



R.C.Patel College Of Engineering & Polytechnic, Shirpur

Department of Civil Engineering



Course Title- Emerging trends in civil Engineering
Programme Name -Civil Engineering

Course Code -315315
315009
Semester-Third

Unit	Title	COs	Learning hours	R Level	U Level	A Level	Total Marks
II	Advance Construction Materials	CO2	06	6	6	2	12

CO2 - Select the relevant advance materials for given civil engineering work.

- 2.1 Properties and applications of building materials: Pollution absorbing bricks, Cooling bricks, 3D printed bricks, Interlocking bricks, Translucent wood, Sound proofing walls, Epoxy flooring.
- 2.2 Properties and applications of road materials: Recycled asphalt shingles, Self healing asphalt, Precast Pre-stressed Concrete Panels (PPCP)
- 2.3 Properties and applications of concrete materials: Synthetic concrete, New admixtures: Masterglanium, Polycarboxylic Ether, Nano concrete, Light transmitting concrete, Foam concrete, Bendable concrete or Engineered Cementitious Composite (ECC), Concrete Fabric, Hydrophobic concrete, Green concrete, Timbercrete, Ferrock.

BUILDING MATERIALS: —

* Artificial sand: — Natural sand is the outcome of wearing of rocks producing different grades or sizes.

As per IS 383:2016

Natural sand: — Fine aggregates resulting from the natural disintegration of rock.

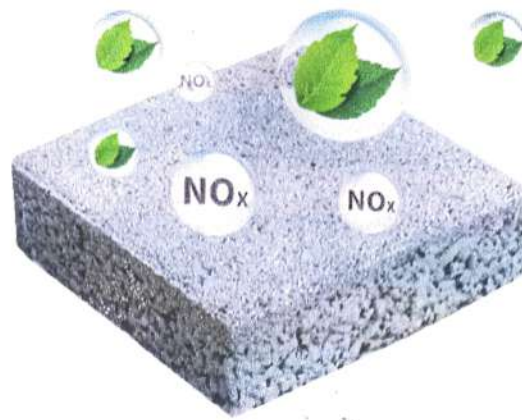
Crushed sand: — Obtaining by crushing hard rock.

Mixed sand: — Produced by blending natural sand & crushed sand in suitable proportion.

BRICKS

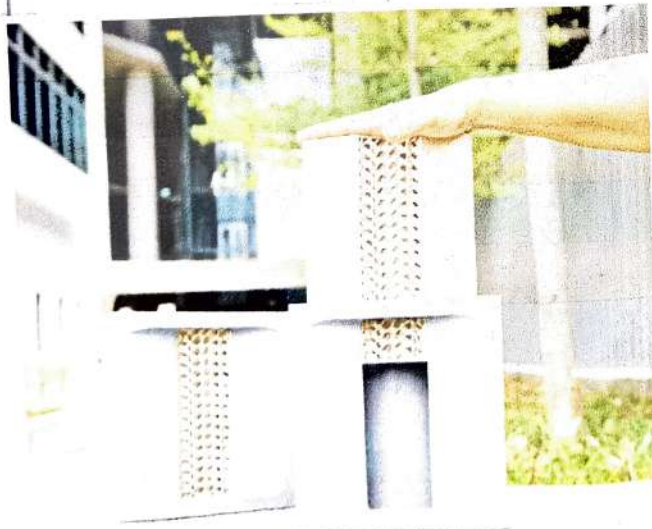
1. Pollution absorbing bricks: —

- Ecofriendly materials designed to reduce air pollution
- Bricks are coated with titanium dioxide (TiO_2)
- TiO_2 treated with sunlight and break down harmful air pollutants
- It is also available in porous structures that can trap particulate matter from the air



2. cooling bricks:-

- As per Name, this bricks specially design to reduce temp. inside building without using any electricity
- principle behind the construction of this brick is passive cooling.
- This bricks is made up by clay, terracotta, concrete or ceramic materials with specially designed cavities.



Advantages:-

- Eco-friendly.
- Energy efficient
- Improves comfort
- Durable and strong.
- sustainable
- low maintenance.

3. Interlocking bricks:-

- These bricks are designed in a such way that, there is no use of mortar in between joints.
- They have projections and grooves for interlocked adjacent bricks
- They are made up by cement concrete, stabilized soil, fly ash or clay.

bricks are widely used.

Advantages:-

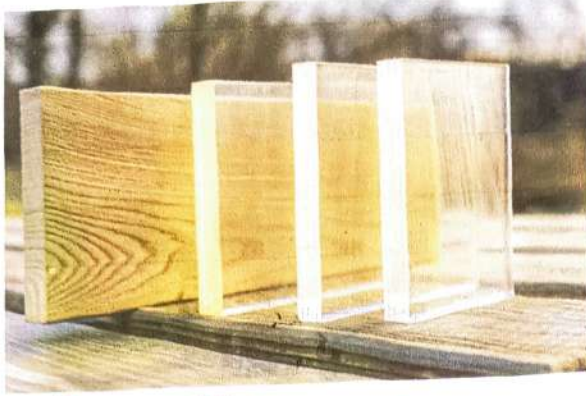
1. Cost-effective
2. Faster construction.
3. durable
4. Eco-friendly.
5. Better seismic resistant.

4. Translucent wood:-

- it is advanced construction material, allows light to pass through while maintaining the natural strength.
- By removing lignin from wood and filling the natural porous structure with transparent polymer such as epoxy and acrylic resin.

Advantages:- ① Energy efficient

- ② High strength. ④ Eco-friendly
③ Light weight ⑤ Improves appearance



⑤ Sound proofing walls:—

- This walls generally used in those areas where the Noise pollution is more than normal.
- these walls are constructed by using sound absorbing or sound insulation materials such as glass wool, acoustic foam, gypsum, etc.
- To provide sound proof, comfort by reducing airborne and impact noise

Advantages:—

- 1) Improves privacy.
- 2) Enhance comfort.
- 3) Energy efficient.
- 4) Fire resistant.
- 5) Easy installation.
- 6) Less maintenance.



⑥ Epoxy Flooring:-

- Instead of traditional flooring epoxy flooring is used widely due to it's strong, durable, and aesthetically pleasing flooring solution.
- They are made up by applying epoxy resin and hardener over concrete surface.
- it is widely used in industrial, commercial, institutional buildings.



Advantages:-

- 1) high durable
- 2) Chemical resistant.
- 3) Easy to clean.
- 4) pleasant appearance.
- 5) Fast construction.

Properties and Applications of Road Materials:-

1. Recycled Asphalt shingles:-

- Asphalt shingles are obtained from waste from manufacturing and construction/demolition waste.
- such material containing high asphalt binder and mineral aggregates,



properties:-

- it contains 20-40% asphalt binder.
- high recycling potential
- it has high durability.

Applications:-

- surface and binder pavement.
- Road infrastructure
- used in airport pavement.

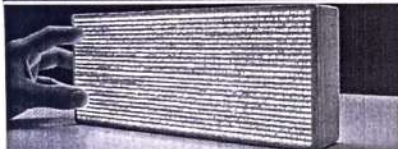
2. Self healing asphalt:- It is an advanced construction material,

- it is an innovative material used to fill micro-cracks.
- Asphalt contain rejuvenating agent.

- properties:-
- it fill micro-cracks automatically
 - Extreme fatigue resistance.
 - Enhance flexibility - Reduce maintenance.

ADVANCED CONCRETE MATERIALS

LIGHT TRANSMITTING CONCRETE (LiTraCon)



Light transmitting concrete is a translucent concrete that allows light to pass through it. It is made by embedding optical fibers in concrete.

PROPERTIES

- Allows natural light transmission
- High compressive strength (similar to normal concrete)
- Good durability and weather resistance
- Energy efficient – reduces need of artificial lighting
- Provides aesthetic and modern appearance

APPLICATIONS



Architectural wall cladding

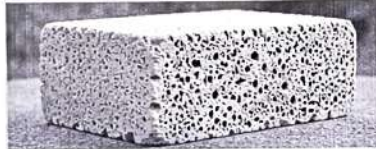
Facade panels & Partition walls

Walkways & Pavements

Decorative elements & Interiors

Composition : Fine concrete mix + Optical fibers (glass or plastic)
Typical Thickness : 25 – 50 mm
Light Transmission : Up to 5-6% (depends on fiber density)

FOAM CONCRETE



Foam concrete is a lightweight concrete consisting of cement, water, sand (or fly ash) and pre-formed foam. It contains uniformly distributed air voids.

PROPERTIES

- Very lightweight (400 – 1800 kg/m³)
- Good thermal insulation
- Low sound transmission
- Fire resistant
- Easy to pump and place
- Economical and reduces dead load

APPLICATIONS



Roof insulation & Screeds

Precast wall panels

Filling in voids & Cavity filling

Road sub-base & Trench backfill

Composition : Cement + Water + Sand/Fly ash + Foam
Typical Density : 400 – 1800 kg/m³
Compressive Strength : 1 – 10 MPa (depends on density)

BENDABLE CONCRETE / ENGINEERED CEMENTITIOUS COMPOSITE (ECC)



ECC is a fiber reinforced cementitious composite that exhibits high ductility and strain-hardening behavior in tension. It can bend without breaking.

PROPERTIES

- High tensile strain capacity (3–5%)
- Strain-hardening behavior
- Multiple fine cracks (self-controlled)
- High durability and impact resistance
- Excellent flexural and tensile strength
- Can be used in thin sections

APPLICATIONS



Seismic resistant structures

Thin overlays & Repairs

Precast elements & Connections

Bridges, tunnels & Infrastructure

Composition : Cement + Fine sand + Water + Fibers (PVA/PE/Steel) + Admixtures
Tensile Strain Capacity : 3 – 5%
Typical Thickness : 10 – 25 mm (can be very thin)



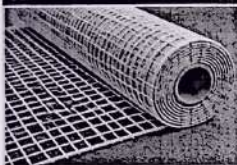
BENEFITS OF THESE ADVANCED CONCRETES

- ✓ Sustainable construction
- ✓ Energy efficient
- ✓ Innovative & aesthetic designs
- ✓ High performance & durability



ADVANCED CONCRETE MATERIALS

1. CONCRETE FABRIC



Concrete fabric is a prefabricated mesh made of high-strength fibers (glass, carbon or basalt) coated with a polymer. It is used to reinforce concrete, control cracking and improve durability.

PROPERTIES

- High tensile strength
- Reduces plastic shrinkage cracking
- Easy and quick to install
- Improves impact and abrasion resistance
- Corrosion resistant
- Alkali resistant

APPLICATIONS

- Slabs on ground
- Pavements and overlays
- Tunnel linings
- Precast elements
- Crack control in concrete

COMPOSITION

High strength fibers (glass / carbon / basalt) + Polymer coating

2. HYDROPHOBIC CONCRETE



Hydrophobic concrete is treated with special chemicals that reduce water absorption by repelling water. It increases durability by preventing moisture ingress.

PROPERTIES

- Water repellent
- Reduces water absorption
- Improves resistance to freeze-thaw cycles
- Protects against corrosion
- Increases durability and service life
- Self-cleaning effect (reduces dirt accumulation)

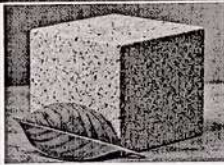
APPLICATIONS

- Bridges and marine structures
- Facades and exterior walls
- Water retaining structures
- Parking structures
- Monuments and heritage structures

COMPOSITION

Conventional concrete + Hydrophobic chemicals (silane / siloxane based water repellent)

3. GREEN CONCRETE



Green concrete is an eco-friendly concrete made by using supplementary cementitious materials and recycled materials to reduce environmental impact.

PROPERTIES

- Lower carbon footprint
- Utilizes industrial by-products
- Good durability and strength
- Reduces heat of hydration
- Improves sustainability
- Can contribute to LEED / GRIHA rating

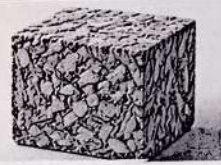
APPLICATIONS

- Sustainable buildings
- Infrastructure projects
- Pavements
- Precast products
- Mass concrete works

COMPOSITION

Cement + SCMs (fly ash, GGBS, silica fume, metakaolin) + Recycled aggregates / reclaimed materials + Admixtures

4. TIMBERCRETE



Timbercrete is a lightweight insulating concrete made by using wood particles, chips or shavings as aggregate. It provides good thermal and acoustic insulation.

PROPERTIES

- Lightweight
- Good thermal insulation
- Good acoustic insulation
- Fire resistant (when properly proportioned)
- Easy to work with
- Uses renewable resources

APPLICATIONS

- Non-load bearing walls
- Partition walls
- Roofs and floors (insulating layers)
- Sound proofing panels
- Rural and eco-friendly housing

COMPOSITION

Cement + Wood particles / chips / shavings + Water + Admixtures

5. FERROCK



Ferrock is an innovative concrete-like material that uses steel industry waste (steel slag) and binds CO₂ permanently. It is one of the most sustainable construction materials.

PROPERTIES

- Extremely low carbon footprint
- Utilizes steel slag and industrial waste
- High strength and durability
- Sequesters CO₂ permanently
- Good resistance to chemicals
- Long service life

APPLICATIONS

- Structural elements
- Road construction
- Coastal and marine structures
- Blocks and pavers
- Sustainable infrastructure

COMPOSITION

Steel slag + Activated minerals + CO₂ curing (carbon mineralization)

BENEFITS OF THESE ADVANCED CONCRETES



Sustainable & Eco-friendly



High Durability & Long Service Life



Improved Thermal & Acoustic Performance



Crack Control & High Ductility



Cost Effective in Long Term

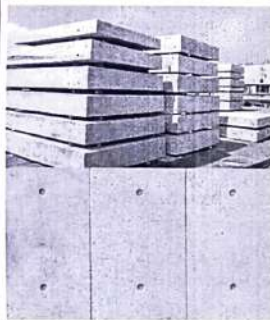


Contributes to Green Building Rating

PROPERTIES AND APPLICATIONS OF ADVANCED CONCRETE MATERIALS

Modern concrete materials and admixtures improve strength, durability, workability and sustainability to meet the demands of modern construction.

1. SYNTHETIC CONCRETE



Synthetic concrete is produced using artificially synthesized raw materials or industrial by-products to reduce dependence on natural resources.

Properties

- High early strength
- Uniform quality
- Low permeability
- Good resistance to chemicals
- Environment friendly (uses waste materials)

Applications

- Precast concrete elements
- Industrial structures
- Pavements and roadways
- Marine structures
- Sustainable construction projects

2. NEW ADMIXTURE – MASTERGLANIUM



MasterGlanium is a high-performance admixture based on advanced polycarboxylate technology.

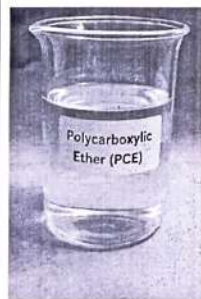
Properties

- Improves workability and flow
- High water reduction (20-30%)
- High early and ultimate strength
- Better durability and long-term performance
- Compatible with all types of cement

Applications

- High rise buildings
- Complex and high performance structures
- Precast and precast prestressed elements
- Mass concreting
- Concrete with low water-cement ratio

3. NEW ADMIXTURE – POLYCARBOXYLIC ETHER (PCE)



PCE is a superplasticizer based on polycarboxylate ether polymer.

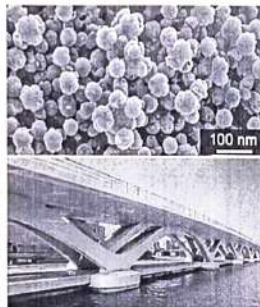
Properties

- Excellent water reduction (up to 30%)
- Superior slump retention
- High dispersion capability
- Low dosage requirement
- Reduces permeability and improves durability
- Improves finish and reduces segregation

Applications

- Ready mix concrete
- Self compacting concrete (SCC)
- High strength and high performance concrete
- Precast, prestressed and post-tensioned concrete
- High workability concrete in hot weather

4. NANO CONCRETE



Nano concrete is produced by using nano materials like nano silica, nano clay, nano alumina to enhance concrete properties.

Properties

- Very high strength and durability
- Low permeability
- Improved resistance to chloride and chemicals
- Better abrasion and wear resistance
- Enhanced bond and microstructure

Applications

- High performance and long life structures
- Bridges, tunnels and marine structures
- Repair and rehabilitation works
- High rise buildings
- 3D printing concrete and specialized concrete

BENEFITS OF USING ADVANCED CONCRETE MATERIALS



Higher Strength



Improved Durability



Better Workability



Longer Service Life



Sustainable Construction



Cost Effective