# GANDHI INSTITUTE OF ADVANCED COMPUTER AND RESEARCH

## RAYAGADA

(Approved by AICTE, Affiliated to SCTE&VT and BPUT - Odisha)

## DEPT OF CIVIL ENGINEERING

# CONCRETE DIALOGUES

2023-24

# Editorial Board



It gives us immense pleasure to present *Concrete Dialogue*, the annual departmental magazine of the Civil Engineering Department. This publication stands as a reflection of the academic excellence, technical competence, and creative spirit of our students and faculty members.*Concrete Dialogue* is a platform where knowledge meets creativity. Authored and edited by students and teachers, the magazine is published in English and showcases a comprehensive report of departmental activities. The magazine provides an opportunity for budding civil engineers to express their innovative ideas, technical insights, research interests, and creative abilities. It encourages students to develop the habit of reading, writing, critical thinking, and professional communication — essential qualities for a successful engineer.

The Editorial Board comprises the Editor, Co-Editor, and Faculty Coordinators who work collectively to review and select quality contributions. We sincerely appreciate the enthusiastic participation of students and staff who contribute articles, technical papers, project summaries, site experiences, creative writings, and innovative ideas.This magazine not only documents the academic journey of the department but also serves as a source of inspiration for students to learn from the experiences and achievements of their peers. We hope that *Concrete Dialogue* continues to motivate young minds to build not only strong structures but also strong ideas for the betterment of society.

**Publisher**

**Gandhi Institute of Advanced Computer and Research, Rayagada**

**Message from Chairman**

**Dr. Chandra Dhwaja Panda**

It gives me immense pleasure to release the current issue of the technical magazine *CONCRETE DIALOGUE* for the academic year 2023–2024, with a special emphasis on civil engineering. This edition stands as a productive technical resource and a skill-enhancing platform for aspiring civil engineers.

Civil engineering is not merely about structures and materials—it is a canvas for imagination and innovation. It offers a dynamic space for independent thinkers to transform ideas into tangible realities. True engineering education goes beyond infrastructure; it nurtures creativity, fosters collaboration, and builds the capacity to work across disciplines—be it with architects, urban planners, environmentalists, or entrepreneurs.

This issue of *CONCRETE DIALOGUE* captures the spirit of civil engineering through a rich blend of technical articles, project showcases, and student-led innovations. It also highlights co-curricular and extra-curricular engagements at both national and international levels, including conferences, faculty development programs, and institute-industry interactions. Seminars and workshops on sustainable construction, smart infrastructure, and emerging technologies further enrich the learning experience.

I am confident that this edition will be both informative and inspiring for students, faculty, and professionals alike. I extend my heartfelt appreciation to the coordinators and editorial team for their tireless efforts in bringing this issue to life. May *CONCRETE DIALOGUE* continue to illuminate the path of innovation and excellence in civil engineering.

Warm wishes and continued success to all!

**Message from Secretary**

**Mr. Manoj Kumar Palo**

It is with great pride and enthusiasm that I present the latest edition of *Concrete Dialogue*, our annual magazine dedicated to the vibrant world of civil engineering. This publication reflects the collective spirit, innovation, and academic rigor that define our department.

*Concrete Dialogue* serves not only as a technical repository but also as a platform to showcase the creativity and commitment of our students and faculty. From sustainable construction practices to smart infrastructure solutions, the articles and features in this issue highlight emerging trends and thoughtful explorations in the field.

The magazine also captures the essence of our co-curricular and extra-curricular engagements—conferences, workshops, industry collaborations, and student achievements—that enrich our academic environment and foster holistic development.

I commend the editorial team and contributors for their dedication in curating this insightful volume. May *Concrete Dialogue* continue to inspire, inform, and ignite curiosity among readers.

Warm regards,

## Message from the Principal

**Dr. Pratap Chandra Mishra**

It gives me immense pleasure to release the annual edition of Concrete Dialogue, a magazine that encapsulates the academic vibrancy, technical excellence, and creative spirit of our Civil Engineering Department.Civil engineering plays a pivotal role in shaping the world around us—from resilient infrastructure to sustainable urban development. This magazine reflects the dedication of our students and faculty in exploring innovative solutions and advancing knowledge in this vital field.

Concrete Dialogue is more than a compilation of articles; it is a testament to the collaborative efforts, intellectual curiosity, and achievements that define our academic culture. It highlights not only technical insights but also the diverse engagements of our students in seminars, workshops, competitions, and industry interactions.

I congratulate the editorial team and all contributors for their commitment to producing a publication that informs, inspires, and celebrates the spirit of engineering. May this edition serve as a source of motivation and a reminder of the boundless possibilities that lie ahead.

Best wishes for continued success and excellence.

## Message from the Head of the Department

**Ms. Jyoti Reddy**

It is with great pride that I present this edition of *Concrete Dialogue*, our annual magazine that captures the essence of academic growth, technical innovation, and creative exploration within the Department of Civil Engineering.

This publication reflects the collective efforts of our students and faculty, showcasing insightful articles, project highlights, and glimpses into the vibrant academic life that defines our department. From sustainable construction practices to emerging technologies like BlockIoT, our community continues to push boundaries and embrace forward-thinking solutions.

*Concrete Dialogue* stands as a testament to our commitment to nurturing talent, fostering interdisciplinary learning, and promoting a culture of inquiry and excellence. I commend the editorial team for their dedication and all contributors for enriching this magazine with their perspectives and achievements.

May this edition inspire continued curiosity, collaboration, and a deeper appreciation for the transformative power of civil engineering.

**Vision and Mission of the Institution**

## Vision

To become a globally recognized, value-driven educational institution committed to excellence in delivering quality education, nurturing students' inherent talents, and developing innovative professionals in technical and managerial fields, thereby equipping them to meet the future challenges of the global economy.

## Mission

**$M_1$:** To deliver quality education through effective teaching–learning processes that foster academic excellence in technical and managerial disciplines.

**$M_2$:** To nurture students' inherent talents by encouraging creativity, critical thinking, innovation, and lifelong learning.

**$M_3$:** To develop competent and ethical professionals with strong values, leadership skills, and social responsibility.

**$M_4$:** To promote industry-oriented learning and research through collaboration, practical exposure, and adoption of emerging technologies.

**$M_5$:** To prepare globally competitive graduates capable of adapting to evolving challenges and contributing effectively to the global economy.

## Vision & Mission of Department of Civil Engineering

### Vision

To emerge as a center of excellence in civil engineering education, delivering globally relevant knowledge and developing ethically strong engineers dedicated to building the nation.

### Mission

M1: To provide strong foundational and advanced knowledge in civil engineering and technology through effective teaching–learning processes.

M2: To inculcate ethical values and professional responsibility among students to develop socially responsible engineers.

M3: To promote practical learning and industry interaction through fieldwork, internships, and real-world projects.

M4: To encourage innovation, research, and sustainable engineering practices addressing global and societal needs.

M5: To prepare competent civil engineers capable of contributing effectively to infrastructure development and national growth.

## CONTENT

# WATER RESOURCES ENGINEERING IN CIVIL

**By Alaka Labanya, 3rd year civil**

What is water resources engineering?Water resources engineering is the study andmanagement of equipment, facilities and techniquesthat are used to manage and preserve life’s mostplentiful resource. In addition to assessing how andthe best ways in which to control water as it pertainsto water-related activities − such as irrigation, wastedisposal and canal development − water resourceengineers are also frequently involved in watermanagement to ensure that it’s safe to drink bothfor humans, plants and animal usage.

Water resource engineers may be tasked withthe awesome responsibility of ensuring that theplanning and management of available water supplyare adequately leveraged and remain safe to usefor as long as possible. They may also be involvedin water treatment so that the quality of water isimproved upon for various end uses, whether that’srecreationally, commercially or industrially.

Why is water resources engineering important?Resources, by their very nature, are finite. There areonly a small handful that are naturally renewable −such as wind, solar, hydro and biomass. While watermay be renewable in terms of the many differentways it can be used and reused, it’s not as abundantas it once was, which many earth scientists andclimatologists point to as a function of climatechange.

Water resource engineers may be charged withdeveloping new systems or processes for private orgovernment entities that can preserve freshwatersources and find new ones. This may requirethe assistance of civil engineers involved as well,designing water purification methods throughdesalination or creating new equipment forcontaminant transport when water is used forirrigation purposes. Understanding what worksand what doesn’t when it comes to water resourcemanagement is often a combined effort and mayinvolve a number of different analyses, includinghydrologic, which is the study of the water cycleand directions in which it flows, which may beinfluenced by weather and other environmentalforces

**STRUCTURAL DESIGN IN CIVIL ENGINEERING**

**By Janaki Khosla, 3rd year civil**

What is Structural Design in Civil Engineering?

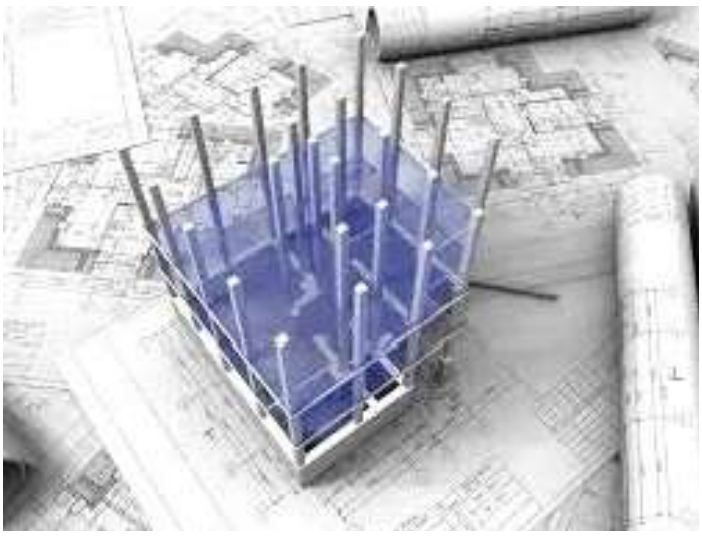
Civil engineering is considered the second-oldestengineering discipline, with military engineeringconsidered the oldest. Civil engineering is aprofessional discipline that deals with the design,construction and maintenance of the physically andnaturally built environment, especially public sectorworks such as roads, bridges, dams, highways,airports, pipelines, sewage and drainage systems,railways, ports and all the rest.

The professional discipline of civil engineeringoffers many opportunities for specialization. Coastalengineers specialize in building coastal structureslike ports, harbors, levies and storm surge barriersthat protect populated areas from flooding anderosion. Environmental engineers specialize in thedesign and construction of structures and facilitiesthat treat chemical, biological or thermal wastes.There are even geotechnical engineers that analyzethe composition of soil to ensure the safety andreliability of building foundations and retainingwalls.

In this blog post, we’re focusing in on one particularaspect of civil engineering: structural engineering.Structural engineering deals with the design andstructural analysis of buildings, bridges, towers,lighthouses, tunnels, and even off-shore structureslike oil rigs.

Structural engineers may use somecreativity to design a structure with visual appeal,but they must also ensure that the structure is safeand stable for its intended use. Keep reading to learnmore about structural design in civil engineering.Basic Principles of Structural Design

Structural engineers combine the core principlesof structural design with a sound backgroundin physics and materials science to ensure thatstructures are built to withstand the loads and forcesthat they will encounter during their usage.Civil engineers that design structure for constructionprojects must be excellent problem solvers. Thedecisions that structural engineers make duringthe structural design phase of the project will affecteverything from the project cost and duration to theultimate safety and viability of the structure.Below, we highlight some of the most importantfactors that structural engineers must considerwhen designing a building.



# SOIL MECHANICS

**By Hasini Kousalya, 1st year Civil**

The term Soil Mechanics was coined by KarlTerzaghi in 1925. He is popularly known as thefather of Soil Mechanics. Soil Mechanics is thestudy of soil, its behaviour, and its use as a materialfor engineering, which is the focus of the civilengineering subject.In engineering problems involving sedimentsand other unconsolidated accumulations of solidparticles that are produced by the mechanicaland chemical disintegration of rocks, regardlessof whether they contain an admixture of organiccomponents or not, soil mechanics is the applicationof laws of mechanics and hydraulics.

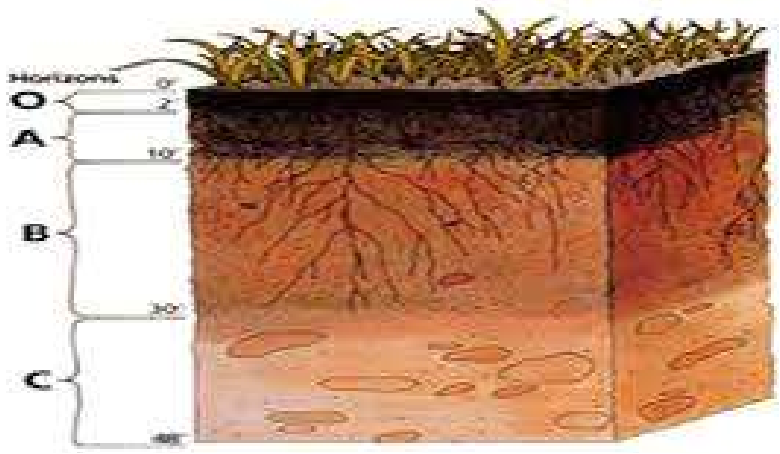
## Importance of Soil Mechanics

1. Soil mechanics ensures safe and stablefoundation design for structures.
2. It analyses slope stability and preventslandslides and slope failures.
3. Soil mechanics guides the design of retainingstructures.
4. It facilitates the selection and implementationof soil improvement techniques.
5. It assesses and mitigates geotechnical hazards.
6. Soil mechanics is crucial for designingunderground structures.

## Application of Soil Mechanics

The applications of soil mechanics are wide-rangingand include:

- Foundation engineering and design.
- Slope stability analysis and landslide mitigation.
- Retaining wall design and construction.
- Earthworks and embankment design.
- Geotechnical investigation and sitecharacterization.
- Soil improvement techniques and groundmodification.
- Underground structure design, such as tunnelsand deep foundations.
- Pavement design and analysis.
- Evaluation of soil liquefaction potential.




**PAVEMENT DESIGN**

By Tuna Ataka, 1st year Civil

A layered structure supported by soil subgradeto form the carriageway of a road is called roadpavement.It is of two types

(1) Flexible pavement or bituminous pavement orblack top pavement

(2) Rigid pavement or cement concrete pavementor white surface pavement

**Purpose of road pavement**

• To carry heavy loads of vehicular traffic andto distribute the same over the larger areaunderlying subgrade soil.

• To prevent the subgrade soil from bad effect ofweathering agencies.

• To provide a smooth riding surface

**Types of road Pavement**

• Flexible pavement

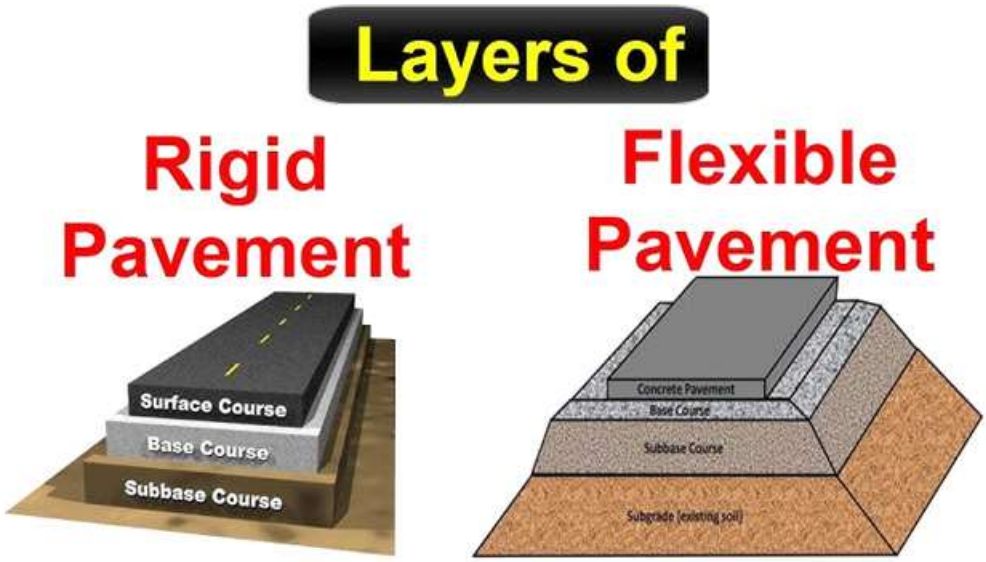
• Rigid pavement

Flexible pavement: The road pavements whichcan change their shape to some extent withoutany rupture are known as flexible pavements.Any change of shape occurring in the subgradeand subsequent layers over its reflected on the topsurface of the pavement.

**Examples:** All bituminous roads, gravel roads,water bound macadam roads, wet mix macadamroads etc.

**Rigid pavement:** The road pavement which cannot change their shape without rupture are knownas rigid pavements.

• Any change of shape occurring in the subgrade isnot reflected by the surface of these pavements.Examples; Cement Concrete pavements, ReinforcedCement Concrete pavements etc.




**CAVITY WALL INSULATION**

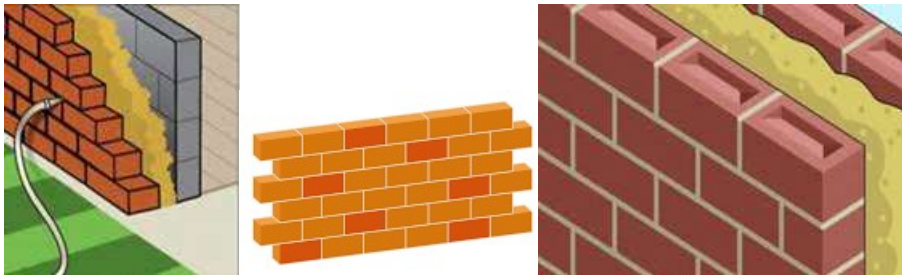
**By Partho Kousalya, 1st year Civil**

The cavity walls of the Visitor Centre have beenfilled with insulation which reduces the amount ofheat lost through the walls. The installation was astraight forward process and involved the installerdrilling small holes (22mm across – slightly smallerthan the size of a 10p piece) at around 1m intervalsinto the outside walls. The insulation was thenblown into the cavity.

**How it Works**

Heat loss occurs because heat naturally flows fromhot objects or areas to colder ones. During winter,when a building is warmer than the air outside, heatwill flow out of the building

through poorly insulatedsolid surfaces such as walls, roofs and windows.Cavity wall insulation creates a barrier between theinside and outside of the building which reduces the amount of heat being lost through the walls. Thishelps to save money on heating bills as the heatingsystem won't have to keep switching on to replacethe heat escaping through the walls.



**For Your Home**

If your home was built after 1930, it is likely to havecavity walls. Cavity walls are made of two layersof brick with a small gap or 'cavity' between themwhich can often be filled with insulation whichcan be made from mineral wool, beads, granulesor foam. Installing cavity wall insulation can savearound 20% on your fuel bill. If your home has cavitywalls but was built after 1995, the walls mightalready be insulated. An installer can check if youhave un-insulated cavity walls and whether yourhome is suitable for insulation. If your home hassolid walls (pre 1930), they can still be insulated– from the inside by fitting rigid insulation boardsto the wall, or by building a stud wall filled in withmineral wool fibre or externally by fixing a layer ofinsulation material to the wall, then covering it witha special type of render (plasterwork) or cladding.The finish can be smooth, textured, painted, tiled,panelled, pebble-dashed, or finished with brickslips. Solid wall insulation could save you around60% on your fuel bills.

**COPPER SLAG AS A SUBSTITUTEIN CEMENT AND CONCRETE**

**By Ranjit Suna 2nd Year Civil**

purification process that is produced at variousstages. Copper slag is widely utilized as anabrasive, as well as a construction ingredient in themanufacturing of concrete and paving materials.Despite, the giant quantities of waste copper slagresults in land filling issues. Land filling of wastecopper slag convert the land into unfertile soiland as result creates environmental problems.Therefore, the waste copper slag may be used asan alternative material in producing sustainableconstruction materials that lead to both economicaland environmental benefits. Most of the studiesobserved that up to 15% by using the weightof copper slag as Portland cement replacementimproves in stress due to declining capillaryporosity related to hydrated lime and 40–50% and40–60% (by weight of sand) of copper slag can beused as a substitute for fine aggregates and coarsecombination concrete is improvement in strength.This paper summarizes the use of waste copper slagin producing concrete as aggregate and as a partialreplacement to cement. Furthermore, the effect ofwaste copper slag on the mechanical, durability andthe effect of elevated temperatures on the propertiesof concrete are presented.

**Copper slag can be used in concrete in thefollowing ways:**

• Fine aggregate in cement mortars

• Coarse aggregates in high strength concrete

• Raw materials for clinker, cementreplacement, coarse and fine aggregates

Copper slag can be used up to 60% without anyharmful impact on the mechanical strength ofconcrete. However, copper slag has lower waterabsorption and creates higher slump which causesbleeding in concrete.

## CSIBRIDGE: AN INTEGRATEDBRIDGE DESIGN TECHNOLOGY

**By Reena Naik, 2nd Year Civil**

Easy-to-use, integrated software program for modelling,analysis, and design of bridge structures. Theease with which all of these critical tasks can beaccomplished makes CSiBridge the most versatileand productive bridge design package in theindustry. Welcome to the new world of CSiBridge!A bridge can be analysed in CSiBridge by generatinga model, to determine the response of bridgestructures to the weight of vehicle live loads which it will carry to fulfil its objective. Considerablepower and flexibility are provided for determiningthe maximum and minimum displacements,forces, and stresses from multiple lanes loads oncomplex structures, such as highway interchanges.The effects of vehicle live loads can be combined

with static and dynamic loads, and envelopes of the response can be computed.The bridge model to be analysed can be createdusing easy to use templates accessed through theFile > New command or a general F.E.M. modelcan be built manually using frame, shell, solid and link elements. Alternatively, a mixed approachcan be used wherein part of bridge model can begenerated using templates and remaining modelcan be completed manually by adding frame orfinite element objects. The superstructure can berepresented by a simple “spine” (or “spline”) modelusing frame elements or it can be modelled in full3D detail using shell or solid elements. A spinemodel is the simplest model as it gives the completeresponse of a bridge structure quickly to get a “feel”of the problem at hand.Lanes are defined that represent a zone on thebridge where the live loads can move on thesuperstructure. Lanes may have width and canfollow any straight or curved path. Multiple lanesneed not be parallel or of the same length so thatcomplex traffic patterns may be considered. Theprogram automatically determines how the lanesload the superstructure, even if they are eccentricto a spine model. Conventional influence lines andsurfaces for loading of each lane can be displayedfor any response quantity. Vehicle live loads canbe selected from a set of standard highways andrailway vehicles or users can specify their ownvehicle live loads. Vehicles are grouped in vehicleclasses, such that the most severe loading of eachclass governs. Wheel loads for a

vehicle needn’tbe at a constant distance and may be at a variabledistance and CSiBridge will automatically workoutthe maximum response for a variable axle load too.

**What CSiBridge Can Do?**

CSiBridge offers the widest assortment of analysisand design tools available for the engineer workingon bridges. The following list represents just aportion of the features included in the CSiBridgesoftware:

- Bridge Analysis Options
- Staged Construction
- Cable-Stayed Bridge
- Stress Ribbon and Extradosed bridges
- CSiLoadOptimizer to find cable loads to have adesired Bridge profile
- Influence Surfaces
- Superstructure Design

– Steel and Concrete

- Load Rating
- Results and Output
- Bridge Animations
- Automated step-by-step Seismic Design of Bridgeincluding Nonlinear Pushover and/or Time HistoryAnalysis
- Bridge Wizard
- Bridge Object Modelling
- Section Designer
- Parametric Deck Sections
- Lanes and Vehicles
- Rail Track modelling for completely automated

Non-Linear Rail Structure Interaction analysis

- Bearing and Bridge Pier Modelling
- Post-Tensioned Box Girders
- Pretensioned Precast Bridge sections
- Cast in place (CIP) or precast Segmental Bridges
- Foundation Modelling including complex soilmodelling
- Loading and Analysis

Design Features

CSiBridge uses the SAPFire analysis engine, thestate-of-the-art equation solver that powers all ofCSI's software. This proprietary solver exploits thelatest in numerical technology to provide incrediblyrapid solution times and virtually limitless modelcapacity.

Superstructure designs can be performed on a varietyof superstructure types, including steel girder andprestressed concrete precast I-girder, bulb tees, boxand multicell box girders. The steel girder designallows engineers to optimize the design such thatthe girder properties may be resized and checkedinteractively. Stress, flexural, and shear designsin accordance with the IRC, AASHTO LRFD2012 (steel and concrete), AASHTO STD 2002(concrete), CAN/CSA-S6-06, and EUROCODE.The steel design results include a number of designplots that allow the user to view demand andcapacities for shear and flexure design results.

**SEFFECT OF SALT WATER ON THE COMPRESSIVESTRENGTH OF CERAMIC POWDER CONCRETE**

**By S. Sunil, 2nd Year Civil**

The ceramic industry inevitably generates wastes,irrespective of the improvements introduced inmanufacturing processes. This research examinesthe feasibility of using ceramic wastes in concreteand the effects of fresh and salt water environmentson the compressive strength of the concrete. Inthisstudy the cement has been replaced with ceramic
waste powder accordingly in the range of 0%,5%,10%, 15%, 20%, and 30% by weight for concretewhich was cured for 56 days in two liquid media(fresh and salt water).The findings revealed thatuse of waste ceramic enhances the properties ofconcrete cured both in fresh and salt water media,based on the results from the compressive test,higher compressive strength occurred in concretecured in salt water than fresh water. The resultsdemonstrate that the use of ceramic powder asactive replacement endows cement with positivecharacteristics like major mechanical strengthand the economic advantages. The concrete alsoexhibited a high compressive strength in both waterbodies. Reuse of this kind of waste has economic andenvironmental advantages (onshore and offshorestructures). Indirectly, all the above contribute toa better quality of life for citizens introduce theconcept of sustainability and greenhouse in theconstruction sector.

## GREEN CONCRETE

**By Tapan Bidika, 2nd Year Civil**

Concrete which is made from concretewastes that are eco-friendly are called as "Greenconcrete". Green concrete is the Production ofconcrete using as many as recycled materials aspossible and leaving the smallest carbon footprintas possible. The other name for green concreteis resource saving structures with reducedenvironmental impact for e.g. energy saving, CO2emissions, waste water.

The technology considers all phasesof a concrete construction's life cycle, i.e.structural design, specification, manufacturingand maintenance, and it includes all aspects ofperformance ,i.e.

• Mechanical properties (strength, shrinkage,creep, static behaviour etc.)
• Fire resistance (spalling, heat transfer etc.)
• Durability (corrosion protection, frost, newdeterioration mechanisms etc.)
• Thermodynamic properties (input to the otherproperties)
• Environmental aspects (CO2-emission, energy,recycling etc.

Several factors which enhance the suitability
of green concrete in structures include:

• Reduce the dead load of the structure andreduce the crane age load; allow handling,lifting flexibility with lighter weight.
• Reduction of emission of carbon dioxide by30%.
• Increased concrete industries use of wasteproducts by 20%.
• Good thermal and fire resistance, soundinsulation than the traditional concrete.
• Improve damping resistance of the building.
• Use of new types of residual products,previously land filled or disposed of in other ways.
• No environmental pollution and sustainabledevelopment.
• It requires less maintenance and repairs.
• Compressive strength behaviour of the concretewith water cement ratio is more than that of conventional concrete.
• Flexural strength of the green concrete isalmost same as conventional concrete.
• CO2-neutral, waste-derived fuels shallsubstitute fossil fuels in the cement production by at least 10 %.

• Use of concrete industries own residualproducts.

Benefits to using green concrete

• Lasts Longer

• Uses Industrial Waste

• Reduces Energy Consumption

• CO2 Emissions

## LIGHT EMITTING CONCRETE

**By Hrushikesh Nayak, 2nd Year Civil**

Concrete is the world's most widely used construction material due to its versatility, durability, sustainability, and economy. Concrete is a mixture of aggregates (sand + gravel or crushed stone) held together by a binder of cementitious paste, typically made up of Portland cement and water. It may also contain supplementary cementing materials (SCMs), such as fly ash or slag cement, and chemical admixtures. Light-emitting cement is a green construction material designed to illuminate highways, roads, and bicycle lanes without using electricity. Light-emitting cement absorbs solar. energy during the day and radiates light at night.

This innovative cement was developed by Dr. Jose Carlos Rubio from the Michoacan University of Saint Nicholas of Hidalgo in Mexico. The research focused on modifying the microstructure of cement to absorb solar energy and emit light in darkness.

**How that concrete made:**

The light emitting concrete composition comprises light-emitting pigments. The light emitting pigments include a titanium powder, a sulphide powder and resins, cement, sand, gravel and water. The method of synthesizing a light emitting concrete structure comprises preparing slurry. The slurry is prepared by mixing sand, gravel, cement and water. Further, a light emitting pigment mixture is prepared. The light emitting pigment mixture is prepared by mixing a titanium powder, resins and a sulphide powder. The light-emitting pigment mixture is added to the slurry. The slurry is molded by adding the slurry in molds. The molds are further kept at a temperature of 15-20° C. for at least 12-14 hours. The slurry is cured at a temperature of less than 30° C. for 24 hours.

**Advantages of light emitting concrete:**

• The material is sustainable since it is formed by condensation of silicates usually found in clay, sand, or dust.

• The process is ecofriendly as the only gas released during manufacturing is water vapor.

• The cement is said to have a life span of 100 years and is being fabricated to emit green or blue light.

• The cement has the power to remain lit for about 12 hours after dark.

• The level of brightness can be adjusted during production.

• The cement is inorganic, and its material components are recyclable.

• It could reduce the overhead costs of decorating homes.

**Disadvantage of Light emitting concrete:**

• Cement is an opaque body that does not allowlight to pass into its interior.

• Although it is manufactured like ordinarycement, the change in the microscopic structureneeded to make it glow modifies the structural properties of the material. It may not have thesame applications as the ordinary cement andis intended to be used on surfaces as a coating material.

# PARTIAL REPLACEMENT OF CEMENT BY PROSOPISJULIFLORA ASH AND FINE AGGREGATE BY STEEL SLAG

**By Rohit Bala, 3rd Year Civil**

The performance of concrete by partial replacementof cement with Prosopis Juliflora Ash and Fineaggregate with Steel Slag. Steel Slag is an industrialwaste which is generated during the productionof steel. In India, annual outcome of Steel Slagis about 10 Million Tonne. It is very importantto utilize these wastes in order to avoid the landpollution. Therefore, replacing some of the naturalaggregate by Steel Slag would lead to considerableenvironmental benefits. Prosopis Juliflora Ashis the residue powder left after the combustion
of wood, such as burning wood in home, hotelsor an industrial power plant. It is also difficult todecompose and also absorbs more groundwater.Therefore, using PJA as a partial replacement ofcement providing the green and clean environment.In this proposed work Prosopis Juliflora Ash withspecified ratio of about 2.5%, 5%, 7.5% & 10% isreplaced for cement and 10%, 20%, 30% & 40% ofSteel Slag for partial replacement of fine aggregateis used. The mechanical properties of concretesuch as compressive strength, tensile strength andworkability has been evaluated. The optimumpercentage of combined percentage was found to be7.5% of PJA and 30% of SS. The project result revealsthat 7.5% of PJA and 30% of SS enhance the strengthof concrete compared to other replacements.

## PRECAST CONCRETE TECHNOLOGY

**By Sibaranjan Sarasabhadra, 3rd year Civil**

As the construction & Real Estate Sector in India& several countries booming rapidly .Today, wecan see that the Indian& International constructionmajors are adopting precast concrete technology inconstructing their latest projects. Precast concretetechnology is a durable and versatile technologyfor construction. In this technology the differentelements or panels of concrete are produced understrict quality control measures in state of the artfactories by highly trained personnel, with virtuallyno wastage. There are dedicated precast factorieswhich serve produce for multiple constructionprojects as well as on-site precast factories whichserve a particular construction project.Precast concrete technology consists of custom-designedprecast concrete elements such as:roof slabs

· beams

· columns

· wall panels

· partition walls

· load bearing walls facades

· preinstalled windows

· staircases

· central core

These elements offer flexibility in size and shapewith a variety of surface finishes and colour options.With precast concrete technology, the developershave a world of creative possibilities in applicationand design. Precast concrete technology also offersan abundance of in precast concrete technology;the precast elements are manufactured or cast instrictly controlled environment with state-of-the-art machinery by the experts. These elements arethen erected on the site with the help of the cranes.Then the precast elements are joined together as perspecification with grouts and screed to provide therequired strength and rigidity to the structure.

Key factors which are enabling the growth ofprecast concrete technology in India are:

• quality

• speed of construction

• value-for-money

• avoiding large labour force on site

• almost 1/3rd less delivery time than theconventional methods

• delivering quality products

• large spans can be achieved using prestressedelements

The following practical considerations make precastconcrete technology the best choice for almost alltypes of construction projects:

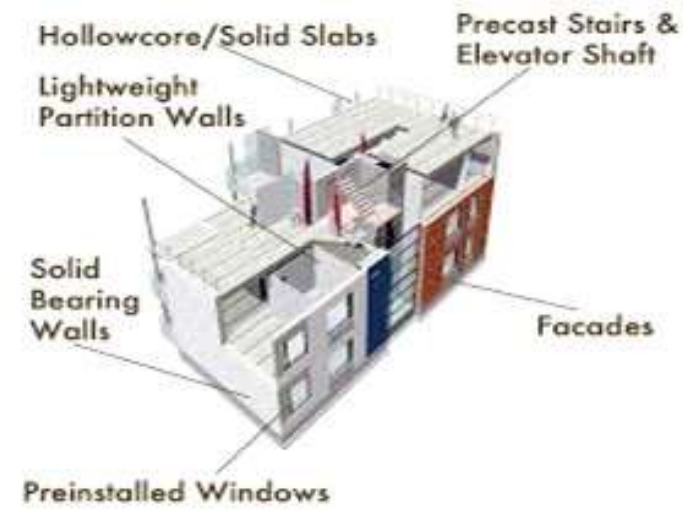
• wastage-control

• speed of construction

• best of quality

• virtually no repair or reworking cost

There is a great potential in the Indian marketto become a major hub for the precast concrete technology across the globe.




## SURFACE ENGINEERING BY SYLOCON

**By Partho Kousalya, 3rd Year Civil**

The Nano composite plasteradditive is closely related with Surface engineering.This is a time-honored solution to protect masonryand concrete from aggressive weather actionconsistently. This strengthens the masonry unitsand concrete as well as serves to shield the structureagainst weather actions. From the point of Surfaceengineering, now there is a range of techniquesavailable to get rid of material degradation. But,in some cases it's noticed that shielding materialitself degrades due to Biological and Biochemicalmodes of materials degradation. Different type ofmodes is found in this field. I would like to addfew relevant points for better understanding of thisclaim of self-degradation of shielding materialsby the Biological and Biochemical effects. If wetalk about few polymers those are widely used inshielding purposes like PVC, Polyurethane, Nylon,Different Acrylics, POLY (Styrene ButadieneStyrene} – SBS, Styrene Butadiene Copolymer, etc.we find the mode of degradation of different typesof shielding material those are based on these kindsof protective polymers.

• POLY (Styrene Butadiene Styrene) –SBS, Styrene Butadiene Copolymer – TheBiocompatibility of ESBS Membrane wasevaluated with the cell culture of fibroblastson the membrane. It revealed that the cells notonly remained viable but also proliferated onthe surface of the various ESBS membranesand the population doubling time for fibroblastculture decreased.

• PVC - This popular item itself is degradedby microorganisms like Fungi (e.g.Aureobasidium Pullulans) and bacteria (e.g.Pseudomonas Aeruginosa). The main modeof action is increased loss of plasticizers dueto microbial degradation.

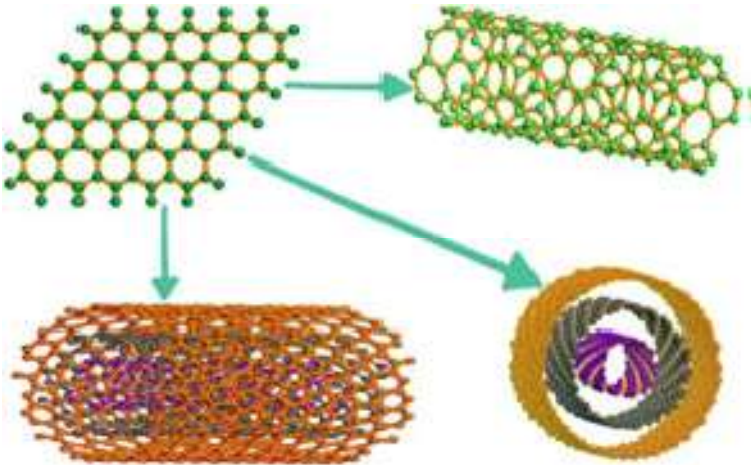
• Polyurethane – This is widely used basematerial for shielding. But, that too isdegraded by Fungi (e.g. ChaetomiumGlobosum) and bacteria (e.g. BacillusSubtilis). The enzymatic activity of Fungiand bacteria causes a major failure of theshielding products based on this.

• Nylon - This is strange degradation of thisshielding compound by wood – degradingfungi (e.g. BjerkanderaAdusta) and bacteria(e.g. Bacillus Pallidus). The degradationis physical disruption and enzymaticdegradation.

• Acrylics – This popular material is decayed byMelanin producing fungi that causes physicaldisruption.

• Interestingly Fungi can also affect glass bycolonizing its surface and secreting organicacids, which etch the surface of the glass.

This form of damage is relatively mild andmainly significant in tropical climates.These clear evidences prove that shielding materialshould have its own durability property to withstandweather action to protect the underneath substances.Considering all above the degradation and mode ofactions of different microorganisms, SYLOCON®is engineered to protect and provide honoured life ofcement-based building materials.The specific characteristic of SYLOCON® iscommonly known as a plaster additive for crack freeplastering and water ingression and efflorescence.But the recent analysis has proved its uniqueefficacy to prolong its sustainability against weatheraction. Thus, the underneath substances remainintact and durability of building is enhanced. Themost important mode of this reaction in terms ofSurface engineering between the Nano particles inSYLOCON® is a slow and prolonged process, asthe agglomeration occurs within the pores or voidsin cement mortar.



## TECHNOLOGY OF OSMOTIC RENDERS IN WATERPROOFINGWORLD

**By Rajkumar Naik, 3rd Year Civil**

The concrete gets wet or water initially get belowthe membrane to create the osmotic cell by initialsaturation, condensation and liquid water withinholes and voids below the membrane and vapourdiffusion from.Osmosis is the chemical-physical phenomenonwhereby two liquid solutions spread into oneanother through a semipermeable membrane and iscaused by the difference in concentration betweenthe two liquids.Specially formulated cement systems, which aredefined as 'osmotic renders', provided importantwaterproofing performances both in the occasionaland permanent presence of rainwater, natural water,groundwater, etc.

### Basic Working Principle

The particular adhesion of osmotic waterproofingsystems, determined by the deep osmotic diffusion,also made them suitable for operating both inconditions of positive and negative water pressure.In building materials (and not only) adhesion andadherence are the result of two different mechanismsthat can be present both separately and as moreoften happens, in coaction: mechanical adhesionand chemical adhesion. The osmotic or diffusiveadhesion also comes into play in the osmoticprocess.

### Final Performance

With 22% mixing water - thickness 2.5 mm: It istested in accordance to EN 1504-2 (surface protectionsystem for concrete, where this membrane comesin the category of Moisture Control and IncreaseResistivity coating.)Coefficient of permeability to free water ($kg/m^2 \cdot h0.5$): Note w < 0.05 Class III (low permeability)according to EN 1062-1.Permeability to water vapour - equivalent airthickness SD - (m): SD < 1 Class I (permeable towater vapour).Bond strength on concrete (substrate in MC 0.40 -water/cement ratio = 0.40) according to EN 1766(MPa): > 2

### Advantage of Osmotic Renders on CrystallineCoatings

• Osmotic renders are compatible for potablewater tanks whereas crystalline coatings are not.

• Osmotic renders are recommended for bothconcrete & masonry structure, crystalline coating only react with the free lime present inconcrete surface to give the reactive solution

• Osmotic renders bonding with concrete surfaceis more than 2M Pa gives extra assurancetowards the integrity of the watertightness,whereas crystalline deeply penetrate in thepores and does not have any surface reaction.

• Osmotic renders can bear negative pressure tooupto 1 ATM whereas crystalline coatings haveno testing for negative pressure.

## UTILIZATION OF DEMOLISHED WASTE AS COARSEAGGREGATE IN CONCRETE

**By Pramesh Jakaka, 3rd Year Civil**

Demolishing concrete building usually produceshuge amounts of remains and wastes worldwidethat have promising possibilities to be utilized ascoarse aggregate for new mixes of concrete. Highnumbers of structures around the world currentlyneed to be removed for several reasons, such asreaching the end of the expected life, to be replacedby new investments, or were not built by thelocal and international standards. Maintaining orremoval of such structures leads to large quantities of concrete ruins. Reusing these concrete wasteswill help in saving landfill spaces in addition tomore sustainability in natural resources. Coresamples for demolished concrete were tested todetermine its compressive strength. The core testresults can be thought of as aggregate properties forthe new concrete. Then, the compressive strengthand splitting tensile strength of the new recycledaggregate concrete (RAC) were determinedexperimentally by casting a cubes and cylinders,respectively. It was found that the evolutionof compressive strength of recycled aggregate

concrete is similar in behaviour to the concrete withnatural aggregate, except that it is about 10% lowerin values. It was also seen that water absorption forrecycled aggregate is noticeably higher than that fornatural aggregate, and should be substituted for inthe mix design.


## MACADAM ROAD

**By Sabitri Kadraka, 3rd Year Civil**

Macadam is a form of pavement invented by JohnMacadam of Scotland in the 18th century. Macadam'sroad cross section was composed of a compacted subgrade of crushed granite or greenstone designed tosupport the load, covered by a surface of the light stoneto absorb wear and tear and shed water to the drainageditches.Macadam's are all based on the principle of an aggregatecoated with a binder, usually bitumen, hence "bituminousmacadam". Asphalts are a mixture of asphaltic cementor mortar (often) bitumen with fine aggregates such assands and grits) and some coarser aggregate, such asgravel or crushed rock.Not only did Macadam's design result in a smoothersurface and carriage ride, but it was cheaper to buildand lasted longer. Modern asphalt is quite similar.The roadway surface and construction process tookMacadam's name.Macadam roads can be classified into following types:

1) Water bound macadam
2) Traffic bound macadam
3) Bituminous macadam
4) Cement macadam

Water bound macadam: broken stone bound togetherby stone dust and water applied during construction(seldom construction).

Traffic bound macadam: It is the wearing coursecomposed of broken stones or gravel, consolidated bythe action of traffic. This type of surface is generallybuilt gradually by

successive application of two or morelayers.The compacted thickness of each layer may vary from2.5 to 5.0 cmBituminous macadam: crushed stone base or wearingsurface in which fragments are bonded together bybituminous material; the aggregate layer is compactedand bituminous material is applied to the surface.Cement macadam: It is similar to bituminous macadam.The only difference is that in this case, cement is used inplace of bitumenConstructor

**RAILS**

**By Rajkumar Naik, 1st year Civil**

A rail is a horizontally extending steel bar betweensupports that serves as a track for trains, automobiles,and other vehicles.

**Types of Rails**

There are three types of rails:

• Double-headed rails

• Bull-headed rails

• Flat-footed rails

**1. Double-Headed rails**

These rails were used in the early stages of railroaddevelopment. They are divided into three sections:• Upper table • Web • Lower table

The upper and lower tables were identical, andthey were introduced in the hopes of doubling therail's lifespan. When the upper table wears out, therails can be placed on the chair upside down andreversed, allowing the lower table to be used.However, this plan quickly proved to be incorrectsince the continuous contact of the lower table withthe chair caused the lower table's surface to becomerough, making smooth train operation impossible.As a result, this type of rail is almost obsolete.These rails are now available in lengths rangingfrom 20 to 24 feet.

**2. Bull-Headed rails**

This type of rail is made up of three pieces:• The head • The web • The footSteel was used to construct these rails. The head islarger than the foot, and the foot holds the woodenkeys that fasten the rails in place.As a result, the foot's sole purpose is to provide therequired strength and rigidity to rails.When these rails are used, two cast iron chairs arerequired for each sleeper. Their weight ranges from85 to 95 pounds, and they can grow up to 60 feetlong

**3. Flat-footed rails**

These rails were first invented in 1836 by CharlesVignoles, and so are also known as Vignols rails.They are divided into three sections:• The head • The web • The footThis type of rail has grown in popularity to the pointwhere it now makes up over 90% of all railwaylines in the world.The benefits of flat-footed rails are as follows:• They don't require a chair and can be spiked orkeyed to the sleepers directly.

• They are thus cost-effective. They're lessexpensive than bull-headed rails.

• Both vertically and laterally, they aresubstantially stiffer; for curves, lateral rigidityis crucial.

• They are less prone to kinking and have a moreconsistent top surface than bull-headed rails. The weights from train wheels are distributed overa large number of sleepers and hence a broaderarea, resulting in increased track stability, longerrail and sleeper life, lower maintenance costs, lessrail failure, and fewer traffic delays.

# RAILWAY SLEEPERS

**BySwagita Naik, 1st Year Civil**

Railway sleepers constitute an important componentof the railway track. These maintain proper gaugeand also facilitate the transfer of point load from thewheel loads to the uniformly distributed load to theballast. The sleepers rest on the ballast and are alsoreferred as ties.Functions of railway sleepersthe main functions of sleepers in railway track are:

- These keep the rails firmly in place also maintain a uniform gauge.
- These facilitate the transfer of wheel loads to the ballast.
- Rail sleepers lessen the vibrations emanating from the rails.
- These provide lateral and longitudinal stability.

Types of sleepers in railway

1. Wooden sleepers: Wooden sleepers are typically 2600 mm long,254 mm broad, and 127 mm thick in cross-section.

- Wooden sleepers are treated with preservatives after being seasoned (drying for up to 12 months to remove the juice/sap) for the preservation of timber. Creosote is an oil that is typically applied to or sprayed on the surfaces of wooden sleepers.
- These sleepers are either made of soft wood or hardwood.
- Due to the easy availability of wood, these sleepers are extensively used.

Benefits of wooden sleepers

- Wooden sleepers are less expensive than other types of sleepers.
- They are lightweight, making them portable and simple to handle during installation.
- On wooden sleepers, fasteners may be fitted with ease. The rails are adequately protectedsince they are effective insulators.
- Wooden sleepers can be used to maintain the rail gauge effectively.
- They are appropriate for all kind of rail sections.
- These possess sufficient elasticity which allows them to absorb vibrations and shocks.in fact, wooden sleeper have the best track elasticity among all the types of sleepers.

Disadvantages of wooden sleepers

- Wooden sleepers are easily vulnerable to pest and weather attacks.
- They are prone to fire.
- With wooden sleepers, maintaining a uniformgauge can be a challenging task.
- The scrap value of wooden sleepers is less.
- They can only last for a period of 12 to 15 years.

2. Steel sleepers

- Steel sleepers can be used when wooden or concrete sleepers cannot be adopted.
- In heavier curves that are prone to gauge widening, steel sleepers are extensively used.
- The signal control system may face issues due to steel sleepers.
- Furthermore, these sleepers are also prone to fatigue cracking issues.
- Steel and concrete sleepers are now often used on railroads due to a shortage of wood and other economic concerns.

**Advantages of steel sleepers**

- Steel sleepers are durable and resilient.
- They have a span of 35 years.
- Less damage sustained in these sleepers during handling and transportation.
- They are resistant to attack of vermin and fire.
- Steel sleepers have a high scrap value.

**Disadvantages of steel sleepers**

- It as susceptible to corrosion.
- Cannot be used for track circuiting.
- It can only be used with the rails for which it was designed.
- Throughout the service of steel sleepers, cracks appear at the rail seats.
- Higher number of fittings is needed overall in steel sleepers.

**3. Cast iron sleepers**

- Cast iron sleepers are used extensively worldwide, but particularly in Indian railways.
- They come in two varieties: pot sleepers and plate-shaped cast iron sleepers.
- Curves sharper than 4 degrees are not ideal for pot type sleepers.
- In Indian railways, cst 9 type sleepers are extensively adopted.

**Advantages of cast iron sleepers**

- Cast iron sleepers have a life span of 60 years.

- They can be produced easily and locally, so there is no need for extensive shipping.
- Cast iron sleepers are resistant to vermin attacks.
- They provide the rail a sturdy seat.
- Cast iron has a high scrap value because wornout sleepers may be reshaped into new ones.
- Cast iron sleepers can prevent creep in rails.

**Disadvantages of cast iron sleepers**

- Due to its fragile nature, cast iron is damaged during handled. So dealing with the transportation and placement of cast iron sleepers is a challenging task.
- Cast iron sleepers are not appropriate for coastal areas since salt water may readily harm and corrode them.
- The derailment may cause serious damage to cast iron sleepers.
- When compared to other sleeping materials, cast iron is more costly. It is thus not profitable.
- These require many fastenings for attaching the rail to the sleeper.
- Maintenance of cast iron sleepers should be done properly.

**4. Concrete railway sleepers**

- Concrete sleepers have a life span of upto 40 years.
- They are simple to mold into the desired shape to withstand forces brought on by heavy traffic.
- The additional weight of concrete sleepers strengthens the rail's ability to withstand stresses brought on by thermal expansion, which can cause the track to buckle. Notably, concrete sleepers weigh around 2.5 to 3 times as much as wooden sleepers.
- Nowadays, pre-tensioned concrete sleepers are typically used.

**Advantages of concrete sleepers**

- It is more resilient and has a longer lifespan up to 50 years.
- Compared to steel and wood, it is more affordable.
- Concrete sleepers are simple to produce.
- It is resistant to attacks from pests.
- It is resistant to fire.
- Concrete sleepers provide good track circuiting.

Disadvantages of concrete sleepers

- Concrete sleepers are fragile and prone to sudden cracking.

- They need to be replaced since overhauling them is not possible.
- These require large number of fittings
- They have no scrap value.

**5. Prestressed concrete sleepers**

Concrete sleepers in which prestressed cementconcrete is employed are called prestressed concretesleepers.

Advantages of prestressed concrete sleepers

- These have a life expectancy of 40 to 50 years.
- Lesser number of fittings are required.
- The gauge is uniform and simple to adjust.
- Strong connections are possible between therail and the sleeper.
- The track has greater lateral and longitudinal stability.
- Track circuiting is feasible in case of prestressedconcrete sleepers.
- These are more resilient and less likely to degrade.
- There is an effective check on the creep in rails.
- They can endure the strains brought exerted by heavy traffic.
- They have a low cost of maintenance.

**Disadvantages of prestressed concrete sleepers**

- They have a higher initial cost.
- These sleepers are prone to breakage when subjected to rough handling.
- Renewal of prestressed concrete sleepers is difficult.
- Scrap value of these sleepers is zero.

**Requirement of railway sleepers**

- The initial cost and maintenance cost of railwaysleepers should be low.
- Sleepers should have a moderate weight and they should be easy to handle
- They should possess a sufficient bearing area.
- These should offer sufficient track circuiting.
- Sleepers should resist shocks and vibrations.
- Removal of fasteners and their overhauling should be easy.
- Sleepers should have an easy maintenance and gauge adjustments.