BUILDERS ENGINEERING COLLEGE

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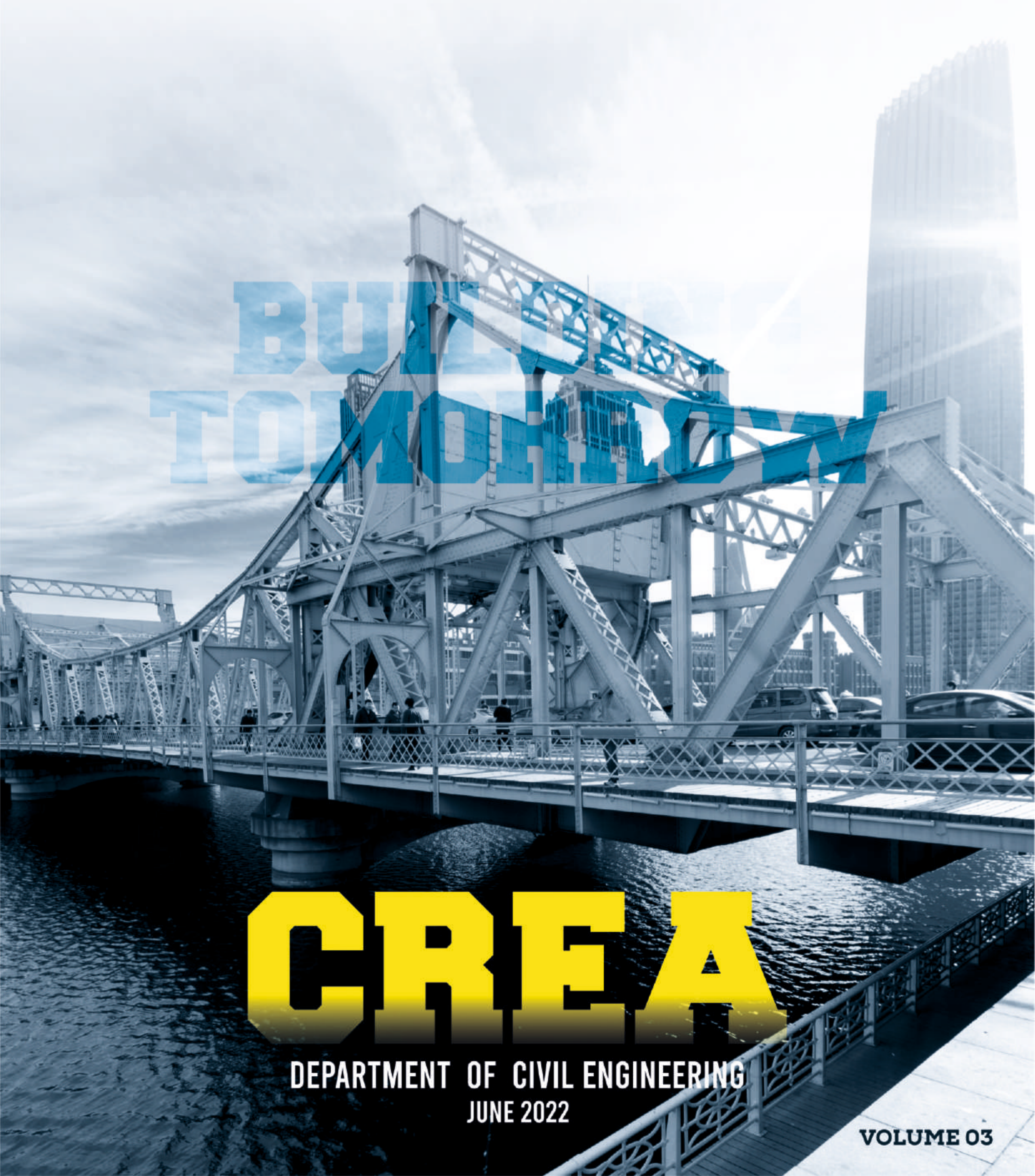

CREA

DEPARTMENT OF CIVIL ENGINEERING

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Civil Engineering

Civil Magazine

CREA is published for the Alumni, Friends, and Peers of the Department.

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About the Institution

Builders Engineering College (Formerly known as Erode Builder Educational Trust's Group of Institutions) was established by Erode Builder Educational Trust (EBET) in the year 2009 as an integrated campus and presently functioning as a technical campus. It offers six UG Programmes (BE - Civil, CSE, ECE, EEE, Mechanical, B.Tech AI&DS) with an intake of 330 students and four PG Programmes (ME - CEM, STR, CSE and MBA) with an intake of 114 students. Stepping into the fourteenth year of service, the Management, CEO, Principal and faculty members are committed to elevating the lives of budding rural aspirants through academics and research. The Chief Patrons are the pioneers in the field of infrastructure and construction all over India.

Vision

To be the most preferred knowledge provider.

Mission

Builders Engineering College endeavors to prepare rural students for successful career through academic and applied research.

About the Department

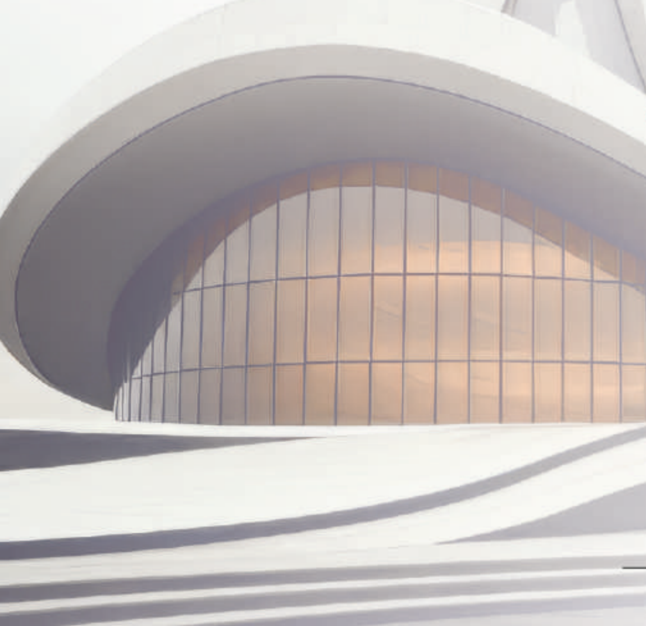
- The Department of Civil Engineering, started in the year 2009, offers BE (Civil Engineering), ME (Construction Engineering & Management) & ME (Structural Engineering).
- The department activities are planned with dual inputs from Industry and reputed academic bodies in the state.
- The department strengthens its core activities periodically with inputs from industry, civil engineers and contractors, some of whom are trustees of the Institution.
- In addition to regular academic activities, the department strives to transform students into a pragmatic Civil Engineer by involving them in solving field problems with needed guidance from faculty members.

Vision

To be a human and technical resource centre to meet the needs of the construction industry.

Mission

Impart students the knowledge of principles and practices of Civil Engineering and shape them to meet the expectations of the industry



Program Educational Objetives (PEOs)

- Graduates will achieve recognition in Civil Engineering profession as practicing Engineers and consultants. Provide technical services to leading organizations in diverse areas promoting professional and moral ethics.
- Graduates recognized for their professional and technical competence to provide sustainable solutions to societal problems.
- Graduates are nurtured to engage in continued learning through professional development and cognizant of emerging issues.

Structural Failure of Buildings: Issues & Challenges

by ***Dr. G. Ramasamy, Professor***

Structural failure begins to occur when the material is stressed to its upper strength limit causing to rupture or extreme deformations. The ultimate strength of the material or the system is the limit of the load bearing capacity. On reaching this limit, the construction materials could already been damaged, and their load carrying capacity is suddenly decreased permanently. If the system is properly designed, a local collapse should normally not be a cause of instant or gradual failure of the complete building. The ultimate failure strength of the construction elements should be carefully considered in the design of structures to prevent failure. Buildings are designed to support certain loads without deforming excessively. The loads are the weights of people and objects, the weight of rain and snow and the pressure of wind called live loads and the dead load of the building itself. With buildings of a few floors, strength generally accompanies sufficient rigidity, and the design is mainly that of a roof that will keep the weather out while spanning large open spaces. With tall buildings of many floors, the roof is a minor matter, and the support of the weight of the building itself is the main consideration. Like long bridges, tall buildings are subject to catastrophic collapse. The causes of building collapse can be classified under general headings to facilitate analysis. These are bad design, faulty construction, foundation failure, extraordinary load, unexpected failure mode and a combination of causes Bad design does not mean only errors of computation, but a failure to take into account the loads the structure will be called upon to carry, erroneous theories, reliance on inaccurate data, ignorance of the effects of repeated or impulsive stresses, and improper choice of materials or misunderstanding of their properties. The engineer is responsible for these failures, which are created on the drawing board. Faulty construction has been the most important cause of structural failure. The engineer is also at fault here, if the inspection has been lax. This includes the use of salty sand to make concrete, the substitution of inferior steel for that specified, bad riveting or even improper tightening torque of nuts, excessive use of the drift pin to make holes line up, bad welds, and other practices well known to the construction worker. Even an excellently designed and constructed structure will not stand on a bad foundation. Although the structure will carry its loads, the earth beneath it may not. The Leaning Tower of Pisa is a famous example of bad foundations, but there are many others. Extraordinary loads are often natural, such as repeated heavy snowfalls, or the shaking of an earthquake, or the winds of a hurricane.

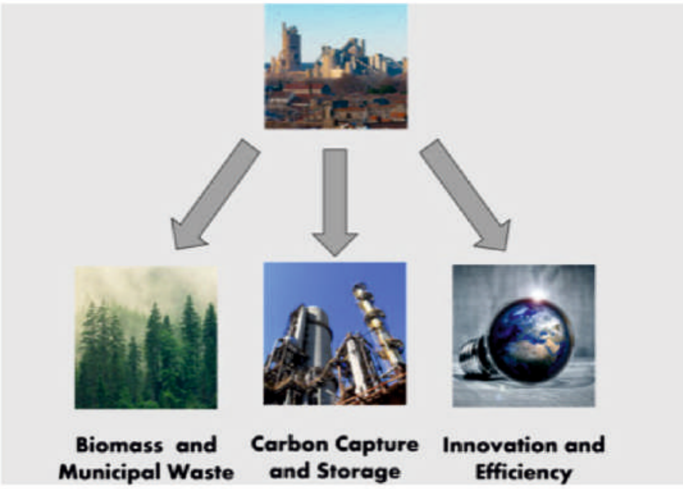
Sampoong Department Store, South Korea

A flimsy flexible structure may avoid destruction in an earthquake, while a solid masonry building would be destroyed. Earthquakes may cause foundation problems when moist filled land liquefies. Unexpected failure modes are the most complex of the reasons for the collapse, and we have recently had a good example. Any new type of structure is subject to unexpected failure until its properties are well understood. Suspension bridges seemed the answer to bridging large gaps.

Reducing carbon footprint: The journey of cement industry towards sustainable practices

by ***Dr. K.E. Viswanathan, HOD***

The cement industry plays a significant role in global carbon emissions, accounting for approximately 8% of total greenhouse gas emissions worldwide, while the Indian cement industry has the lowest carbon emission in the world. However, there has been a growing emphasis on sustainability and reducing carbon footprint across industries in recent years. The cement sector has embarked on a transformative journey, adopting innovative technologies and practices to minimize environmental impact. In addition to adopting sustainable practices within their own operations, the cement industry is also placing a strong emphasis on working with eco-friendly vendors and suppliers. As part of their carbon emissions policy, cement manufacturers are giving extra preference to vendors who demonstrate lower carbon emissions and are committed to environmentally friendly practices. The cement manufacturing process involves the release of large amounts of carbon dioxide ($CO2$), primarily due to the calcination of limestone and the energy-intensive nature of production. As concerns about climate change and environmental degradation intensify, the cement industry has recognised the need to address its carbon footprint and transition towards more sustainable operations.



One crucial step in reducing carbon emissions is the transition from fossil fuels to alternative energy sources. Cement manufacturers are increasingly adopting alternative fuels such as solar & wind energy, biomass, municipal solid waste, and used tires.

Implementing energy-efficient technologies:

Energy efficiency is a key aspect of sustainable cement production. The industry has been actively investing in energy-efficient technologies to optimize processes and minimize energy consumption. Advanced kiln systems, preheaters, and waste heat recovery systems are being deployed to capture and utilize excess heat, thereby reducing the need for additional energy inputs. Integrating artificial intelligence and machine learning algorithms has also enabled precise control and optimization of energy usage, resulting in significant energy savings.

Utilizing low-carbon cements:

The development and utilization of low-carbon types of cement are crucial for reducing the carbon footprint of the cement industry. One such innovation is the use of supplementary cementitious materials (SCMs) such as fly ash, slag, free lime and silica fume as partial replacements for clinker in cement production. These materials not only reduce the carbon intensity of cement but also enhance its durability and performance. Furthermore, the emergence of novel binders, including geopolymers and calcium sulfoaluminate cement, offers greener alternatives with lower CO_2 emissions compared to ordinary Portland cement.

Promoting circular economy practices:

Circular economy principles are gaining traction in the cement industry, aiming to minimize waste generation and maximize resource efficiency. Cement manufacturers are actively exploring ways to incorporate industrial by-products and waste materials as raw materials or fuel substitutes in cement production. This approach not only reduces the consumption of natural resources but also diverts waste from landfills and reduces environmental impact. Additionally, the industry is actively engaging in partnerships and collaborations to establish effective waste management systems and promote the circular economy ecosystem.

Eco-friendly transportation:

The cement industry is recognizing the importance of eco-friendly transportation in reducing emissions. Currently, road transportation dominates the industry's logistics, but efforts are being made to shift towards greener alternatives. By increasing the utilization of railways and waterways for transportation, the industry can significantly reduce its carbon footprint. Railways and waterways produce fewer emissions compared to trucks running on diesel. Cement manufacturers are also focusing on adopting eco-friendly fuels such as Compressed Natural Gas (CNG) for their road transportation needs. By embracing these sustainable transportation practices, the cement industry aims to minimize its environmental impact and contribute to a greener and more sustainable future.

The cement industry has embarked on a transformative journey towards sustainable practices, recognizing the need to reduce its carbon footprint and address environmental concerns. By transitioning to alternative fuels, implementing energy-efficient technologies, utilizing low-carbon cement, promoting circular economy practices, and embracing CCUS technologies, cement manufacturers are making significant strides in reducing their environmental impact. These initiatives not only contribute to climate change mitigation but also enhance resource efficiency and promote a greener and more sustainable cement industry.

Innovation in Construction Materials - A Review

by ***Mr. V. Gowrishankar, Assistant Professor***

It was found that advancement in nanotechnology, use of mineral admixture, glass and plastic, biological materials, wood and other construction materials have contributed significantly to the growth of discovery and production of innovative construction materials. The implementation of some innovative construction materials, meets the requirements for sustainability, durability, reliability, safety, cost reduction, increasing quality, better mechanical and physical characteristics, flexibility in extreme conditions and locations, simple assembly and environmentally friendly. Construction materials used to carry out project consumed about 40% of the entire cost of the project in the construction industry. The success stories were recorded in the area of turning industrial and agricultural wastes to wealth. This reviewed paper will enrich the database for innovative materials entering the construction industry. Construction materials can be described as the mainstay of civil engineering . Construction materials are utilized in structure development, development of streets, railroad tracks, airplane terminals, viaducts, burrows, spans, dams, seawards structures, television towers, water reservoirs and in nearly all spheres of the planet earth, to boost safety, minimize pollution, environment-friendly, user-friendly, aesthetically rich and consequently embraces a healthy atmosphere . Construction materials consumed up to 40% of the entire cost of the project in construction projects. There is a common saying that "Necessity is the mother of Invention." Quest for better life forced man to create safer and better living conditions that provide reliability, durability, functionality and have some elements of harmony and beauty. Acceptability of innovative construction materials should be based on satisfying some of these requirements such as sustainability, durability, reliability, safety, reduction in cost, improved quality, better mechanical and physical characteristics, extreme condition flexibility, simple assembly and environmentally friendly. Construction materials should be widely accepted by the construction industry and the end user. The economic feasibility is significant in the selection and acceptance of any construction materials. It is imperative to ensure that the new construction materials should be labour-saving at construction sites, and further reductions in construction costs on the project.

Modern construction materials should be sustainable and environmentally friendly. One of the main factors affecting acceptance of new construction materials is non-availability and production of new materials locally. The innovative materials should have the potential for further modification, suitable for the requirements at that point in time. The adoption of waste products will save cost and space for their disposal.

India's First Under Water Tunnel (Kolkata's East-West Corridor)

by ***Mr. V. Sasikumar, Assistant professor***

Kolkata, India's City of Joy, is being see the country's first underwater rail tunnel started to run on February 13, 2020. The said train is a metro line, runs between Salt Lake Sector V and Howrah, which is known as the East-West Corridor in Kolkata with the stretch of 16.6 km and 12 stations, six of which are under the ground, while the remaining six metro stations are on elevated tracks. The underground metro stretches from Phoolbagan station up to Howrah Maidan, and has a total of six stations in between, including Phoobagan, Sealdah, Esplanade, Mahakaran, Howrah, and Howrah Maidan. The companies responsible for constructing the country's first tunnel under the Hooghly River for establishing metro link between Howrah and Kolkata are Afcons Transtonnelstroy and Kolkata Metro Railway Corporation Ltd. The major complication of the project was Boring; "Rachna", a giant tunnel-boring machine (TBM), was brought from Herrenknecht AG plant in Schwanau, Germany; deployed to dig the underwater tunnel that runs a length of 502 metres under the river. The first of its kind in the country, the metro train is said to be at par with the likes of Eurostar that connects London and Paris. It spans a total of around 16 km, with a part of it (around 10 km), running underwater in River Hooghly. While underwater, the train runs at a depth equivalent to a ten-storey building. The underwater stretch for the metro train will comprise of twin tunnels, which are made of 1.4 m wide concrete rings. They have been further fitted with hydrophilic gaskets to prevent water from entering the tunnels. As per the Kolkata Metro Rail Corporation (KMRC), this is among the many "firsts" in the country with regards to railway development. Also, it was estimated that this metro will play around one million passengers daily and will cut down the travel time between Salt Lake to Howrah from an hour to less than 30 minutes. Further India's first underwater metro twin tunnel project in Kolkata, the East-West Metro, added another feather to its cap by getting India's deepest metro ventilation shaft on the banks of the Hooghly River at 43.5m depth equalling 15-story building. The ventilation shaft is crucial in underground Metro construction as it facilitates evacuation of passengers from the tunnel to ground level in case of any emergency situation. The shaft is also used for air circulation, pumping air in and out of the air conditioning system, and ensure the flow of air in the tunnels to prevent passengers from feeling suffocated. The ventilation shaft is also equipped to extract smoke in case if a fire breaks out. The metro ventilation shaft located on strand road is 43.5m deep having a diameter of 10.3m. The Kolkata Metro Line 2 (Line 2 or East-West Corridor) is a rapid transit line of the Kolkata Metro that is eventually set to connect Teghoria with Howrah by going underneath the Hooghly River. In this process, Line 2 is set to be India's first underwater metro tunnel.

Excess Steel Reinforcement: Problems and Remedies

by ***Dr. G. Thirugnanam, Professor***

Reinforcement is generally put into concrete to cater for its relative weakness in tension compared with compression. The term 'cross-sectional area' (CSA) refers to the area of the section under consideration, both for the concrete and for the steel. The ratio of the area of the steel to that of the concrete is the percentage of reinforcement, which for concrete sections such as slabs, beams or columns could typically be 3-5%. Many cases have been encountered where percentages of reinforcement of upto 25% have been used. These have led to problems on site, in the precast concrete factory and in mix design at the preliminary stage. One problem that was examined concerned precast columns in a building. The columns were about 3.5m tall and 0.3m square section in plan. Four 40mm diameter bars, one at each corner with 40mm nominal cover, made up the main reinforcement. The main rebars were lapped by 10mm diameter stirrups at approximately 0.3m centres. The mix was a 20mm/10mm/5mm to dust limestone aggregate with a 450kg/m3 white Portland cement content and a total water/cement ratio of about 0.5 with a slump of 100mm. About three months after installation on site, severe vertical cracking with no steel corrosion occurred in lines with accompanying spalling in lengths up to 0.5m long. This was diagnosed as probably being due to there being too much rebar restraining influence on a concrete with a high initial hydration shrinkage potential. Another example where excess reinforcement affected mix design concerned bifurcated in-situ white concrete columns, where congestion of reinforcing bars at the crossover resulted in there being about 25% steel of the CSA in plan at the throat. The original mix design, using a 20mm aggregate with a 75mm slump, had to be changed to a 10mm aggregate with collapse slump. Fortunately, a Portland limestone aggregate was used, and the 30-60 minute aggregate suction effect on the excess water content gave cube results that built up quite significantly after four days. The specified cube strength was obtained about a week later.

Problem Recognition

The following are highlights those that have been commonly experienced like Pieces of tie wire and detritus on the offsite , Cracking mirroring the main rebars, without steel corrosion, Shrinkage cracking due mainly to the use of too much water and/or too dusty an aggregate in the mix, Honeycombing above the steel due to the close-packing of the rebars, allowing fine material sole passage.

Remedial Measures for Over Reinforced Concrete

The following are the few remedial measures that are necessary to be taken in case of excess steel used:

- Remove tie wires, detritus etc. from the face of the concrete as soon as possible, and reface cut-out areas with mortar of the same mix as the fine material in the substrate concrete.
- On the assumption that by the time the problem is observed most of the hydration shrinkage considered responsible for the cracking will have taken place, remove all unsound concrete and repair.

Reduction of Solid Waste Management

by ***Ms. L. Reena, Assistant professor***

Effective solid waste management is imperative for maintaining environmental sustainability and public health. This abstract provides an overview of strategies and initiatives aimed at preventing solid waste generation and promoting sustainable waste management practices. By emphasizing waste reduction, recycling, and community engagement, these efforts contribute to the global goal of minimizing the environmental impact of waste disposal. The management of solid waste is a critical aspect of environmental stewardship and public well-being. With the escalating challenges posed by increasing populations and urbanization, there is a pressing need for proactive measures to prevent solid waste generation and implement sustainable waste management practices. Historically, traditional waste management strategies focused on disposal methods such as landfilling and incineration. However, recognizing the limitations and environmental consequences of these approaches, a paradigm shift towards prevention and sustainable practices has gained momentum.

Waste Prevention:

Preventing solid waste at the source is fundamental to sustainable waste management. This involves minimizing the generation of waste through initiatives such as waste reduction campaigns, product design improvements, and the adoption of circular economy principles. By encouraging consumers and industries to prioritize waste prevention, the overall environmental impact of solid waste can be significantly reduced.

Recycling and Resource Recovery:

Promoting recycling and resource recovery plays a pivotal role in diverting materials from landfills. Establishing efficient recycling programs, implementing separation at source, and creating markets for recycled materials contribute to a circular economy. This approach not only conserves resources but also mitigates the environmental impacts associated with extracting and processing raw materials.

Community Engagement and Education:

Empowering communities through education and engagement initiatives is essential for fostering a culture of responsible waste management. Public awareness campaigns, school programs, and community events can inform individuals about the importance of waste reduction, proper disposal practices, and the benefits of recycling. Engaged communities are more likely to participate actively in waste prevention efforts.

Policy and Regulatory Frameworks:

The development and implementation of robust waste management policies are crucial for guiding sustainable practices. Governments and municipalities can enact regulations that encourage waste prevention, set recycling targets, and incentivize businesses to adopt eco-friendly packaging. Effective policies provide the framework necessary to align individual and corporate behaviors with broader environmental goals.

Technological Innovations:

Advancements in waste-to-energy technologies and innovative waste processing methods contribute to sustainable waste management. By harnessing technology, it becomes possible to convert waste into valuable resources, such as energy or recycled materials, thereby minimizing the environmental impact of waste disposal.

This abstract sets the stage for exploring the multifaceted approaches to preventing solid waste generation and promoting sustainable waste management practices. As societies grapple with the challenges of waste management, a holistic and collaborative effort is essential to create a future where waste prevention is prioritized, resources are conserved, and environmental impacts are minimized.