash from coal-fired power plants and granulated slag from the blast-furnace iron industry provide excellent examples of industrial ecology because they offer a holistic solution to reduce the environmental impact of several industries

Technology for Green Concrete The high-volume fly ash provides a promising of how we can build concrete structures in the future that would be far more durable and resource-efficient than those made of conventional Portland-cement concrete. Whether as a component of blended cements or as a mineral admixture added to concrete during mixing, the fly ash content of HVFA concrete mixtures is typically between 50 to 60 percent by mass of the total cementitious material.

A Better Concrete in the Future Although as a structural material concrete generally has a history of satisfactory performance, it is expected that even a better product will be available in the future owing to overall improvements in elastic modulus, flexural strength, tensile strength, impact strength, and permeability

A reduction of the water content in a concrete mixture decreases the porosity of both the matrix and the interfacial transition zone and thus has a strengthening effect. Again, the presence of a pozzolan in a hydrating cement paste can lead to the processes of pore-size and grain-size refinement

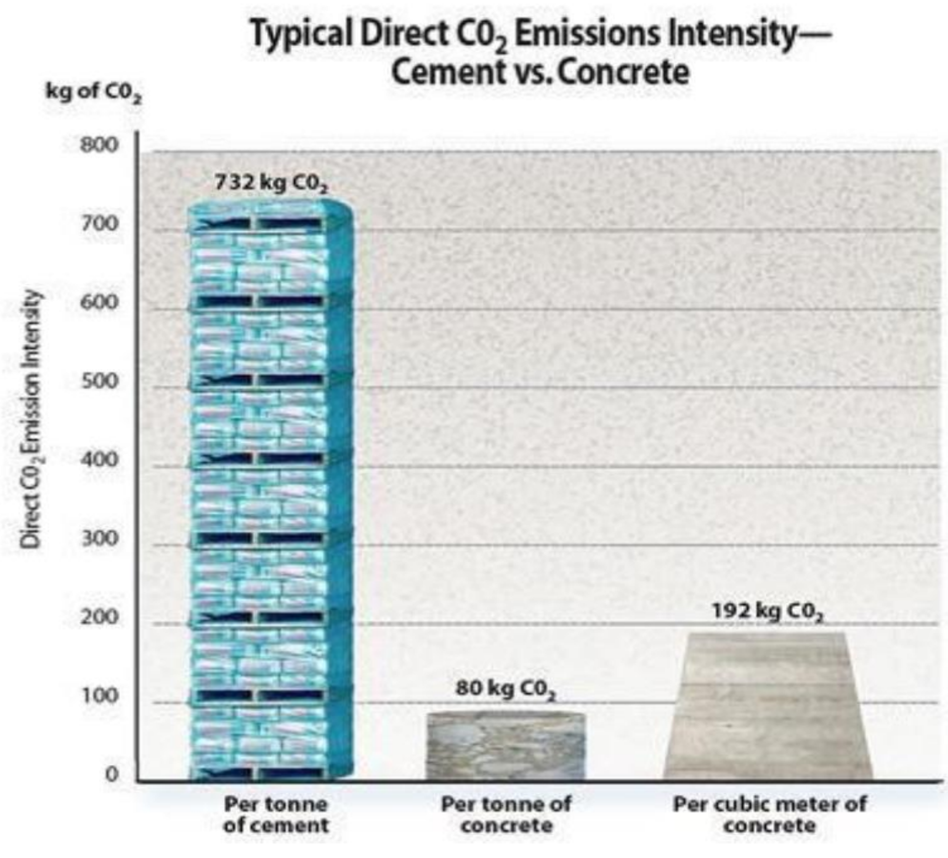
Improved concrete (1) A better control of the bleeding tendency in concrete mixtures will be sought through proper aggregate grading, and the use of water-reducing and mineral admixtures (e.g., fly ash or finely ground natural pozzolans or slags).

Improved concrete (2) Fiber reinforcement of concrete that is subject to cyclic or impact loads will be commonly practiced. For developing countries, the use of natural organic fibers (such as sisal fiber and rice straw) presents interesting possibilities.

The use of centralized and high-speed concrete mixers instead of truck mixing will help in the production of more homogeneous concrete than is generally available today.

Environmental Benefits

Low CO_2 intensity - the production of concrete, which consists of 10% - 15% cement, results in emissions of about 0.13 tonne of CO_2 per tonne of concrete, equal to 1/9 the emissions of cement. Concrete manufacturing results in less CO_2 per unit than almost all other construction materials, making it the sustainable construction material of choice.



- Resource efficient - the ingredients for concrete - sand, gravel and limestone - are abundant worldwide. Quarries are readily reclaimed for recreation, residential or commercial development. They can also be restored to their natural state.
- Local resource - because the ingredients of concrete exist almost everywhere, concrete can be manufactured near a job site, requiring minimal energy for transportation. At least 60% of all concrete is made within 160 km of the job site. Wood and steel products, on the other hand, typically travel hundreds or even thousands of kilometers.
  - Less construction waste - as concrete is manufactured to specifications, only the product that is required is delivered to the site. This means that less material is sent to landfill upon project completion.
  - Reusable - many concrete products can be reused, such as concrete pavers and precast wall panels. Concrete sidewalk slabs are reused to build "dry stone" retaining walls. A well designed concrete building with long floor spans and column-free space is adaptable to a succession of different occupants.
  - Recycling medium - Concrete makes waste products useful. Concrete is ideal as a medium for the inclusion of recycling waste or industrial byproducts such as blast-furnace slag (from steel making) and fly ash (from coal-burning electric plants). About a third of the fly ash produced annually in the U.S. is used in concrete. Use of such industrial by-products as Supplementary Cementing Materials (SCMs) to replace some of the cement in concrete mixtures also improves product performance for specific applications.
  - New life for old concrete - Used concrete can be 100% recycled as aggregate for use in roadbeds or as a granular material. Concrete yields 45% to 80% coarse aggregate usable for new concrete mixtures. The rest can be crushed and re-used as base material for roadbeds, parking lots or other applications.
  - Replenishes aquifers - Pervious concrete pavement and permeable interlocking concrete pavers can be used to reduce storm water runoff and allow water to return to the water table.