THE BLUE PRINT

Department of Civil Engineering

Volume -5 2021-22

In this issue

DEPARTMENT OF CIVIL ENGINEERING

VISION

To develop Civil Engineering Department as a Centre of Excellence for imparting value-based education to the students at under-graduate and post-graduate level to meet industry needs and to develop as a major research center to meet the national and international standards.

MISSION

- To impart in-depth and up-to-date knowledge of Civil Engineering, stressing concepts with focus on character enhancement, leadership qualities, effective communication, social responsibility, pursuit of lifelong learning and professional development.
- To provide a platform to students to engage in innovative research work.

DEPARTMENT OF CIVIL ENGINEERING FACULTY AND STAFF

Principal's Message

It gives me immense pleasure and satisfaction to witness the release of newsletter from the Department of Civil Engineering. The College has made tremendous progress in all areas academic, non-academics, research, capacity building relevant to staff and students. I am confident that this issue of newsletter will send a positive signal to the staff, students and the person who are interested in technical education and Technology based activities. A newsletter is like a mirror which reflects the clear picture of all sorts of activities and events undertaken by a department and showcasing them. I applaud the contributors for their stimulated thoughts and varied hues in articles contributed by them and congratulate the members for their commendable job.

Dr. C.D. Naidu, Principal, VNRVJIET

Editorial Note

As 2020-2021 draws to a close COVID -19 pandemic has demanded re-inventing the teaching in higher education. It was a challenging year and I am happy that our faculty have proven to their excellent adaptability for ICT skills in teaching. Department continued to move forward navigating the students in online teaching platforms. I also applaud our alma matter for initiating alumni webinar series. 6 webinars are conducted by our alumni. This newsletter demonstrates even pandemic could not impede the accomplishments of our faculty and students. Department welcomes new faculty in to the department and congratulate the Ph D awardees. I heartfully congratulate entire team for their sincere and continuous efforts in taking the department into the track to achieve its vision.

Dr. A. Mallika,
Prof. & HoD-CE, VNRVJIET

DEPARTMENT NEWS

ACHIEVEMENTS

- ✪ Department of Civil Engineering, B.Tech. (Civil Engineering) programme is conferred with an extension from 5 years to 6 years by NBA (i.e.,30.06.2021 -30.06.2022).
- ✪ Faculty of Civil Engineering Department Published 13 journal papers (Scopus indexed & Web of Science), **27** Conference papers and **2** Book chapters.

MEMORANDUM OF UNDERSTANDING (MOU) INITIATIVES

- The Department has signed a MoU with L & T Edutech for certification & internships at L & T projects.
- Department of Civil Engineering has entered an MoU with NHAI (National Highway Authority of India) for 5 years.

MoU with NHAI

CONSULTANCY WORKS CARRIED OUT BY DEPARTMENT

- ✧ Department has participated in contract bid for GHMC- TPQC works and further awarded with the TPQC works for Serilingampally (circle 20) and RC Puram (circle 22) for the year 2021-2022.
- ✧ A surveying team consisting of Prof. A. Ramesh, Mr. T Naga Teja, Assistant Professor, and Mr. V Gopal Krishna, Technical staff along with 7 Highway Engineering students have conducted survey at Gagillapur site of Vignana Jyothi and submitted a boundary layout and contour plan.
- ✧ Department of Civil Engineering generated an amount of Rs.2,14,681 revenue against Material Testing Consultancy works besides GHMC TPQC consultancy.
- ✧ Department has done consultancy works of worth Rs**.** 25.0 Lakhs under GHMC TPQC and structural stability studies, Concrete mix designs and material testing works of worth Rs.2,06,532/- in 3 months (Jan, Feb, March; 2021).
- ✧ Department has done structural stability studies for MEIL, Qualitus pharma solutions.

- Department of Civil Engineering has done Geotechnical investigations on hill-lock area for the proposed new building.

GUEST LECTURES

- Surya Prakash, Managing Director, Satyavani Consultants Pvt. Ltd delivered a lecture on "Career opportunities in civil Engineering" on December 5th, 2020.
- Dr. P N Singh, Professor delivered a lecture on "Valuing Water" on World water day on 22nd March 2021.
- Dr. M R Madhav, Professor delivered a lecture on "What it takes to write a Journal paper" on 24th April 2021.
- Prof Dr. D. N. Ravi Shankar, Director (Technical) ENEWATE delivered a lecture on "Wastewater treatment and energy concentration" on May 19th 2021.
- Dr. S Pradeep Kumar, Assistant Professor delivered a lecture on "Awareness on environmental crisis" on occasion of World Environmental Day on 5th June 2021.

Prof. Dr. D.N Ravi Shanker, Director (Technical) ENEWATE

Prof. Dr. Pradeep Kumar Sugumar, Assistant Professor (VNRVJIET)

ALUMNI LECTURES

- ✧ Mr. Sameed Ahmed, Fellow, Teach for India delivered a lecture on "Career and Skills: Lifeline after B. Tech" on 26th September 2020.
- ✧ Mr. Rohit Polavarapu, Data Scientist at Walt Disney Company – Star TV Network, delivered a lecture on "Beyond B. Tech: Career path and Data Science" on 11th September 2020.
- ✧ Mr. Anuragh Vasam, Software Engineer at Hexagon Capability Centre delivered a webinar on 'Cracking Domain based IT job - Sharpen the saw' on 10th October 2020

Rohit Polavarapu -Alumni.

FACULTY CORNER

JOURNAL PUBLICATIONS

- ✧ Dr. A. Mallika, B. Rajashekaram, published a paper titled, "***Efficacy of supervised learning techniques in damage detection of structural components***" in A review Journal of Seybold report Vol.15, No.9, pp:3347 -3359,2020 September 2020 1533-9211.
- ✧ Dr. A. Mallika B. Venkat Rao, T. Subrahmanyeswara Rao, G.K. Viswanath published a paper titled, ***"Study on Optimization of High-Rise Building with Perforated Steel Plate Shear Walls"*** in Journal of Seybold Report Vol.25, Issue:510pp:578-591 December 2020 ISSN No. 15339211.
- ✧ Dr. B. Narendra Kumar, Vidya Mahitha. Chalasani published a paper titled, ***"Influence of Red Mud on the Performance characteristics of High Strength Self Compacting Concrete"*** in. Proteus Journal Volume 11, Issue 10, 44105 ISSN No: 08896348.
- ✧ Dr. B. Narendra Kumar, V. Rajesh published a paper titled, ***"Development of Graphene Oxide on Cement Mortar and Concrete"*** in A Review International Journal of Engineering Research in Current Trends (IJERCT) Volume- 2, Issue No: 3 44013 ISSN: 2582-5488.

- Dr. B. Narendra Kumar, M. Rajesh, U. Latha Sri, G.B Sravya published a paper titled***, "Effect of Quartz Materials on Properties of High Strength (M60) Self Compacting Concrete"*** in International Journal of Engineering Research in Current Trends Volume- 2, Issue No: 3 July,2020 ISSN: 2582-5488.
- Dr B. Narendra Kumar, M. Akhila, K. Nithish, Ch. Poojitha published a paper titled, ***"Improving Hardened Properties of Concrete by Adding Fly Ash and Micro Silica"*** in International Journal of Engineering Research in Current Trends Volume- 2, Issue No: 3 44013 ISSN: 2582-5488.
- Dr B. Narendra Kumar, G. Vinod Kumar published a paper titled, ***"Influence of Nano-Silica and Nano-Alumina on Properties of Concrete"*** in International Journal of Engineering Research in Current Trends Volume- 2, Issue No: 3 44013 ISSN: 2582-5488.
- Dr. B. Narendra Kumar, V. Vidya Mahith published a paper titled, ***"Red Mud as a Replacement of Cementitious Materials"*** in A Review International Journal of Engineering Research in Current Trends Volume- 2, Issue No: 3 44013 ISSN: 2582-5488.
- Dr. B D V Chandra Mohan Rao & Shiva Prasad R published a paper titled, ***"Numerical Simulation for Health Monitoring of Thin Simply Supported Plate using PZT Transducers"*** in Materials Today: Proceedings Accepted for publication -2214 – 7853.
- Dr. A. Ramesh, Sandeep Reddy G, Ramu P published a paper titled, ***"Evaluation of bituminous mix characteristics prepared with laboratory developed high modulus asphalt binder"*** in Journal of The Institution of Engineers (India): Series A (Accepted for publication) August 2020
- Dr. A. Ramesh, G Kalyan, V Venkata Ramayya published a paper titled, ***"Performance Evaluation of Warm mix Asphalt mixture with Partial inclusion of RAP"*** in Materials Today: Proceedings September 2020.
- Dr. A. Ramesh, B. Praveen, M. Kumar published a paper titled, ***"A Comparative Study on Pedestrian Crossing Behaviour Before and After Implementation of Control Measures at Mid-Block"*** in Journal of Indian Highways Vol.48(11) November 2020 ISSN No. 0376-7256
- K. Ravikumar., JSS Sudarshan and K. Ravikumar published a paper titled, ***"Assessment and recurrence of Kidney Stones through optimized machine learning tree classifiers using dietary water quality parameters and Patient's history"*** in international J-Journal of Advanced Science, Engineering and Medicine 44013 EISSN: 2164-6635.
- Suresh Kommu, Geethika Kalvakuntla, SS. Asadi published a paper titled, ***"Correlations between Undrained Shear Strength and SPT N for Cohesive Soil"*** in Journal of Green Engineering (JGE) Volume-10, Issue-7, pg.no: 44013 2363-6203.
- Dr. K. Suresh, B. Suresh, SS. Asadi published a paper titled, ***"Design of Mechanically Stabilized Earth wall for Widened Embankment Solid State Technology"*** in Vol.63, Issue:5 December 2020 ISSN No. 0038111.

- G. Lalitha, B. Ritish Reddy, J. Rakesh, B. Varun, B. Rakesh Kumar published a paper titled, A Review paper on ***"Applications and Techniques in Concrete Printing"*** in International Journal of Engineering Research & Technology (IJERT) Vol. 9 Issue 09 44075 2278-0181.
- G. Lalitha, B Sai Kumar, M Vishnu Vardhan, N Surya Teja, M Siri, Md. Sharfuddin Baba published A Review paper titled ***"E Waste in concrete As a Replacement of Fine and Coarse Aggregate"*** in International Journal of Engineering Research & Technology (IJERT) Vol. 9 Issue 09 44075 2278-0181.
- G. Lalitha, C. Sashidhar, C. Ramachandrudu published a paper titled, ***"Evaluation of Mechanical Properties on M30 Concrete Crushed Waste Glass as Fine Aggregate"*** in Journal of Green Engineering Volume-10, Issue-9, 44075 ISSN No:22454586.
- T. Naga Teja, Maddela Jagadeesh, Dr. C. Naveen Kumar published a paper titled, ***"Analysis and development of noise prediction model"*** in Journal of critical reviews Vol 7, issue 11, 2020, pg.no:4142-4148 44044 2394-5125.
- T. Naga Teja KM Lakshmana Rao published a paper titled, ***"Calibration of fundamental flow model for pedestrian crosswalks at un-signalized intersection for mixed traffic conditions"*** in Journal of seybold Report Volume 15, Issue-9 September 2020 1533-9211.
- B. Murali Krishna, Venkatesh noolu., Yeswanth Paluri., Sudhakar Mogil published a paper titled, ***"Performance evaluation of recycled granular material as sustainable sub-base material"*** in international journal Materials Today: Proceedings Volume: 44044 2214-7853.
- Yamini, Mallika Alapati published a paper titled, ***"Effect of External Vibrations on Electro-Mechanical Impedance Signatures in Damage Detection"*** in Materials Today: Proceedings Accepted for publication 2214 – 7853.
- Sandeep Sagar, Mallika Alapati published a paper titled, ***"Numerical Investigation on EMI Signatures in Pipes with Varied Damage Levels"*** in Materials Today: Proceedings Accepted for publication 2214 – 7853.
- Rochishnu Elchuri, Ramesh Adepu published a paper titled, ***"Sustainable Pavement Technologies - Performance of High RAP in WMA Surface mixture containing Nano Glass Fibres"*** in Journal of Materials Today: Proceedings Volume 31, Part 1 August 2020.
- Ms. V. Ramya Krishna, P. Harish Kumar Reddy, and Kadali Srinivas published a paper titled, ***"Design of Land Fill liners for fine grained soils using CTRAN/W"*** in Materials today proceeding Accepted for publication - ISSN No. 2214-7853.
- Harish Kumar Reddy, V. Ramya Krishna and Kadali Srinivas published a paper titled, ***"Design of Land Fill liners for fine grained soils using CTRAN/W"*** in Materials today proceeding Accepted for publication --- ISSN No. 2214-7853.

CONFERENCES PUBLICATIONS:

- P Narender Kumar, Dr. A Ramesh and R Durga Prasad presented a paper on ***"A Study on Plastic Cell Filled Concrete Pavement with Partial Replacement of recycled Aggregate for Low Volume Road"*** in Advances in Sustainable Construction Materials, March 2019.
- Manisha Vugge, Dr. CH. Nageshwar Rao and Dr. M.R. Madhav presented a paper on ***"Evaluation of Coefficient of Consolidation using Different Methods"*** in National Conference on Geotechnical Applications, March 2019.
- M Akhil Kumar, K Suresh, and Dr. M. R. Madhav presented a paper on ***"Optimization of Embankment Widening"*** in National Conference on Geotechnical Applications, March 2019.
- S. Sairam and Dr. Kadali Srinivas presented a paper on ***"Relation between Thermal Conductivity, Minerology, Cation Exchange Capacity and Specific Surface Area"*** in National Conference on Geotechnical Applications, March 2019.
- Dr. Durga Prasad R and M. Rajashekar presented a paper on ***"Effective of rubber chips and quarry dust on compaction, FSI and UCS values of expansive soil"*** in Two Day National Conference on Recent trends in Civil Engineering, February 2019.
- Mrs. Jyothirmai, Dr. Durga Prasad, Mrs. Jeevana Smitha, Kunal Agarwal presented a paper on ***"Effects of Contaminants in mixing water on the performance characteristics on cement concrete"*** in Two Day National Conference on Recent trends in Civil Engineering, February 2019.
- P Vinod Kumar G, Boya Manikanta R and Dr. Madhira Madhav presented a paper on ***"Ground Response Analysis and Liquefaction Susceptibility Assessment of Passighat Airport"*** in National Conference on Geotechnical Applications, March 2019.
- Vinodh Naik J, Penki Ramu and Srinivasa Rao T presented a paper on ***"GIS and AHP Methodology for parking site selection in Hyderabad City"*** in Advances in Sustainable Construction Materials, March 2019.
- Yashwanth Goud. S and Dr. R Durga presented a paper on ***"Evaluation of Optimum usage of copper slag aggregate in High Performance Concretes"*** in Advances in Sustainable Construction Materials, March 2019.

FACULTY SPONSORED FOR CONFERENCES/ SEMINARS/ WORKSHOPS/ FDPS/ OTHER PROGRAMS

Programs organized:

- Department organized an AICTE Sponsored One Week Online Short-Term Training Program (STTP) on Emerging Tools for Design and Analysis of Sustainable Roads (ETADSR 2020).
    - Series -1- Titled: Insights into the development of sustainable road materials and traffic systems (27.07.2020 – 01.08.2020).

- Series-2 –Titled: Computational tools used in the development of sustainable road materials and traffic systems (24.08.2020 – 29.08.2020).
- Series-3.-Titled: Computational Design Tools used for Planning and Maintenance of Sustainable Road Network. (ETDASR 2020) 7th – 12th December 2020

☞ Department of Civil Engineering conducted One Week Online Faculty Development Program on "Advances in Concrete Science and Technology for Sustainable (ACSTS)" during 13-18, July 2020.

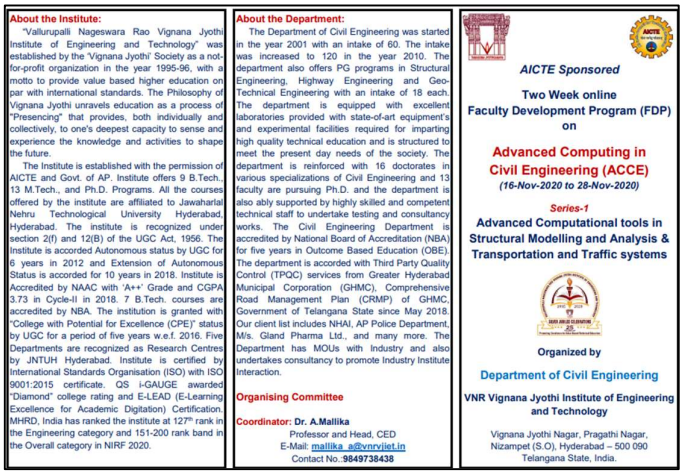
☞ Department has successfully organized an AICTE sponsored Two-week online Faculty Development Program on 'Advanced Computing in Civil Engineering:

- Series-1-Titled: Advanced Computational Tools in Structural Modeling and Analysis & Transportation & Traffic'. (16th -28th November 2020)
- Series-2: Advanced Numerical Modeling in Geotechnical, Hydraulic and Environmental Quality Applications. (15th to 27th February 2021)

☞ Department organized a Two-day workshop on Structural Evaluation of Reinforced Concrete Elements using Loading Frame Equipment-a hands on experience.

☞ Department of Civil Engineering conducted ***Panel Discussion*** on "Engineering Education-Match your passion-Charting the right career choice" of 16th September 2020

One Week Online FDP on "Advances in Concrete Science and Technology for Sustainability (ACSTS)"



Two Week Online FDP on "Advanced Computing in Civil Engineering (ACCE)"

FACULTY ACHIEVEMENTS/ RECOGNITIONS:

- Dr. K. Ravi Kumar, Associate Professor published his research article in European Physical Journal-B (SCI journal).
- Mr. JYV Shiva Bhushan and a student from III B.Tech. Mr. BLVVDSS Abhinav were selected for Mentoring of Engineering teacher and students by INAE fellow's scheme.

- Dr. K. Suresh, Assistant Professor has been awarded with Doctor of Philosophy degree from JNTU Hyderabad on "Design of Geo composite Liner for Fly ash Foams." August 2020.
- Dr. B. Murali Krishna, Assistant Professor has been awarded with Doctor of Philosophy degree from NIT Warangal on "Image based framework for condition assessment of RCC Bridge Girders" August 2020.

Journal / Book Reviewers:

Name of the faculty	Nature of Contribution	Details of associated Organization / Journal / Conference etc.
Dr. A Mallika	Reviewer	Institution of Engineers Series-A, Journal of Asian Architecture and Building Engineering
Dr. B. Narendra Kumar	Reviewer	Material Today Proceedings, Innovative infrastructure solutions
Dr. A Ramesh	Reviewer	International Journal of Pavement Research and Technology, Journal of The Institution of Engineers (India): Series A (IEIA), 6t^{h} Conference of Transportation Research Group
Dr. K. Ravi Kumar	Reviewer	International Journal of Environment and Waste Management
Dr. Kadali Srinivas	Reviewer	Agriculture Science Research Journal
Dr. B Murali Krishna	Reviewer	STRUCTURES Journal , Materials Today Proceedings, Journal of Building Construction and Planning Research

SOCIETAL IMPACT PROJECTS:

The following UG projects focused on societal impact:

- *Experimental Evaluation of Geo-synthetics fiber to Stabilization of Weak Subgrade for Low-Volume Roads*
- *WebGIS Development for Telangana and Andhra Pradesh*
- *Effect of using different types of Nanomaterials on performance Characteristics of High Strength Self Compacting Concrete*
- *Numerical modelling of embankment on soft soils*
- *Study on indoor environmental quality of College Building and its impacts on health*

STUDENT CORNER

INDUSTRIAL VISITS:

- PG Students of Structural Engineering and Highway Engineering visited Railway Under Bridge at) at Hitech-city MMTS Railway station on 26.12.2020.
- III B. Tech II semester students visited Dr. Reddy's Lab at Bachupally On 23.03.2021.
- Students of I year M.Tech. (Structural Engineering) were taken to the construction of Function Hall using PEB structure at Pragathi Nagar, Bachupally, Hyderabad on 10.08.2021

Students at construction of function hall using PEB structure at Bachupally

Students at construction of Railway Under Bridge

STUDENT ACHIVEMENTS:

- P. Pradeep Kumar, M. Tech (Structural Engineering) student under the guidance of Dr. B. Narendra Kumar has presented paper in an international Conference on “Latest Trends in Civil, Mechanical and Electrical Engineering” (LTCMEE- 2021) at NIT, Bhopal and bagged the best paper award.
- Four students have been selected for internship at **“INMOVIDU”** on Construction Planning & Management.
- Eight students from the 2017-2020 batch were selected for 6 months internship at "Shapoorji & Pallonji company Pvt. Ltd".
- 15 Final year Civil Engineering students were selected by NCL company and with an internship of Rs.20,000/- per month.
- 16 Students from III B.Tech. Civil Engineering have participated in Nationwide Quiz Competition "UltraTech Stimulus" organised by UltraTech Cement Ltd. out of which 2 students (BLVVDSS Abhinav (18071A0104) & J Rakesh (19075A108) have been short listed.
- 36 students have attended sessions organized by Dr. Reddy’s labs (Best industry practices on Water Conservation, Innovative ideas on Water Conservation,) on occasion of world water day.
- 56 students from I, II, III and IV B.Tech. have successfully completed their certificate courses from various platforms like Coursera, NPTEL, Unschool, Inmovido, and Shaw Academy

CIVIL ENGINEERING ASSOCIATION (CEA), INDIAN CONCRETE INSTITUTE (ICI) STUDENT CHAPTER & IGBC STUDENT CHAPTER

The Civil Engineering Association along with ICI & IGBC student chapter have organized the below events.

- Industrial Visit to construction of Railway Under Bridge (RUB) at Hitech-city MMTS railway station on 24-12-2020.
- Road Safety Awareness campaign was organized on 17th February 2021 to spread awareness on road safety on the occasion of Road safety week.

- Webinar on "Career Opportunities in Civil Engineering by Er. Girish Sridharan structural Engineer, LA California on 11-07-2020.

Road Safety Awareness Campaign

Career Opportunities in Civil Engineering

DISTINGUISHED ALUMNI

- Distinguished alumni Mr. Rishi Tirupari (2002-2006) sponsored tuition fee for two meritorious and economically under students Mr. K. Sai Charan (16071A0125) and Mr. I. Pavan Kalyan (17071A0182).

Mr. Rishi Tirupari

K. Sai Charan

TECHNICAL ARTICLES

ENGINEERING EXCELLENCY OF KAKATIYA'S PRIDE, RAMAPPA TEMPLE

Mrs. G. Lalitha,
Assistant Professor, Department of Civil Engineering

The Ramappa temple at Palampet in Telangana's Warangal has been conferred the tag of UNESCO World Heritage site, the Culture Ministry said on Sunday, 1-8-2021.

Many Hindu temples were developed under the patronage of Ganapati Deva, Rudrama Devi and Prathaparudra who were of Kakatiya dynasty. The Ramappa temple was built by the Kakatiya King Ganapatideva Chakravarthy's sub-ruler Recherla Rudrayya in the year 1213 AD. It took 40 years to build the temple. Interestingly, even as the entire temple is dark in colour, the Ramalingeswara in the inner temple illuminates. The Shiva lingam is visible even without electric lights in the Sanctorum.

Palampur is about 60 km from Warangal, which was the capital of the Kakatiya dynasty. It's not just the exquisite craftsmanship that adorns the Kakatiya Rudreswara Temple, also known as the Ramappa temple, that makes it an architectural marvel as well as an Engineer Excellency project. Experts have been puzzled at the "engineering skill" behind the construction of the 13th-century temple, which has been intact for nearly 800 years. On 1-8-2021, the temple, tucked away at Palampet in the hinterlands of Telangana, was inscribed as a UNESCO world heritage site, the 39th in India. It is the first and only monument from Andhra Pradesh and Telangana to make it to the list.

It stands out to be a masterpiece and achieved major heights in terms of architectural skills by the ancient Kakatiya Vishwakarma Sthapathis (Architect). Interestingly, this is perhaps, the only temple in South India named after its architect, Ramappa Stapathi. Inside the temple complex is Rudreswara temple, which stays unharmed by the ravages of time till date.

Fig 1: UNESCO Certified Ramappa Temple

Architectural Engineering Excellency of Ramappa temple

Monuments that make it to the list, according to UNESCO, need to have an “outstanding universal value”. It’s not just the exquisite craftsmanship that adorns the Kakatiya Rudreswara Temple, also known as the Ramappa temple that makes it an architectural marvel there are hanging pillars, The sculptures are carved so sensitively like a small needle can pass through the space between them.

Fig 2: Sculptures on walls and Pillars of Ramappa Temple

Engineering Geology excellency of Ramappa Temple

Marco Polo during his visit to the Kakatiya Empire allegedly called the temple "the brightest star in the galaxy of temples". Ramappa temple stands majestically on a 6-foot (1.8 m) high star-shaped platform. The hall in front of the sanctum has numerous carved pillars that have been positioned to create an effect that combines light and space wonderfully.

The main structure is in a reddish Sandstone, but the columns have large brackets of black Basalt which is rich in iron, magnesium and silica. These are carved as mythical animals or female dancers or musicians, and are "the masterpieces of Kakatiya art, notable for their delicate carving, sensuous postures and elongated bodies and heads”. Tough Black basalt is so well polished that after 800 years one can still see their reflection in them. Interestingly the sculptures here show the women wearing heels. The intricate designs on the ceiling and the thin threaded holes in the stones are a proof of use of sophisticated technology.

Fig 3: Sculptures with Red Sandstone and Basalt on walls and Pillars of Ramappa Temple

Engineering excellency of Floating bricks used in Ramappa Temple

The bricks are so light that they can float on water. The density of the bricks is between 0.85 to 0.9 grams per cubic centimeter, whereas the density of water is 1 g/cc. Any usual brick has a density around 2.2 g/cc. The bricks were made of clay mixed with acacia wood, chaff, and myrobalan (a tree), to a 1000 degree Celsius, and was made into a lightweight block, making it sponge-like and allowing it to float on water. No other monument, at least in India, has the history of such floating bricks they are one of the reasons for the temple's longevity, as their weight or lack of it meant that there was little pressure on the foundation.

Fig 4: Floating bricks used for walls of Ramappa Temple

Engineering Excellency of Geo Technical Engineering in Ramappa Temple

Another key feature that highlights the geotechnical aspects of the temple is its" sandbox technology", in foundations which has helped it sustain despite being in a seismic zone.

The entire temple has been built using this technology wherein a certain area is dug up, filled with sand, and then the structure is constructed on top of it. So that sad filled acts as a cushion to protect the temple in the event of earthquakes. Structures built on these 'sandboxes' have a robust foundation as the seismic waves generated due to earthquakes are absorbed by the sand.

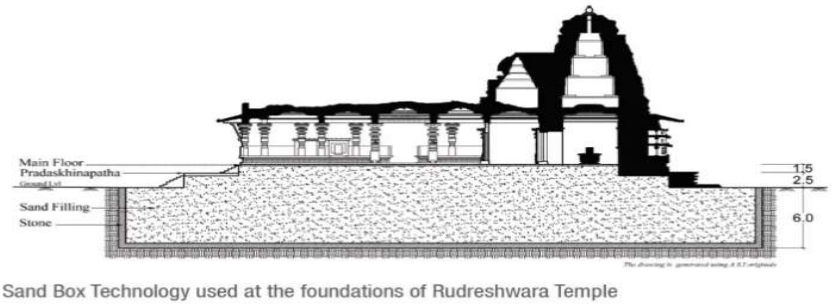


Fig 5: Sand Box Technology used in Ramappa Temple

The temple survived earthquakes in the 17th and 18th centuries even as the houses around it collapsed. The temple's pillars have sunk into the ground but despite this, the structure remains intact. The technique involved in sandbox technology was filling the pit — dug up for laying foundation — with a mixture of sand lime, Jaggery (for binding) and karakkaya (black myrobalan fruit), before the buildings were constructed on these 'sandboxes. The sandbox in the foundation acts as a cushion in case of earthquakes. Most of the vibrations caused by earthquake lose their strength while passing through the sand by the time they reach the actual foundation of the building." "Although techniques similar to sandbox have been found to be employed in other parts of the world but usage of sand is probably unique to Kakatiya dynasty as in other places mud or stones were to be used". This can be used even now, for making concrete

buildings earthquake-resistant and that sandbox technique is even long-lasting and more beneficial than the modern techniques. Presently, Elastomeric Base Isolation technique is used in making a building earthquake resistant as part of which rubber is used in the foundation which gets worn out in a span of 30 to 40 years and needs more maintenance. In sandbox technique sand is used, whose weathering rate is very slow, as a result it can last for hundreds of years as is evident in the case of Ramappa or Thousand Pillar temples. Moreover, the process of laying sandbox foundation will also be more economical naturally available.

Limitations & applications of Sand box technology

The sandbox technique, however, has its limitation that it cannot be used in construction of tall buildings like skyscrapers though it can be easily used in shear-predominant structures, which are the most common form of buildings in India. The use of sandbox technique will be beneficial for construction of houses in earthquake-prone zones in the country. “However, much more research work and standardization are required to be done for using the sandbox technique in construction. As of now, only preliminary experiment of just the sandbox has been carried out in laboratory by him and his team by building a small prototype of sandbox,”. It was observed that almost 60 per cent of the impact force of vibrations was reduced after passing through a sandbox with dry sand.

Sand box technology was used for low magnitude earthquakes sand box technology works out very well. For large level earthquakes. They developed a unique technic small tunnel like holes were made through all stones used for construction of walls, pillars, rooftops. Melted iron is filled in that holes which resisted the earthquake forces. As a result, these dowels hold the rocks together strongly making the total construction fit like a frame and strong.

WIDENING OF EMBANKMENT USING REINFORCED EARTH RETAINING WALL USING PLAXIS SOFTWARE

Dr. S. Sasanka Mouli
Assistant Professor, Department of Civil Engineering

ABSTRACT

Mechanically Stabilized Earth (MSE) walls are the earth retaining structures which have been gaining tremendous popularity from the past few decades. MSE walls are reliable and are more economical than traditional retaining structures. The main components of MSE wall are backfill, reinforcing material and facing elements. Wall facing not only determines the aesthetics of the retaining walls but also influence the behavior of wall. In the present study, the effect of soil properties on the behavior of wall is obtained from the numerical modelling using PLAXIS-2D software. The existing embankment of 3.1m height has a 4-lane road with top width 14m and side slope of 1.5 H: 1V. The 4-lane embankment is proposed to be extended to 6-lane to meet the increased traffic requirement. The widening is done using geosynthetic and soil nailing as reinforcement. The proposed MSE wall was designed using Federal Highway Administration (FHWA) guidelines (FHW2001). Since the reinforcement layers do not have sufficient effective length a composite design with both geosynthetic reinforcement and soil nailing into the existing embankment is proposed. The lateral deformation and lateral pressures along the depth is analyzed.

INTRODUCTION

Mechanically stabilized earth walls reinforce the earth material so that they can support their own weight. Bamboos have been used as reinforcing material thousand years ago. In 1972, the first reinforced earth retaining wall was constructed in United States in southern California using metal strips as reinforcement. In MSE wall design the reinforcing elements such as metal bars, strips, geosynthetics or other anchorage systems to improve the mechanical properties of the soil mass. By using reinforce material the overall strength of composite soil is increased by preventing the deformation. MSE walls have four components mainly 1) Retained backfill soil 2) Reinforced backfill soil 3) Geogrid reinforcement and 4) Wall facing.

Reinforced backfill soil is a component which has been strengthened by tensile reinforcing elements. The geosynthetic reinforcement is placed horizontally with required spacing in the reinforced zone. Wall facing is vital to the stability of walls, which is increasing the strength of soil and shear is generated at the interfaces of reinforcement and soil. Facia of wall is a thin wall element to retain the backfill material. The major advantage of MSE walls include i) They are stable under seismic loads ii) minimum space requirement for their construction iii) Economical than traditional retaining structures and iv) Absorbs deformation in poor foundation soil.

Reinforced walls are designed based on FHWA code or Indian road congress (IRC) guidelines. Referring to the stability of MSE wall design procedure is divided into external and internal investigation. External examination involves check for slip failure, overturning, bearing capacity and Deep-Seated failure and internal examination involves the check for breakage and pull-out resistance of the reinforcement material. In the design of considered loads are live loads, surcharge load and seismic loads.

Embankments are the most ancient forms of civil engineering structures which assign to large magnitude of geo material which is initially placed and densified for an intention of rising level of a road above the existing structure. The design and performance of the embankment mainly depends upon the purpose of construction. In the field of transportation, the embankments design is concern about differential settlement due to external loads. Based on the type of material used for construction embankment are grouped as reinforced structure, earth fill and rock fill structures. In roadway based on the requirement and design the existing embankment are extended to serve the purpose.

The explosion of population in this modern age is making the infrastructure project like roads obsolete due to the incessant use of roads by the users. To overcome this problem, roads are being widened from single or two lanes to multiple lanes. widening of existing roads is a regularly adapted practice in the field to increase the capacity or usage to accommodate traffic, but in the process of widening the bottom width of the embankment gets extended to larger width if it is designed with prevailing slope angle, that results in requirement of a large acquisition of land which is very difficult either due to cost or non-availability of land. even the widening process requires a large quantity of back fill material of adequate properties which fulfils the requirement for construction, but the availability of adequate soils is becoming lesser due to urbanization and industrialization, resulting in usage of soil with inadequate properties for construction by improving strength using various techniques which leads to uneconomic nature of the project.

In the current study, the effect of friction angle on the MSE wall is analyzed. The lateral aspect of pressures and deformations at the facing and the tensile forces in the reinforcement are studied. The causes of failure of MSE wall are due to weak backfill and inadequate length of reinforcement. The overall stability of wall decreases due to sudden drawdown of water.

Methodology:

Soil properties

Mohr-Coulomb model was considered and it requires an input parameter such as cohesion (c), friction angle (ϕ), Poisson's ratio (μ), Young's modulus (E) and dilatancy angle (ψ). During the analysis to avoid difficulty, the cohesion is taken as c= 1kN/m^2. Mohr-Coulomb model is an elasto-plastic model.

Mohr-Coulomb equation

$S= c+ \sigma \tan(\phi)$

where S= shear strength of soil, c= cohesion of soil, ϕ= friction angle and σ is the normal stress. The basic parameters such as cohesion and friction angle are determined by conducting tests like triaxial test and direct shear test. Effect of external load on soil is modelled by using secant modulus (E50). With Mohr-Coulomb failure criteria the backfill soil was assumed to be homogeneous, isotropic etc.

Table 1: Properties of Backfill and Foundation soil

Material	Unit weight (kN/m^3)	Friction angle	Cohesion (kN/m^2)	Elastic modulus (kN/m^2)	Poisson Ratio

Backfill soil	18	34°	3	35	0.3
Foundation Soil	18	34°	3	35	0.3

Mohr-Coulomb model advantages:

The model predicts yield criteria which is similar to backfill material.

Using direct shear test and triaxial test parameters such as cohesion and friction angle can be easily determined.

Wall facings

Wall facing is a thin wall element to retain the backfill material and it plays an important role in the erosion control. In the design four facing plates with 0.2m width and 0.75m length are used. Geogrid reinforcement are inserted in between the panels and interface elements are also needed to model the interaction between backfill material and facing panel material. Different models in facing are wrap-around facing, segmental-panel facing and full-height panel facing.

Table 2: Properties of facing panels

Properties	Facing panel
Axial stiffness (EA) kN/m	5.48e6
Flexural rigidity (EI) kNm^2 /m	1.8e4
Thickness (d) m	0.2
Poisson ratio (μ)	0.1

Wall construction and surcharge load

Generally, at the time of construction of wall, wall deformation occurs. As the depth of wall increases the lateral deformation decreases due to increase in elastic moduli of soil. An additional load of 30kPa is applied at upper most part of the wall. In the surcharge a 1m thick sub base layer pavement material is considered.

Geogrids

Geogrid with an axial stiffness of 500kN/m are used. The vertical spacing between the geogrid are 0.45m. Geogrid can only sustain tensile forces but not compression. Geogrid alone cannot withstand the tensile stresses, so anchors are also used in the design. The geogrid at its end is connected to the anchor and the anchor is inserted into the adjacent soil. This composite connection will transfer the residual tensile stress into the adjacent soil. The anchor of length 3m and at an inclination of 100 with a spacing of 0.5m is considered.

Table 3: Properties of Geogrid

Properties	Geogrid
Axial stiffness (kN/m)	500, 5,000, 50,000

Model configuration

The MSE wall simulation and analysis is done by modelling configuration shown in Figure 1. The model includes the loading condition, boundary condition and geometry. It consists of a MSE wall with height 3.1m, 14m width and geogrid with vertical spacing of 0.45m and anchors with spacing of 0.5m. The surcharge load of 30kPa is applied at the top of the wall and four panel plates of 0.2m thick and 0.75m height are considered.

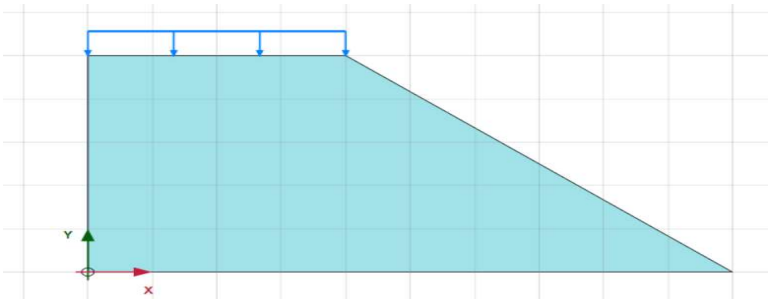


Figure 1. Numerical model of the embankment before widening

Mesh Generation

In order to perform finite element analysis, the geometry has to be divided into finite elements and the composition of finite elements is called a mesh. The mesh is generated in the mesh mode (Figure 2). Loads, boundary condition, soil stratigraphy and structural objects are taken into account in the generation of mesh. The stability of soil is not considered in mesh generation and the foundation soil is assumed as stiff soil. The horizontal boundaries are considered as fixed and the vertical boundaries are free to move.

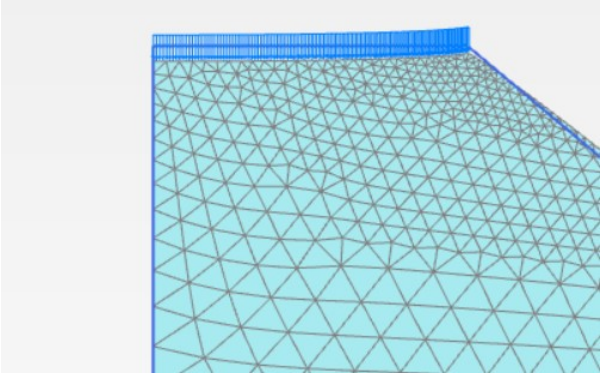


Figure 2: Unwidened Embankment with mesh

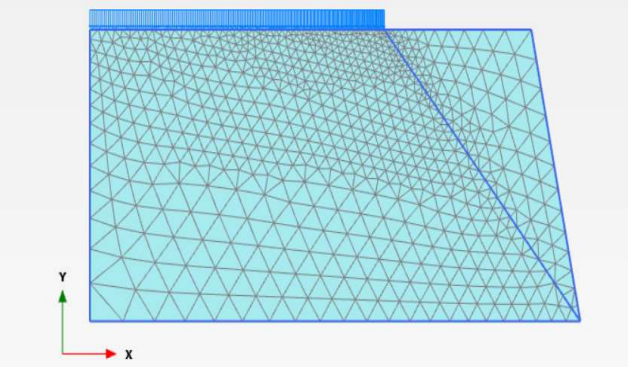


Figure 3: Widened Embankment with mesh

Results And Discussions

Initial Embankment

The embankment is 5m high and has 4m top width and 10m base width.

The factor of safety of the initial embankment without load was 1.465. When a downward line load of 30kN/m is applied factor of safety has reduced to 1.221.

Widened Embankment

The Embankment is widened to 9m with top width 9m and base width as 10m (Figure 4).

A new embankment is made using MSE wall which consists Geogrids and facing. Various connections are also given.

The Factor of safety of the widened Embankment without application of load is 2.073.

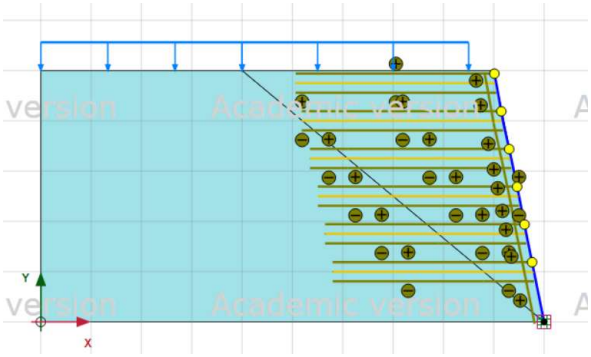


Figure 4 Numerical model with widening of the embankment When a vertical load was applied, the factor of safety is reduced to 1.785 (Figure 5).

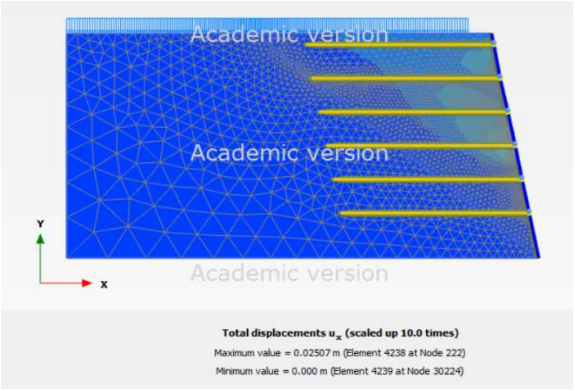


Figure 5. Displacements along X-direction

CONCLUSIONS:

- Lateral pressure at the facing were not linearly proportional to the depth of the wall under at-rest condition. This is because the model considered the realistic interface present between the wall facing and the backfill.
- Lateral pressure at the facing were a function of the facing stiffness of the wall. As the stiffness of facing increases, lateral pressure is found to be higher.
- Backfill friction angle had a significant effect on lateral pressure and displacement of wall. Strength of the soil backfill increases as the friction angle increases and the wall geometry does not have much effect on lateral pressure. Lateral pressure at the facing is greater than the Rankine active pressure.
- The maximum lateral deformation can be reduced as the friction angle increases. As the reinforcement stiffness and cohesion of the soil is improved the lateral deformation of wall can be reduced.
- The tensile force induced in the reinforcement increases with an increase in reinforcement axial stiffness.

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Lightweight Concrete

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Lightweight concrete is a special concrete which includes an expanding agent that increases the volume of the mixture while giving additional qualities such as lessened dead weight thermal and electrical insulating properties. The main specialties of lightweight concrete are its low density (300 kg / m3 to 1850 kg / m3) and thermal conductivity. Due to lightweight and high strength to mass ratio their use results in lesser steel consumption. Here we will learn about Lightweight concrete, types of foam concrete, advantages & disadvantages of lightweight concrete.

Introduction to lightweight concrete:

Light concrete is made of lightweight aggregate, it is also called foam concrete.Since this cement consists of lightweight aggregates, it is used in coarse aggregates and sand, clay, foamy slag, clinker, and crushed stone, aggregates of organic and inorganic. This concrete saves 15 to 20 % in the cost of construction of floors and roofs.

Principle behind lightweight concrete:

The basic principle behind making lightweight concrete is by inducing air in the concrete. To achieve the above principle practically, there are three totally different methods:

- By changing conventional mineral aggregates by cellular porous aggregates. (Light-weight aggregates concrete).
- By including air or gas bubbles into concrete (Aerated concrete).
- By excluding sand from concrete (No fines concrete).

Properties of lightweight concrete:

- This cement is lighter because of 'fly ash' as aggregate.
- A massive number of custom mixes from 1000 psi of soil cement to 50,000 psi of tower concrete.
- There are concrete sailboats (Ferrocement) and foam concrete canoe.
- Different aggregates have different colors.
- Permeability, strength, durability, aesthetics are just some of the requirements.

Types of Foam Concrete:

1.Aerated concrete:

- Aerated concrete is produced from cement or lime, silica sand, and sometimes pozzolanic materials and classified as foam concrete.
- The aerated concrete means having a large number of air bubbles, these bubbles are created to reduce

the concrete's density and provide excellent thermal insulation.

- Air is entrapped artificially by chemical (metallic powders like Al, Zn, H2O2 used as gas-producing agent) or mechanical (hydrolyzed protein or resin soaps used as a foaming agent) means.
- The air pores in aerated concrete are usually 0.1 to 1 mm in diameter. Based on the method of pore-formation, it is classified into three groups:
- Entraining method (gas concrete), foaming method (foamed concrete), and combined method.

2. Lightweight Aggregate Concrete:

- This concrete can be produced with a variety of foam concrete aggregates.
- They are produced by natural materials or raw materials like clay, slate, or shale.
- They are manufactured from industrial by-products such as fly ash or pelletized expanded slabs, i.e., pelite.
- The best type of lightweight aggregate will affect the required properties.
- If high thermal insulation properties are required then a lightweight, weak aggregate can be used, it results in relatively low strength concretes.

3. No Fines Concrete:

- It is a lightweight concrete consisting of coarse aggregate, cement, and water, without any fine aggregates.
- The density of concrete is about 2/3 that of dense concrete, constructed with the same set.
- The compressive strength of concrete without any concrete is 5 N / mm2 to 15 N / mm2 & bonding strength of no-fine concrete is low.
- The cement/aggregate ratio by volume ranges from 1:6 to 1:8.
- For drainage layers ratio should be 1:10, it is placed within 20 minutes after mixing, otherwise, the workability of concrete gets reduced.
- And it is not suitable for reinforced concrete structure due to low bonding strength. It is suitable for the foundation due to its high water absorption properties.

4. Structural lightweight concrete:

This concrete is made with a rotary kiln to form lightweight structural aggregates, which reduces weight and durability problems in buildings and vulnerable structures.

This structural foam concrete has higher strength than ordinary weight concrete, it is typically 25% to 35% lighter.

Advantages of lightweight concrete:

- This concrete reduces the dead load due to less density.
- No segregation and capillary movement of water because of the absence of fine aggregate.

- It has better insulation properties than conventional concrete.
- It has good sound insulation.
- Produce low-cost concrete due to lower cement content.
- It is eco-friendly due to the clinker, fly ash, slag.
- It has low drying shrinkage.
- Also has excellent drainage properties due to its open texture.
- It has low formwork pressure.

Disadvantages of lightweight concrete:

- This concrete is susceptible to water content in the mixture.
- Cement mixtures have difficulty in placing and finishing.
- In some combinations, the porosity and angularity of the holes, the aggregates separate and float towards the surface.
- The mixing time is longer than conventional concrete to achieve proper mixing.

Applications of Foam Concrete:

- In load-bearing masonry wall using cellular concrete blocks.
- Also, precast floor and roofs.
- In partition wall in residential, institutional buildings.
- In insulation cladding to exterior walls of all types of construction. L

Lightweight Concrete vs. Normal Weight Concrete:

Normal Weight Concrete	Lightweight Concrete
A normal weight concrete is going to be about 140 to 150 pounds per cubic foot	A lightweight concrete is going to be about 90-115 pounds per cubic foot.
Normal weight concrete has lower water content.	Lightweight concrete has higher water content.
Projects made with normal-weight concrete require additional materials for framing, cladding, and a steel reinforcement that ultimately increasing overall costs.	LWC remains a cost-effective building material especially for large projects.

Fig.1 Porous Aggregate

Fig.2 Light weight Concrete

Fig.3 Light weight concrete block

Conclusion:

Lightweight concrete is an extremely versatile material, which can be used for a wide range of applications. Although lightweight concrete has been in use for two millennia, there are still uncertainties, which were addressed in this article. Clear definitions were given for the different types of lightweight concrete and information was provided about crucial topics regarding lightweight aggregate properties and about lightweight concrete. Several issues represent key information in the state-of-the-art of lightweight concrete. Lightweight concrete is ideal for constructing additional flooring on top of older or even newer structures, as it reduces the risk of collapse. As such, it can be used to successfully build bridges, decks, girders, piers, precast constructions, and high-rise buildings with reduced density.

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Pervious Concrete

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19075A0112

History:

Pervious concrete was first utilized as a pavement surfacing and load bearing wall in Europe in the 1800s. Due to a reduction in the amount of cement used, cost efficiency was the primary motivation. In Scotland and England, it was popular again in the 1920s for two-story homes. Due to the lack of cement in Europe after WWII, it became increasingly viable. It was not until the 1970s that it gained popularity in the United States. It got popular in India in the year 2000.

Introduction:

Pervious concrete (also known as porous concrete, permeable concrete, no-fines concrete, and porous pavement) is a high-porosity concrete that allows water from precipitation and other sources to pass through directly, decreasing runoff and permitting groundwater recharging. Large particles are used in pervious concrete, whereas fine aggregates are used sparingly. The aggregates are then coated with the concrete paste, which allows water to travel through the slab. Parking lots, low-traffic zones, residential streets, pedestrian pathways, and greenhouses are all examples of pervious concrete applications. It's a crucial application for sustainable construction, and it's only one of several low-impact development approaches that builders utilize to maintain water quality.

Properties:

Cement, coarse aggregate (size should be 9.5 mm to 12.5 mm), and water make up pervious concrete, with little to no fine aggregates. A small amount of sand can be added to boost the strength. The water-to-cement ratio is 0.28 to 0.40, and the void content is 15 to 25%. It's crucial to have the right amount of water in the concrete. A low water to cement ratio increases concrete strength, but too little water can lead to surface failure. A sufficient amount of water in the combination gives it a wet-metallic appearance. The mixture should be field verified because this concrete is sensitive to water content. A Rapid Air system, with the concrete tinted black, can be used to measure entrained air.

Riser strips are placed on top of a common flatwork form so that the screed is 3/8-1/2 inches (9 to 12 mm) above the ultimate pavement height. Manual screeds are preferred over mechanical screeds. To help with compaction, the riser strips are removed. The concrete is compacted right after screeding to improve the bond and smooth the surface. Excessive compaction of pervious concrete increases compressive strength but reduces porosity (and thus lower permeability).

The jointing of this concrete slab is very similar to that of other concrete slabs. Prior to curing, joints are tooled with a rolling jointing tool or saw cut. Within 20 minutes of concrete discharge, cover the concrete with 6 mil plastic sheeting. This, however, contributes to a large amount of waste being dumped in landfills. To cure pervious concrete without generating waste, preconditioned absorptive lightweight aggregate and internal curing admixture (ICA) have been used.

Pervious concrete has a strength range of 600–1,500 pounds per square inch (4.1–10.3 MPa), yet it can reach 4,000 pounds per square inch (28 MPa). Compressive strength does not have a standardized test. The unit weight of a sample of poured concrete is used to determine acceptance using ASTM standard no. C1688. A density tolerance of plus or minus 5 pounds (2.3 kg) of the design density is allowed. [more clarification is required] Because of its particular composition, slump and air content tests are not relevant to pervious concrete. Prior to the facility's opening, the designer of a storm water management plan should visually inspect the pervious concrete's drainage characteristics to confirm that it is performing effectively.

(a) (b) (c) (d)

(e) (f) (g)

(h) (i) (j)

Applications:

- Residential roads, alleys, and driveways
- Sidewalks and pathways
- Parking areas
- Low water crossings
- Tennis courts
- Subbase for conventional concrete pavements
- Patios
- Artificial reefs
- Slope stabilization
- Well linings
- Tree grates in sidewalks
- Foundations/floors for greenhouses, fish hatcheries, aquatic amusement centres, and zoos
- Hydraulic structures

- Swimming pool decks
- Pavement edge drains
- Groins and seawalls
- Noise barriers
- Walls (including load bearing)

Advantages:

Environmental Benefits:

- It reduces stormwater runoff replenishes water tables and aquifers.
- It eliminates detention ponds that are costly for stormwater management practices.
- Also permits for extra environment-friendly land growth.
- It prevents warm and polluted water from getting into streams.

Safety Benefits:

- It minimizes flash flooding and standing water.
- Skidding is lowered.
- Light reflectivity is greater than asphalt surfaces, therefore reduce the heat island effect.
- Glare from the wet pavement is virtually eliminated.

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"The difference between an energetic person and a confused person is the difference in the way their minds handle their experiences."

- A.P.J. Abdul Kalam

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