



## MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Sponsored by Mohamed Sathak Trust

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

Siruseri IT Park, Egattur, Chennai 603 103.

### BE - CIVIL ENGINEERING

S.No	Name of the course that include experiential learning through Project work/ Internship (2017 - 2018)
1	CE6006 - Traffic Engineering and Management
2	CE6401 - Construction Materials
3	CE6002 - Concrete Technology
4	CE6405 - Soil Mechanics
5	CE6703 - Water Resources and Irrigation Engineering
6	CE6503 - Environmental Engineering I
7	CE6504 - Highway Engineering
8	GE6351 - Environmental Science and Engineering
9	CE6301 - Engineering Geology
10	CE6502 - Foundation Engineering
11	CE6506 - Construction Techniques, Equipment and Practice
12	CE6005 - Construction Planning and Scheduling
13	CE6505 - Design of Reinforced Concrete Elements
14	EN6501 - Municipal Solid Waste Management
15	CY6151 - Engineering Chemistry - I

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**OBJECTIVES:**

- To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

**UNIT I TRAFFIC PLANNING AND CHARACTERISTICS 9**

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

**UNIT II TRAFFIC SURVEYS 10**

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized

transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

**UNIT III TRAFFIC DESIGN AND VISUAL AIDS 10**

Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals – Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

**UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 8**

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

**UNIT V TRAFFIC MANAGEMENT 8**

Area Traffic Management System - Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

**TOTAL: 45 PERIODS****OUTCOMES:**

On completing this course, the Students will be able to

- Analyse traffic problems and plan for traffic systems various uses
- Design Channels, Intersections, signals and parking arrangements
- Develop Traffic management Systems

**TEXTBOOKS:**

- Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
- Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
- Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

**REFERENCES:**

- Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
- Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
- SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
- John E. Tyworth, "Traffic Management Planning, Operations and control", Addison Wesley Publishing Company, 1996
- Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

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## OBJECTIVES:

- To introduce students to various materials commonly used in civil engineering construction and their properties.

**UNIT I STONES – BRICKS – CONCRETE BLOCKS 9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

**UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness – Soundness and consistency – Setting time – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

**UNIT III CONCRETE 9**

Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

**UNIT IV TIMBER AND OTHER MATERIALS 9**

Timber – Market forms – Industrial timber – Plywood – Veneer – Thermacole – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

**UNIT V MODERN MATERIALS 9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

**TOTAL: 45 PERIODS**

## OUTCOMES:

On completion of this course the students will be able to

- compare the properties of most common and advanced building materials.
- understand the typical and potential applications of these materials
- understand the relationship between material properties and structural form
- understand the importance of experimental verification of material properties.

## TEXT BOOKS:

- Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
- Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
- Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd., 2008.
- Gambhir.M.L., "Concrete Technology", 3<sup>rd</sup> Edition, Tata McGraw Hill Education, 2004
- Duggal.S.K., "Building Materials", 4<sup>th</sup> Edition, New Age International, 2008.

## REFERENCES:

- Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
- Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
- IS456 – 2000: Indian Standard specification for plain and reinforced concrete, 2011
- IS4926–2003 : Indian Standard specification for ready–mixed concrete, 2012
- IS383–1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete, 2011
- IS1542–1992: Indian standard specification for sand for plaster, 2009

## OBJECTIVES:

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.

**UNIT I CONSTITUENT MATERIALS**

9

Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water- Quality of water for use in concrete.

**UNIT II CHEMICAL AND MINERAL ADMIXTURES**

9

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

**UNIT III PROPORTIONING OF CONCRETE MIX**

9

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples

**UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE**

9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus.

**UNIT V SPECIAL CONCRETES**

9

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete - SIFCON-Shotcrete – Polymer concrete - High performance concrete- Geopolymer Concrete

**TOTAL : 45 PERIODS**

## OUTCOMES:

- The student will possess the knowledge on properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.

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## TEXTBOOKS:

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- Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency 2010
- Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

## REFERENCES:

- Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
- Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
- Gambir, M.L "Concrete Technology", 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
- IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998



**OBJECTIVES:**

- To impart knowledge on behavior and the performance of saturated soil. At the end of this course student attains adequate knowledge in assessing both physical and engineering behaviour of soils, mechanism of stress transfer in two-phase systems and stability analysis of slopes.

**UNIT I SOIL CLASSIFICATION AND COMPACTION**

9

Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – Index properties of soils - BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

**UNIT II SOIL WATER AND WATER FLOW**

9

Soil water – static pressure in water - Effective stress concepts in soils – capillary stress – Permeability measurement in the laboratory and field pumping in pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow nets – Simple problems. (sheet pile and weir).

**UNIT III STRESS DISTRIBUTION AND SETTLEMENT**

9

Stress distribution - soil media – Boussinesq theory - Use of Newmarks influence chart – Components of settlement — immediate and consolidation settlement – Terzaghi's onedimensional consolidation theory – computation of rate of settlement. -  $\sqrt{t}$  and  $\log t$  methods– e-log p relationship - Factors influencing compression behaviour of soils.

**UNIT IV SHEAR STRENGTH**

9

Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – cyclic mobility – Liquefaction.

**UNIT V SLOPE STABILITY**

9

Slope failure mechanisms – Types - infinite slopes – finite slopes – Total stress analysis for saturated clay – Fellenius method - Friction circle method – Use of stability number - slope protection measures.

**TOTAL: 45****PERIODS****OUTCOMES:**

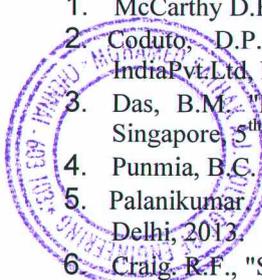
- Students have the ability to determine Index properties and classify the soil. They can also know to determine engineering properties through standard tests and empirical correction with index properties.

**TEXTBOOKS:**

- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2007
- Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern Ltd, New Delhi (India), 2000.
- Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2002.

**REFERENCES:**

- McCarthy D.F. "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2002.
- Coduto, D.P. "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
- Das, B.M. "Principles of Geotechnical Engineering". Thompson Brooks / Coles Learning Singapore, 5<sup>th</sup> Edition, 2002.
- Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2005.
- Palanikumar M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private Limited, Delhi, 2013.
- Craig R.F., "Soil Mechanics". E & FN Spon, London and New York, 2007
- Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2<sup>nd</sup> Edition, Pearson Education, 2013



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**OBJECTIVES:**

- The student is exposed to different phases in Water Resources Management and National Water Policy. Further they will be imparted required knowledge on Reservoir planning, management and economic analysis including Irrigation and Irrigation management practices.

**UNIT I WATER RESOURCES 9**

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Estimation of water requirements for irrigation and drinking- Single and multipurpose reservoir – Multi objective - Fixation of Storage capacity -Strategies for reservoir

operation - Design flood-levees and flood walls.

**UNIT II WATER RESOURCE MANAGEMENT 9**

Economics of water resources planning; – National Water Policy – Consumptive and nonconsumptive

water use - Water quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget- Conjunctive use of surface and ground water

**UNIT III IRRIGATION ENGINEERING 9**

Need – Merits and Demerits – Duty, Delta and Base period – Irrigation efficiencies – Crops and

Seasons - Crop water Requirement – Estimation of Consumptive use of water.

**UNIT IV CANAL IRRIGATION 9**

Types of Impounding structures: Gravity dam – Diversion Head works - Canal drop – Cross drainage works – Canal regulations – Canal outlets – Canal lining - Kennedy's and Lacey's Regime theory

**UNIT V IRRIGATION METHODS AND MANAGEMENT 9**

Lift irrigation – Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and

Micro Irrigation - Merits and demerits – Irrigation scheduling – Water distribution – Participatory

irrigation management with a case study

**TOTAL :45 PERIODS**

**OUT COMES:**

- The students will have knowledge and skills on Planning, design, operation and management of reservoir system.
- The student will gain knowledge on different methods of irrigation including canal irrigation.

**TEXTBOOKS:**

1. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000.
2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16<sup>th</sup> Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23<sup>rd</sup> Revised Edition, New Delhi, 2009

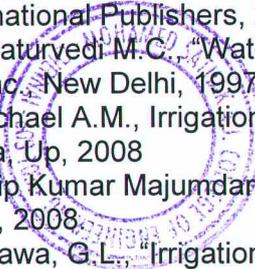
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1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc, New Delhi, 1997.
3. Michael A.M., Irrigation Theory and Practice, 2<sup>nd</sup> Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008
4. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
5. Asawa, G.L., "Irrigation Engineering", NewAge International Publishers, New Delhi, 2000

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**OBJECTIVES:**

- To make the students conversant with principles of water supply, treatment and distribution

**UNIT I PLANNING FOR WATER SUPPLY SYSTEM 8**

Public water supply system -Planning - Objectives -Design period - Population forecasting -Water demand -Sources of water and their characteristics -Surface and Groundwater- Impounding Reservoir Well hydraulics -Development and selection of source - Water quality - Characterization and standards- Impact of climate change.

**UNIT II CONVEYANCE SYSTEM 7**

Water supply -intake structures -Functions and drawings -Pipes and conduits for water- Pipe materials - Hydraulics of flow in pipes -Transmission main design -Laying, jointing and testing of pipes - Drawings appurtenances - Types and capacity of pumps -Selection of pumps and pipe materials.

**UNIT III WATER TREATMENT 12**

Objectives - Unit operations and processes - Principles, functions design and drawing of Chemical feeding, Flash mixers, flocculators, sedimentation tanks and sand filters - Disinfection- Residue Management - Construction and Operation & Maintenance aspects of Water Treatment Plants.

**UNIT IV ADVANCED WATER TREATMENT 9**

Principles and functions of Aeration - Iron and manganese removal, Defluoridation and demineralization -Water softening - Desalination - Membrane Systems - Recent advances.

**UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9**

Requirements of water distribution -Components -Service reservoirs -Functions and drawings - Network design -Economics -Computer applications -Analysis of distribution networks - Appurtenances -operation and maintenance -Leak detection, Methods. Principles of design of water supply in buildings -House service connection -Fixtures and fittings -Systems of plumbing and drawings of types of plumbing.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students completing the course will have

- an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
- an understanding of water quality criteria and standards, and their relation to public health,
- the ability to design and evaluate water supply project alternatives on basis of chosen selection criteria

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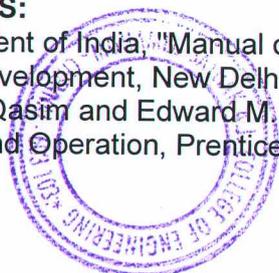
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34, Rajiv Gandhi Road (OMR), Siruseri, IT Park  
Chennai-605 003.**TEXTBOOKS:**

- Garg, S.K., "Environmental Engineering", Vol.1 Khanna Publishers, New Delhi, 2005.
- Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.
- Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2005

**REFERENCES:**

- Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2003
- Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning", Design and Operation, Prentice Hall of India Private Limited, New Delhi, 2006.



**OBJECTIVES:**

- To give an overview about the highway engineering with respect to, planning, design, construction and maintenance of highways as per IRC standards, specifications and methods.

**UNIT I HIGHWAY PLANNING AND ALIGNMENT 8**

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – Classification of highways – Locations and functions – Factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.

**UNIT II GEOMETRIC DESIGN OF HIGHWAYS 12**

Typical cross sections of Urban and Rural roads — Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses.

**UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9**

Design principles – pavement components and their role - Design practice for flexible and rigid Pavements (IRC methods only) - Embankments .

**UNIT IV HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE 8**

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) - Quality control measures - Highway drainage — Construction machineries.

**UNIT V EVALUATION AND MAINTENANCE OF PAVEMENTS 8**

Pavement distress in flexible and rigid pavements – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements –Types of maintenance – Highway Project formulation.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students completing this course would have acquired knowledge on planning, design, construction and maintenance of highways as per IRC standards and other methods.

**TEXTBOOKS:**

1. Khanna.S. K., Justo.C.E.G and Veeraragavan.A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010
3. Indian Road Congress (IRC), Guidelines and Special Publications of Planning and Design.

**REFERENCES:**

1. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8<sup>th</sup> edition Delhi, 2013.
2. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth Impression, South Asia, 2012
3. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1<sup>st</sup> Edition, USA, 2011
4. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis" Wiley India Pvt. Ltd., New Delhi, 2011
5. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
6. O'Flaherty.C.A "Highways, Butterworth – Heinemann, Oxford, 2006

**OBJECTIVES:**

To study the nature and facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a megadiversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and

desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins – Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards disaster management: floods, earthquake, cyclone and landslides. Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXTBOOKS :**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw Hill, New Delhi, 2006.

**PRINCIPAL**

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#### **REFERENCES :**

1. Trivedi R.K. 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham W.P.Cooper., T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan R, 'Environmental Studies - From Crisis to Cure', Oxford University Press, 2005



**OBJECTIVES:**

To study the nature and facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical

classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

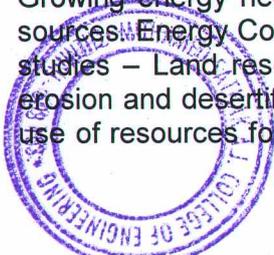
**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources – Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –



Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

#### UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### TEXTBOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw Hill, New Delhi, 2006.

#### REFERENCES :

1. Trivedi R.K. 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham W.P.Cooper., T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of india PVT LTD, New Delhi, 2007.
4. Rajagopalan R, 'Environmental Studies - From Crisis to Cure', Oxford University Press, 2005



**OBJECTIVES:**

- To impart knowledge on common method of sub soil investigation and design of foundation. At the end of this course student acquires the capacity to investigate the soil condition and to select and design a suitable foundation.

**UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION** 9

Scope and objectives – Methods of exploration – auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – Sampling techniques – Representative and undisturbed sampling – methods - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Penetration tests (SPT and SCPT) - Bore log report – Data interpretation - strength parameters and Liquefaction potential - Selection of foundation based on soil condition.

**UNIT II SHALLOW FOUNDATION** 9

Introduction – Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (SPT, SCPT and plate load) Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

**UNIT III FOOTINGS AND RAFTS** 9

Types of footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning – Mat foundation – Types and applications – Proportioning – Floating foundation – Seismic force consideration – Codal Provision.

**UNIT IV PILE FOUNDATION** 9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity- Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

**UNIT V RETAINING WALLS** 9

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls.

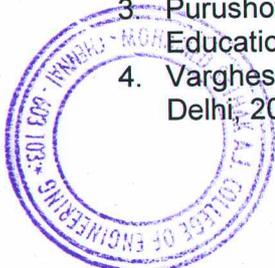
 TOTAL : 45 PERIODS

**OUTCOMES:**

- Students will have the ability to select type of foundation required for the soil at a place and able to design shallow, foundation, deep foundation and retaining structures.

**TEXTBOOKS:**

- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors Ltd., New Delhi, 2007.
- Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International Pvt. Ltd, New Delhi, 2005.
- Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2<sup>nd</sup> Edition, Pearson Education, 2013
- Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.



## REFERENCES:

1. Das, B.M. "Principles of Foundation Engineering" 5<sup>th</sup> edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGrawHill Publishing company Ltd., New Delhi, 2002.
3. Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2005
4. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint)
5. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.
6. IS 6403 : 1981 (Reaffirmed 1997) "Breaking capacity of shallow foundation", Bureau of Indian Standards, New Delhi, 1998
7. IS8009 (Part1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi, 1999
8. IS8009 (Part2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi, 1992
9. IS2911(Part1):1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi, 1994
10. IS2911(Part2):1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi, 2007
11. IS2911(Part 3) :1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi, 1998
12. IS2911 (Part 4) :1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi, 1997



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**OBJECTIVES:**

- To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

**UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 9**

Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method.

**UNIT II LIMIT STATE DESIGN FOR FLEXURE 9**

Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.

**UNIT III LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION 9**

Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.

**UNIT IV LIMIT STATE DESIGN OF COLUMNS 9**

Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

**UNIT V LIMIT STATE DESIGN OF FOOTING 9**

Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The student shall be in a position to design the basic elements of reinforced concrete structures.

**TEXTBOOKS:**

- Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
- Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
- Subramanian,N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.

**REFERENCES:**

- Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998
- Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002
- Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2009
- Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2007.
- Bandyopadhyay. J.N., "Design of Concrete Structures", Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
- IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
- SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999

**OBJECTIVES:**

- The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities. At the end of this course the student shall have a reasonable knowledge about the various construction procedures for sub to super structure and also the equipment needed for construction of various types of structures from foundation to super structure.

**UNIT I CONCRETE TECHNOLOGY 9**

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete - manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete – curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

**UNIT II CONSTRUCTION PRACTICES 9**

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick – weather and water proof – roof finishes – acoustic and fire protection.

**UNIT III SUB STRUCTURE CONSTRUCTION 9**

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.

**UNIT IV SUPER STRUCTURE CONSTRUCTION 9**

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.

**UNIT V CONSTRUCTION EQUIPMENT 9**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end loaders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting. Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling,

**TOTAL: 45 PERIODS.****OUTCOMES:**

- Students completing the course will have understanding of different construction techniques, practices and equipments. They will be able to plan the requirements for substructure and superstructure a construction.

**TEXTBOOKS :**

- Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5<sup>th</sup> Edition, McGraw Hill, Singapore, 1995.
- Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.
- Varghese P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.
- Shetty M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.

**REFERENCES:**

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2002.
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
4. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.
5. Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004



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**OBJECTIVES:**

- To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

**UNIT I SOURCES AND TYPES**

8

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

**UNIT II ON-SITE STORAGE AND PROCESSING**

8

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

**UNIT III COLLECTION AND TRANSFER**

8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower-Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

**UNIT IV OFF-SITE PROCESSING**

12

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

**UNIT V DISPOSAL**

9

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor-Dumpsite Rehabilitation

TOTAL: 45 PERIODS

**OUTCOMES:**

The students completing the course will have

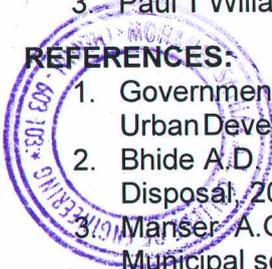
- an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- ability to plan waste minimisation and design storage, collection, transport, processing and disposal of municipal solid waste.

**TEXTBOOKS:**

- Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.
- Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981
- Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000

**REFERENCES:**

- Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.
- Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
- Manser, A.G.R. and Keeling A.A., "Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996



**OBJECTIVES:**

- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor as well as to choose types of foundations.

**UNIT I PHYSICAL GEOLOGY** 9

Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

**UNIT II MINEROLOGY** 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

**UNIT III PETROLOGY** 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

**UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS** 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

**UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS** 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students completing this course

- Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
- Will realize the importance of this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.
- Can choose the types of foundations and other related aspects.

**TEXT BOOKS:**

- Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
- Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
- Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
- Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
- Parbin Singh. A " Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.

**REFERENCES:**

- Muthiayya, V.D " A Text of Geology", Oxford IBH Publications, Calcutta, 1969
- Blyth F. G. H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
- Bell, F.G. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
- Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988

**OBJECTIVES:**

- To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

**UNIT I CONSTRUCTION PLANNING**

6

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

**UNIT II SCHEDULING PROCEDURES AND TECHNIQUES**

12

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software.

**UNIT III COST CONTROL MONITORING AND ACCOUNTING**

9

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

**UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION**

9

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

**UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION**

9

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

TOTAL: 45 PERIODS

**OUTCOMES:**

- The student should be able to plan construction projects, schedule the activities using network diagrams, determine the cost of the project, control the cost of the project by creating cash flows and budgeting and to use the project information as decision making tool.

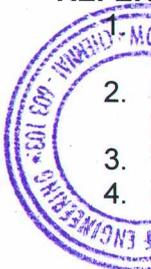
Dr. Rajiv Gandhi Road (OMR), Siruseri, IT Park  
Chennai-603 103.

**TEXTBOOKS:**

- Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005
- Srinath, L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001

**REFERENCES:**

- Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
- Moder, J., Phillips. C. and Davis E., "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3<sup>rd</sup> Edition, 1985.
- Willis, E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
- Halpin D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.



**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY** 9

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin

**UNIT II CHEMICAL THERMODYNAMICS** 9

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY** 9

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Intersystem crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS** 9

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANO CHEMISTRY** 9

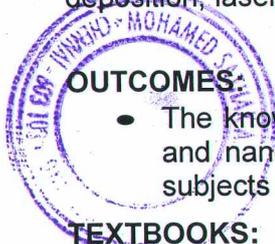
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications.

**TOTAL :45 PERIODS****OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXTBOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010





**COMPARATIVE STUDY OF COMPACTION  
CHARACTERISTICS OF SOIL STABILIZED  
WITH SILICA FUME AND RICE HUSK ASH**

**PROJECT REPORT (CE6811)**

*Submitted by*

**BAVYA.A.G**

**311814103011**

**MEENA.B**

**311814103034**

**VIJAYALAKSHMI.S**

**311814103078**

*In partial fulfillment for the award of the degree*

*of*

**BACHELOR OF ENGINEERING**

**IN**

**PRINCIPAL**

**MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING**  
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park  
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**CIVIL ENGINEERING**

**MOHAMED SATHAK A J COLLEGE OF ENGINEERING**

**ANNA UNIVERSITY : CHENNAI 600 025**

**APRIL 2018**



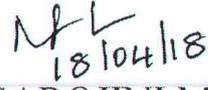
ANNA UNIVERSITY : CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report "COMPARATIVE STUDY OF COMPACTION CHARACTERISTICS OF SOIL STABILIZED WITH SILICA FUME AND RICE HUSK ASH" is the bonafide work of "BAVYA.A.G (311814103011), MEENA.B (311814103034), VIJAYALAKSHMIS (311814103078), " who carried out the project work under my supervision.



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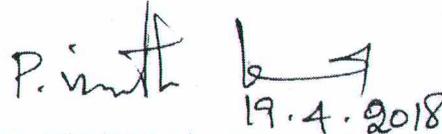


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## ABSTRACT

The **superstructure** built on any type of soil may undergo some sort of failures like **settlement**, **bearing capacity failure**, and **loss of shear strength**. In order to arrest those failure **soil strength** can be increased by **stabilization**. Stabilization is one of the methods to improve the engineering properties of soil. In this study we have taken two types of soil. The Laterite soil sample is obtained near Pallikaranai. The landfill soil is taken from Pallikaranai dumpyard. The **landfill soil sample** is taken at a **depth of 1m**.

The basic index properties test had been conducted for the soil samples. Their **compaction characteristics** have been studied by adding the SF and RHA with various percentages. Their compaction characteristics were conducted with different percentages of SF and RHA by adding those admixtures in combination with soil samples. The experiments were carried by mixing soil with different percentages of RHA and SF by varying each of them as 4%, 6%, 8% in combination with **laterite and landfill soil**. From the experimental results it had been observed that addition of RHA and SF with laterite soil gave good results when compared with landfill soil.



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## CHAPTER 7

### CONCLUSION

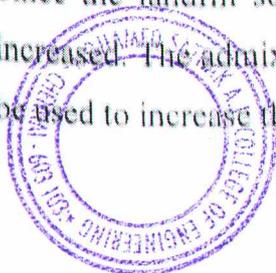
#### 7.1 GENERAL

From the experimental test results, it is evident that both the admixtures silica fume and the rice husk ash can be used as an admixture or additives.

- It has a great influence on increase of **dry density** in laterite soil, Also it is evident from the study that the addition of silicafume and rice husk ash had been decreased the dry density for the landfill soil.
- Since the **laterite soil** is a strong soil its strength can be increased by adding admixtures. There is an improvement in dry density for combination soil+4%ash+8% silica fume.
- The landfill soil though it is contaminated it attained a dry density of 1.87 g/cc and then there is a decrement in the **dry density**.

#### 7.2 SCOPE OF FUTURE WORK

- The admixtures like silica fume and the rice husk ash can be used as an stabilizing agent for the soil, by adding them with various concentrations to the soil sample.
- By adding the **admixtures** with various concentrations of silica fume and rice husk ash, the strength properties of laterite soil can be studied, because it showed a improvement in increase of dry density.
- Since the landfill soil is contaminated, its dry density cannot be increased. The admixtures like silica fume and rice husk ash cannot be used to increase the dry density of landfill soil.



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CONSTRUCTION PLANNING AND WORK SCHEDULING OF A  
RESIDENTIAL APARTMENT USING PRIMAVERA R 8.1

A PROJECT REPORT

*Submitted By*

**SRI SHANKAR P**

311814103069

*In partial fulfilled for the award of the degree*

*Of*

BACHELOR OF ENGINEERING

IN

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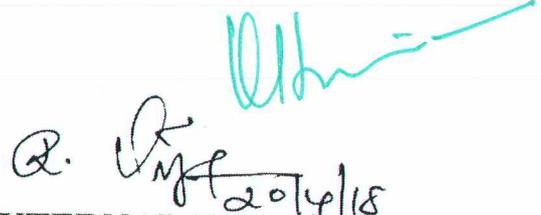
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**INTERNAL EXAMINER**



**EXTERNAL EXAMINER**

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## ABSTRACT

The construction industry has been for years, the major contributor for the national economy, accounting more than 10% of gross national product. Construction management is the composite of all modern projects, management technologies having their objective as control of time, cost and quality in the design and construction of a new facility.

In this project the concept of construction management are applied to construction of a **Residential Apartment**. It consists of 2 blocks of stilt +3 , 4bhk apartment. This project commenced on 2 Jan 2017 without scheduling the activity. After that tracking the project in March 2017. It was found that percentage of completion was 5% against the planned target 15% using the scheduling software tool(primavera). First data are collected and from those collected data, all required parameters (activities duration, predecessors) are calculated considering all the activities of the project and then CPM network is drawn using **PRIMAVERA** project planner and the critical path is identified.

As per the present progress the project is expected to be completed by Sep 2018 against the original schedule of completion date of April 2018.the will be delayed by 35calendar days.as per revised schedule using primavera, the project is expected to be completed by May 2018, with delay of 15 days.



  
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## CHAPTER 9

### RESULT

In this project, the work is delay due to not having the awareness of critical path method and scheduling tool. During the construction of building certain amount of money will get invested, it gives profit only when the construction gets over. So delay of project may leads to decrease in economy. **Scheduling of activities in construction of small gives lot of merits.** So under the project management the planning and scheduling is prepared in the detailed format. The project managers try to keep the construction progress as per the planning and scheduling. The comparision chart is shown below.

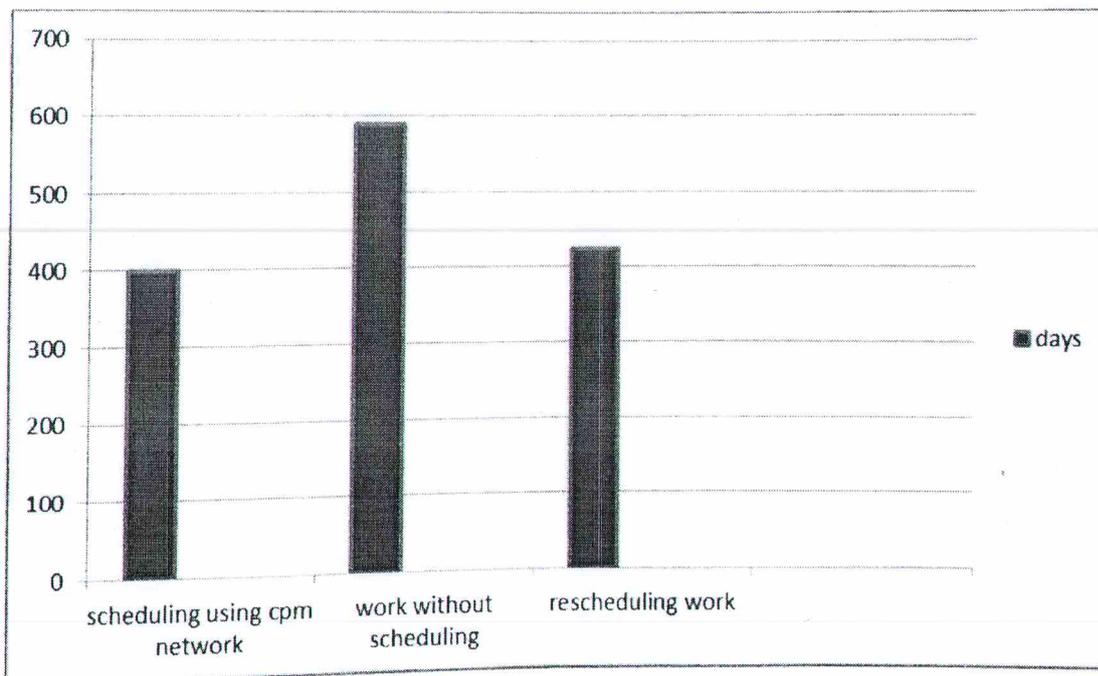


Chart 9.1 Comparison Chart



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**CASE STUDY ON WATER RESOURCE  
MANAGEMENT IN VELACHERY**

**A PROJECT REPORT**

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## ABSTRACT

Water is a transparent, tasteless, odourless, and nearby colorless chemical substance that is the main constituent of Earth's streams, lakes and oceans, and the fluids of most living organisms. Due to recent development in technology and growth of population we are facing severe water scarcity. Water scarcity is the lack of fresh water resources to meet water demand. Two-thirds of the global populations live under conditions of water scarcity at least one month of year. Half a billion people in the world face severe water scarcity all year around. Half of the world's largest cities experience water scarcity. This is due to improper water resource management. Water resource management is the activity of planning, developing, distributing and managing the optimum use of water resources. It is a sub-set of water cycle management. Ideally, water resource management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all uses and demands. This project is a question type surveying which involves collection of various datas from around 500 residents of velachery. Using the datas various informations such as water quality, demand of water, ground water utilisation will be known and the solutions to overcome water related problems will be provided.



  
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## CHAPTER-7 CONCLUSION

### SURVEY RESULT DISCUSSION

From the survey results we found that residents of velachery are mostly dependent on two sources for their daily survival. The one is groundwater and another is from Metro Water Board.

The population of velachery was found to be around 35,000 in 2014 and it is increasingly dramatically in the series of years which is expected to attain 65,000 in 2020 so the demand for is also increasing automatically.

The per capita demand for a resident is 151 litres where it comprises of 131 litres of groundwater and 20 litres of metro water for their usage. Around 85% of residents have done rainwater harvesting but there was no proper maintenance which affects the efficiency of it very much.

So the demand for metro water will increase from 7lakh litres per day to 13lakh litres by 2020. To reduce the demand residents should use rain water harvesting properly so that the demand for water during drought seasons can be achieved through saved rainwater.

Open wells should be constructed at regular spacing in velachery lake. Rain water drainage system should be implanted by every individuals and the rainwater should be transferred to the constructed openwells which can be utilized later during need arises which also plays a major role in groundwater recharge



## BONAFIDE CERTIFICATE

Certified that this project report "**EXPERIMENTAL STUDY OF CONCRETE IN REPLACEMENT OF FINE AGGREGATE IN USED FOUNDRY SAND**"

is the bonafide work of "K.MOHAMED ARSATH (311814103037), E.ABUTHAHIR (311814103301), H.HUSSAIN RIZWI (311814103302), M.MOHAMED YOUNIS (311814103303)" who carried out the project work under my supervision.



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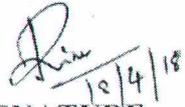
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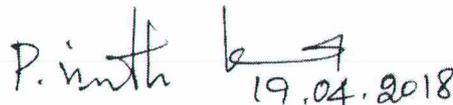
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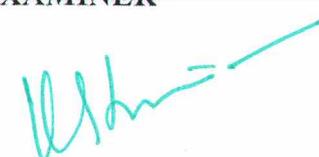


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## ABSTRACT

Generation of waste foundry sand as by-product of metal casting industries causes environmental problems such as infertility of land, unsightness, awful odour etc. because of its improper disposal. Thus, its usage in building material and in other fields is essential for reduction of these environmental problems. This research was carried out to produce a low-cost concrete.

An experimental investigation was carried out on a concrete containing waste foundry sand in the range of 0%, 5%, 10%, 15%, 20%, and 25% by weight for M-15 grade concrete.

The concrete containing foundry sand was tested and compared with conventional concrete in terms of workability, compressive strength and split tensile strength. Cubes and cylinder were casted and compression test and split tensile strength was performed on 28th day for mix of 1:1.73:2.8 at a w/c of 0.5.

The aim of this research is to know the mechanical properties of concrete after adding optimum quantity of waste Foundry sand in different proportion.



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## CHAPTER 9

### CONCLUSION

Based on the result can be concluded as follows:

- The  $M_{15}$  grade of concrete design mix has been achieved.
- Workability of concrete made using foundry sand observed to be increased slightly with replacement level.
- The compressive strength  $M_{15}$  of concrete cube on replacing foundry sand 5%, 10%, 15%, 20% and 25% was tested. And the optimum foundry sand is 15% achieved.
- Split tensile strength  $M_{15}$  of concrete cylinder on replacing foundry sand 5%, 10%, 15%, 20% and 25% was tested. And the optimum foundry sand is 15% achieved.
- Calcium, silica and hydrate(C-S-H) are bind together and give strength to the concrete. There is some non-activated calcium and hydrate (C-H) are present in this mix while adding foundry sand(silica sand) the remaining non-activated content is activated and gives strength also increase
- Disposal problem of waste and environmental effect can be reduced through this.



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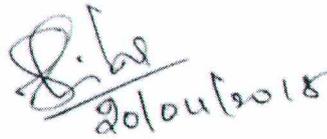
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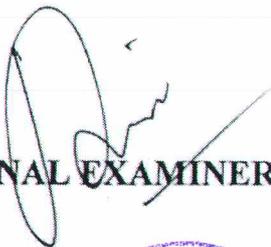
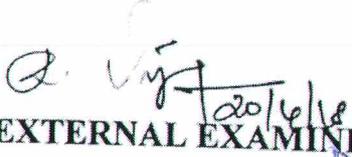
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## ABSTRACT

In India, construction of ambitious **highways** net-working and development, of several **expressways** for high speed corridors need more than 8000 million tons of aggregate. The Growing need for new roads may, in many cases, require construction over soft or loose soils that are incapable of supporting additional loads. Designers must identify innovative materials and construction techniques to address the problem of building on soft soils or where sensitive existing utilities or wetlands are present while, at the same time, accelerating project schedules.

Expanded Polystyrene (EPS) Geofoam can be used to replace compressible soils or in place of heavy fill materials to prevent unacceptable loading on underlying soils and adjacent structures. The high compressive resistance of Geofoam makes it able to adequately support traffic loadings associated with secondary and interstate highways.

The goal of **design and construction of highway** over soft ground is to provide an adequate transportation facility at the lowest overall life-cycle, performance and safety using EPS Geofoam.

At last the pavement structure would be analyzed for all possible load combinations pertaining through **IRC** recommendations.



## CHAPTER 7

### CONCLUSION

This study suggests **Designing Flexible pavement** using Geofoam will increase the strength of pavement and also increase the life time of the Pavement Structure.

EPS Geofoam has an extremely high compressive resistance, making it able to adequately support traffic loadings associated with secondary and interstate highways. When used in road construction projects, EPS Geofoam saves considerable time as well, thanks to ease of handling - unlike other fill materials, you do not need special equipment when working with EPS Geofoam.

These studies are mainly for safe and economic usage of Geo Material products in a better and cost-effective manner. Based on all Geo Materials products, Geofoam is not widely used in road construction in India. To improve and protect environment, a cautious and efficient use of natural resources is present day need.



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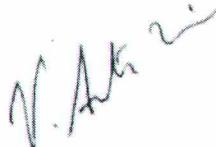
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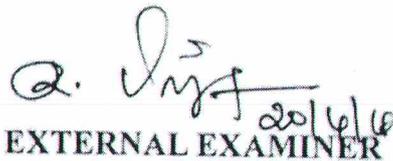
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## ABSTRACT

This study describes the experimental study of fiber reinforced concrete with manufacturing sand (M-Sand) in addition of crimped steel fibers.

To over-come the difficulties due to excessive sand mining, M-Sand is used as fine aggregate. M-Sand is uniformly in size, produced from gravel crushers.

The main objective of this research is to investigate the effect of steel fibers on concrete manufactured by M-sand as fine aggregate and develop a high performance concrete.

It is proposed to determine and compare compressive strength and tensile strength of the concrete grades M20 having different percentage of steel fiber (0%, 10%, 15%). The experimental investigation is carried out on a total no. of 18 specimen by conducting compressive strength test.

In the first phase of the study, the specimen of standard cube of (150 mm x 150 mm x 150 mm) and cylinder (150mm x 300mm ) was used to determine the compressive and tensile strength of concrete.

  
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## CHAPTER 14

### CONCLUSION

Based on the experimental investigation the following conclusions are given within the limitations of the test results.

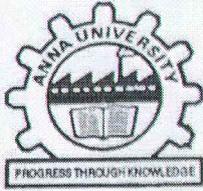
- Addition of crimped steel fibres resulted in significant improvement on the strength properties of concrete with M-Sand used as fine aggregate.
- Compared to plain concrete, the fibre addition resulted in better matrix strengthening and enhanced compressive & tensile properties of concrete.
- The reinforcing efficiency of fibre addition was dependent on the optimum dosage level of steel fibre up to 5 % of crimped steel fibres since increased fibre addition resulted in loss in workability.
- Unrestricted failure of plain concrete specimens was restricted with volumetric bulging due to presence of fibres and gradual release of fracture energy was anticipated.
- The maximum increase in compressive strength ( $44.44 \text{ N/mm}^2$ ) was observed of concrete grade M-20 respectively at 15% of crimped steel fibres.
- Tensile strength is continuously increased with increasing the percentage of steel fibre and maximum tensile strength was achieved in the case of 15% steel fibre for grade M20. These were occurred due to ultimately we provide the reinforcement to the concrete.



- A maximum split tensile strength of  $3.55 \text{ N/mm}^2$  was observed with 15% steel fibre concrete (28 days) at a maximum volume fraction of steel fibre which was compared to reference concrete and the roles of fibres in delaying the crack formation with subsequent increase in strength were realized.
- The compressive and split tensile strength for all mix proportions of fibre content showed a favorable improvement in the strength properties due to crack arresting mechanism of fibres at different scales of cracking.
- Interaction of steel fibres with concrete were realized in fibre reinforced concrete which provided a maximum crack tie together and stress transfer mechanism to yield a superior performance.
- Effect of crimped steel fibres M20 grade of concrete is almost same, some variation may occur because fibre is uniformly distributed but randomly oriented.



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# BEHAVIOUR OF SODIUM BENTONITE ON LIME STABILIZED SOIL

A PROJECT REPORT

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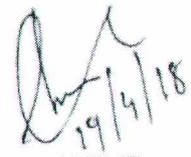
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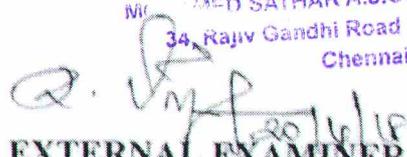
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## ABSTRACT

The project aims at stabilizing clay soil using mechanical mixing of sodium bentonite and lime as admixtures. Stabilization of soil has become a vital part of construction industries due to fast growth in population and urbanization. Use of sodium bentonite in geotechnical engineering to alter the soil index and engineering properties is studied in detail through laboratory experiments and analysis. Addition of sodium bentonite increases the surface area for the lime to react in lime stabilized soil.

This study presents the attempts made to incorporate the mechanical mixing of sodium bentonite to the traditional and oldest lime stabilization technique, to study its influence on the index properties and strength of clayey soil. Laboratory tests were conducted to determine the Atterberg limits, compaction characteristic and unconfined compressive strength of the lime stabilized soil mixed with small proportions of sodium bentonite.

The addition of Sodium Bentonite to virgin soil, liquid limit, plasticity index and optimum moisture content increased, whereas plastic limit, shrinkage limit and maximum dry density decreased. For lime stabilized soil, plastic limit, shrinkage limit and optimum moisture content increased, whereas liquid limit, plasticity index and maximum dry density decreased. For both immediate and curing effect, the maximum unconfined compressive strength was achieved with 2% of Sodium Bentonite and 5% lime as 96% and 272% higher than that of the actual soil strength.



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## CHAPTER 5

### CONCLUSION

To study the effect of sodium bentonite on the lime stabilized soil, index tests, compaction tests and unconfined compressive strength tests were carried out. For a comparative study, tests was conducted on uncured and 7 days cured soil. Based on the analysis of the results, the following conclusions maybe drawn,

1. Addition of sodium bentonite alters the index properties of soil with and without lime.
2. In both, uncured and cured conditions, the addition of sodium bentonite to lime stabilized soil greatly increased the unconfined compressive strength of the soil.
3. The plastic limit increased from 34% to 38% respectively for 7 days cured lime stabilized soil.
4. Shrinkage limit increases from 10% to 20% for 7 days cured lime stabilized soil.
5. Optimum moisture content increased with the increase in the percentage of nano materials and maximum dry density of decreased from 1.6g/cc to and 1.18g/cc on lime stabilized cured soil sample.
6. For Sodium Bentonite, the maximum unconfined compressive strength was attained for Soil + 5% Lime + 2% Sodium Bentonite, as 244.65kN/m<sup>2</sup> and 463.76 kN/m<sup>2</sup>for uncured and cured lime stabilized soil samples respectively.



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Nano particles provide larger surface area for reaction during curing period which results in high reactivity of soil and thus increases the strength to a great extent. Cured samples result in improved strength as the curing period ensures proper completion of pozzolanic reaction between soil and lime.



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# UTILIZATION OF RECLAIMED ASPHALT PAVEMENT IN MASTIC ASPHALT PAVEMENT

A PROJECT REPORT

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EXTERNAL EXAMINER

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## ABSTRACT

India is the third largest road network in the world with 0.66km of roads per square km. The increase in the construction of new roads increases the demand for the materials required for the new construction. In India, about 15,000 tons of aggregates are required per kilometer of highway. The use of alternative materials like plastic and rubber wastes have been implemented in some parts however the recycling of bituminous pavement is yet to popularize in India.

The deteriorated pavements are milled to partial or full depth depending upon its distress condition. The Reclaimed Asphalt Pavement (RAP) thus obtained is made of mineral aggregate covered with a thin film of bitumen and are usually dumped into landfills. The recycling of the RAP material is a logical and practical way of conserving the diminishing supply of the pavement material. In Chennai the old pavements are dumped in the landfills in Egmore and these wastes are degrading the environmental condition.

Less than 15% of these are used as RAP in road construction along with conventional aggregate and a large quantity of it is dumped in the yards. Hence there is a need to effectively utilize the old pavement material for the road construction. Hence in this study the 100% RAP material is used for designing a mastic asphalt pavement and since no virgin aggregates are used, apart from the reduction in cost of construction, also reduces emissions, traffic and energy associated with the transport and production of these materials and also provide good water proofing and skid resistance to the pavement surface.

Since many of the pavement gets deteriorated because of the seepage of ground water. And it can be minimized only by providing void less, water proofing pavements such as Mastic asphalt pavement. So alternative materials like RAP can be mixed with mastic asphalt to minimize the utilization of materials and also to provide a good-water-proofing surface.



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Mastic asphalt pavements are resistant to chemical attack, vermi proof and their durability is nearly 15 years. Hence the RAP waste can be greatly minimized and utilization of this waste material in mastic asphalt pavement is economical.



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## CHAPTER 5

### CONCLUSION

#### SUMMARY AND CONCLUSION

- Reclaimed Asphalt Pavement (RAP) materials were used to design mastic asphalt pavement without the addition of virgin aggregates.
- Centrifuge extractor was done to retrieve the binder content in the RAP material and this was found to be 3.75%.
- Mastic Asphalt mix design was done using coarse aggregates passing 19mm and retained on 2.36mm sieve without any segregation in size between 19mm and 2.36mm.
- Four types of bitumen like CRMB 55, PMB 70, 60-70 and 30-40 were used for the same mix proportion of mastic asphalt.
- Five types of gradation using different proportions of RAP, fine aggregate, Lime Powder and binder content and tested for hardness test.
- 16% and 13% binder content made the bitumen puffy in the mastic asphalt design though the hardness number was high.
- Among all the types 30-40 grade bitumen alone met the requirements of mastic asphalt pavement as per IRC 107:1992.
- Skid resistance properties was tested for wet conditions was found to be low and hence it was decided to impregnate 12mm aggregates to the mastic asphalt pavement in order to avoid skidding of vehicles.
- The mix proportion mentioned in the table 4.11 with 40% RAP, 50% fine aggregate, 10% Lime powder and 13% binder content is best suited for urban conditions because the skid resistance value lies within the limit specified by IRC



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STUDY OF ULTIMATE TENSILE STRENGTH OF MARKET  
AVAILABLE HYSD BARS

A PROJECT REPORT

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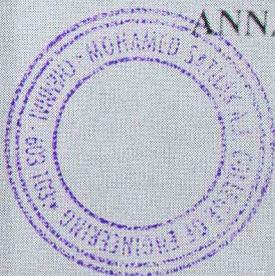
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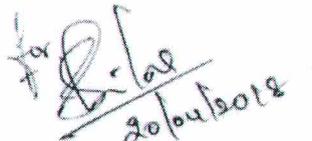
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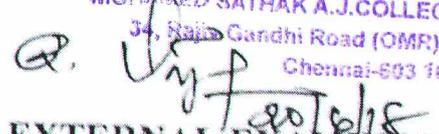
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**EXTERNAL EXAMINER**

## ABSTRACT

In this project we study about strength of steel (TMT bars). The strength of the beam, column and slabs are mainly depends upon the concrete strength and reinforcement. Mostly reinforcement steels place major role in framed structures. So from this, we collect varieties of TMT bars in different companies. From the above based companies the tensile strength test, rate analysis and microscopic study has been carried out in 10mm and 12mm bars for comparison purpose based on the original strength provided in such companies and cross section have also been carried out to study the harden layer of TMT bars by microscopic study.



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## CHAPTER 6

### CONCLUSION

From this experimental study we find out the **tensile strength of reinforcement bars** in few different companies in testing laboratory with graphical representation.

By comparison of 10mm bar maximum yield stress is obtained in KAMACHI TMT Bar( $535.317 \text{ N/mm}^2$ ) and the lowest yield stress is obtained in ARS TMT bar( $209.837 \text{ N/mm}^2$ ).

By comparison of 12mm bar maximum yield stress is obtained in ISTEEL TMT Bar( $578.448 \text{ N/mm}^2$ ) and the lowest yield stress is obtained in ARUN PLUS TMT bar( $251.709 \text{ N/mm}^2$ ).

By comparison of 10mm bar maximum elongation percentage is obtained in TATA TMT Bar (27.60%) and the lowest yield stress is obtained in TULSYAN TMT bar(15.80%).

By comparison of 12mm bar maximum elongation percentage is obtained in KAMACHI TMT Bar (22.00%) and the lowest yield stress is obtained in ARS TMT bar(16.67%).

By Comparing the chemical composition of steel with reference to the code book which are tested in testing laboratory.

The microscopic study has been carried out to refer about the surface of Thermo mechanically Treated Bar for denoting the corrosion layer in the reinforcement bar.

The study of pattern have been carried out for the purpose of proper boundary layer.

From all the above the difference in the strength and corrosion resistant of few TMT bars study have been have been carried out.



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**INFLUENCE OF NANO COPPER SLAG  
ON LIME STABILIZED SOIL  
PROJECT REPORT**

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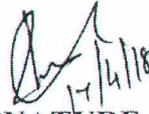
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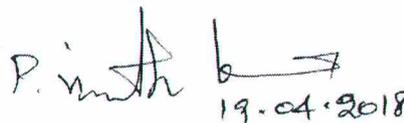
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INTERNAL EXAMINER



EXTERNAL EXAMINER



19.04.2018



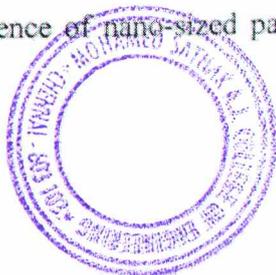
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## ABSTRACT

Nanotechnology is the understanding, control and restructuring of matter on the order of nanometers, i.e. less than 100nm, to create materials with fundamentally new properties and functions. It is a rapidly emerging technology with vast potential to create new materials with unique properties and to produce new and improved products for numerous applications. At scales of nanometer range, materials can exhibit unique properties different from their bulk state. Application of nanotechnology into field engineering was developed in recent two decades. Its application in construction industry has become an innovative approach. This will result in more efficient and effective use of basic resources at economical and environmentally sustained products with improved material properties. Thus, nanotechnological achievements has provided a modern approach in geotechnical engineering also.

This approach can be proposed in geotechnical engineering as two issues: (i) Studying the soil structure in nanometer scale and hence gaining a better understanding of soil nature, together with studying performance of soils with different nanostructure; (ii) Soil manipulation at atomic or molecular scale, which has currently been facilitated through addition of nanoparticles as an external factor to soil.

This study presents the attempts made to incorporate the recently emerging nanotechnology to the traditional and oldest lime stabilization technique, to study the influence of nano-sized particle on the index properties and strength of clayey soil.



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## CHAPTER 5

### CONCLUSION

To study the effect of nano copper slag on the lime stabilized soil, index tests, compaction tests and unconfined compressive strength tests were carried out. For a comparative study, tests was conducted on uncured and 7 days cured soil. Based on the analysis of the results, the following conclusions maybe drawn,

1. Addition of nano copper slag alters the index properties of soil with and without lime.
2. In both, uncured and cured conditions, the addition of nano copper slag to lime stabilized soil greatly increased the unconfined compressive strength of the soil.
3. Plastic limit increased from 34% to 44% respectively for 7 days cured lime stabilized soil.
4. Shrinkage limit increases from 10% to 24% on 7 days cured lime stabilized soil.
5. Optimum moisture content increased with the increase in the percentage of nano copper slag and maximum dry density of decreased from 1.6g/cc to 1.22g/cc for nano copper slag on lime stabilized cured sample.
6. For nano copper slag, the maximum unconfined compressive strength was attained for Soil + 5% Lime + 1% Nano Copper Slag, as 171.74 kN/m<sup>2</sup> and 255.95 kN/m<sup>2</sup> for uncured and cured sample respectively.

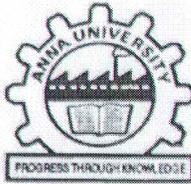


Nano particles provide larger surface area for reaction during curing period which results in high reactivity of soil and thus increases the strength to a great extent. Cured samples result in improved strength as the curing period ensures proper completion of pozzolanic reaction between soil and lime.



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**EFFECT OF PARTICLE PACKING OF FINE  
AGGREGATE USING MINERAL ADMIXTURES**

**A PROJECT REPORT**

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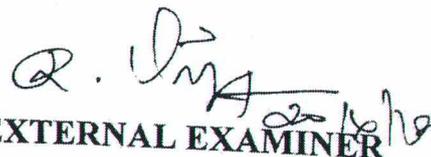
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**INTERNAL EXAMINER**



**EXTERNAL EXAMINER**

## ABSTRACT

In this project work, we study about void content in aggregate (fine aggregate) and reduction of voids in aggregates. Concrete contain 60-70% of aggregates, so we have to give more attention on aggregate. Aggregate is a only material to give strength, stiffness, economy to make concrete and it is a material to make concrete denser. Major problem in concrete is its voids. Mainly voids in aggregate make the concrete weak in strength and that voids are mostly occur in aggregate cement mortar. Basically aggregate is a filler material, filler material of coarse aggregate is fine aggregate and cement be the filler material of fine aggregate and also it is a binding material in concrete. From our project we find out the particle packing of fine aggregate by using mineral admixtures and reduce the cement, also yield definite strength.



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## CHAPTER 6

### CONCLUSION

- From our experimental study we find the voids in fine aggregate and reduce that voids by using mineral admixtures.
- More voids are reduced by Metakaolin and GGBS when compared to silica fume, rice husk ash.
- By using this mineral admixtures we consume the cement content and also yield strength.
- Admixtures used in concrete mix consider as an cement replacement materials or components, and that material fill up the voids as well as yield effective strength and also consume cement used in concrete mix.
- By reducing cement content, we can consume the cost of cement and protect atmosphere carbon dioxide emission because due to manufacturing of cement  $\text{CO}_2$  gas can be highly released.



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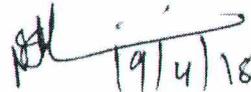
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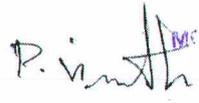
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## ABSTRACT

In this project we study about the water quality of pallikaranai marshy land. Marshy lands are one of the most living ecosystem for several living organisms. For marshy lands rainfall is the main aquifer. In Chennai there is a marshyland called as pallikaranai marshy land and it is degraded by dumping of wastes (domestic and industrial wastes). the marshy land contains several rare and endangered species and acts as breeding ground for thousand of migratory birds from various places. The surface water is polluted by dumping of wastes in marshy land and it affects the ground water also. The study area around perungudi dumping site has been studied with reference of toxic metals.

The metal analysed include Lead, Cadmium, Arsenic, Nickel and the physico-chemical parameters such as pH, Total dissolved solids, Electrical conductivity, Total hardness, BOD, COD. By taking of four samples around dumping site on the month of feb-march(2018) and tested in laboratory.

The results are compared with BIS 10500-2012. Most of the parameters are in higher concentration compared to the standards. It is inferred that the surface water is not good and safety for aquatic as well as for domestic life. Hence necessary management actions should be taken to control the quality of the surface water.



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## CHAPTER 8

### CONCLUSION

In heavy metal contamination result analysis Lead, Cadmium and Arsenic are within the permissible limits and there is no problem due to presence of these. Nickel exceeded the permissible limit of 0.005mg/l in sample 2 (0.416mg/l).

The colour and odour are exceeding the permissible limit which shows the water is contaminated with sewage disposal.

The values of  $P^H$  of the samples are in acidic level except sample 2. In sample 2 the  $P^H$  value is neutral. It causes kidney stone, skin irritation, gastro intestinal issues.

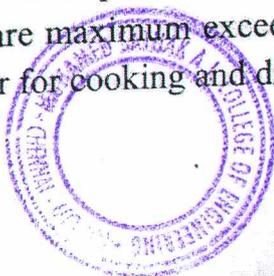
COD is an important water quality parameter and the values of COD exceeding the permissible limits it reduces the dissolved oxygen in water.

Total hardness is not within the permissible limit except sample 4 which is the result of metallic ions dissolved in the water. This decreases the lather formation of soap. Sewage contamination may also have increased total hardness.

In this study area with regard to total dissolved solids as crossed the permissible limit except sample 3 location. It shows the perungudi dump yard impacts are maximum which contaminate ground water which will affect the areas like perungudi, Oggiyamthuraipakkam. Due to TDS the water quality will be reduced which results in laxative effects and may give an unpleasant mineral taste to water.

Without any regard to proper care for the protection of surrounding environment, the solid wastes are dumping in Chennai at perungudi location. It is expected to become cause of serious ground water pollution.

The heavy metal nickel exceeds the limit which cause harmful health effects like chronic bronchitis, reducing lung function and lung cancer. Since the TDS value exceeds the BIS permissible limit of 2000mg/l. And the physico-chemical parameters are maximum exceeding the permissible limits. So it is not advised to use the water for cooking and drinking purposes nearby residential places.



It is suggested as a remedial measure is to shift municipal solid waste dump yard out of the pallikaranaimarshyland. If this cannot be done leachate effects can be minimized by using high density polyethylene sheets.



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# **ELECTROKINESIS STABILIZATION OF SOIL**

## **PROJECT REPORT**

*Submitted by*

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**ABDULLAH.P.M**

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*In partial fulfillment for the award of the degree*

*of*

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## ABSTRACT

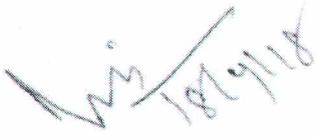
The application of chemical ground improvement using the electro stabilization (EKS) method has the potential to overcome problems in soft soil. The principles of EK treatment method involves applying a direct current or a potential gradient to electrodes inserted in the low permeable soils. The aim of this study was to evaluate the use of EKS as an effective method to stabilize soft clayey soil. The investigations were carried out in the laboratory using soil sample from locally collected clay soil. The cationic fluid used in EKS is calcium chloride ( $\text{CaCl}_2$ ) and the electrodes used in this process are graphites. EKS of soft soil was done by using graphite electrodes as anode and cathode. In above method of EKS the concentration of cationic fluid for each test run is 10, 15 and 20g/l of calcium chloride and the voltage maintained for each test run is 40 and 50 volt for 3 hours. Electro kinetically stabilized soil was tested for liquid limit test, plastic limit test and swell index test. The results shows that the Liquid Limit was reduced up to 45.27% from 67.45%, Plastic Limit increased from 36.11% to 37.4%, Plasticity Index decreased from 31.34% to 17.73% and Free Swelling Index was decreased to 2.9% from 17%. The results showed that the Graphite – Graphite electrode combination was efficient.



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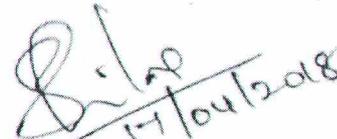
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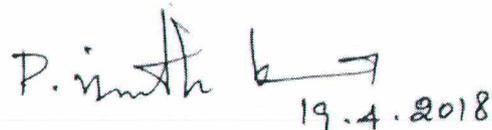
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## ABSTRACT

Due to increase in population and the attraction of human activities into urban region which in turn leads to the growth of vehicle ownership and use, there is demand for road space which has led to increase in the number of public transport operation. Consequently, the demand for road space is greater than the supply because the rate of provision of transport facilities is less than the rate of growth of vehicle ownership and use which result into traffic congestion. Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of transport system approaches capacity. Traffic congestion in Tamil Nadu, taking Shozhingnallur Road in Chennai as a case study has been analysed using experimental and theoretical approaches. These involve traffic counting and delay survey. In order to carry out effective research work on the case study road, the method adopted were traffic counting and traffic delay survey. The effect of traffic congestion on the study area are Waste of time, Delay movement, Accident, Inability to forecast travel time, Fuel consumption, Road rage and environmental pollution. Possible solutions to traffic congestion on the case study area is to: Dualize the Road, Provide Adequate Parking Space, Construct proper Drainage and Install Traffic Control Devices, implementing new bridge, improving public transport by reducing the private motor vehicles.



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## CHAPTER 6

### CONCLUSION

It was found that Sholinganallaur road is characterized with daily traffic congestion; thus, followings were recommended based on findings:

- Proper attention and management should be given to this road due to the importance of the road
- Bridge have been constructed – using the VISSIM software the problem has been rectified for future use
- Channelizing devices or traffic control devices should be installed especially as the junctions to aid flow as traffic wardens judgement is inaccurate.
- Separate bus lanes should be provided along the road
- The road should not be encroached with shops (market). Traffic survey can be efficiently used for traffic monitoring, traffic control and management, traffic control and traffic enforcement, traffic forecasting, model calibration and validation. The result of the study indicates that traffic control system have to be improved. The survey data and result may be used for further use.



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## BONAFIDE CERTIFICATE

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## ABSTRACT

Increase in the demand of conventional construction materials and the need for providing a sustainable growth in the construction field has prompted the designers and developers to option for 'alternative materials' feasible for use in construction.

For this objective, the use of industrial waste products and agricultural byproducts are very constructive.

These industrial wastes and agricultural by products such as Fly Ash, Rice Husk Ash, Silica Fume, and Slag can be replaced instead of cement because of their pozzolanic behavior, which otherwise requires large tract of lands for dumping.

In the present investigation, Rice Husk Ash has been used as a replacement to cement in brick and its properties has been studied.

For normal brick, standard brick size is 190mm x 90mm x 90mm as per recommendation of BIS.

For replacement of rice husk ash 10%, 20%&30% with cement is selected and studied with respect to the replacement method.

The main aim for the project is to finding mechanical properties of bricks while adding rice husk ash on bricks at different proportion using m-sand.



  
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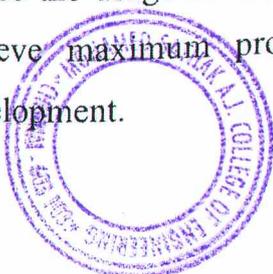
## CHAPTER 7

### CONCLUSION

The various waste that are currently recycled in bricks manufacturing have been reviewed. The effect of those waste on the bricks properties are reviewed. Enhance performance in terms of making more environmental and an economical brick neither consumes energy resource nor emits pollutant gases gives an economical option to design the green building. Certain bricks are produced without firing which is an advantage over other manufacturing of bricks in term of low embodied energy material. The study is useful for various research involved using industrial or agricultural waste material to develop sustainable construction material.

From this project work the following points are concluded

- Rice husk ash can be added in a different percentage as compared to the other material used.
- The percentage of water absorbed is nearly same percent for 10% and 20% of rice husk ash which indicates that this brick comes under first class and second class brick and we can use less amount of water in cement mortar for construction of brick work.
- The compressive strength of a rice husk ash brick of 10%, 20% is found to be slightly increase of strength, which implies this brick comes under first class brick. From the code IS: 1077-1992, it is concluded that this brick comes under first class brick type.
- Thus the bricks can be said heavy duty bricks and internal walls.
- Hence the usage of these bricks in large construction company helps to achieve maximum profit potential and would result in sustainable development.



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# MEASUREMENT OF NOISE LEVEL USING NOISE METER IN URBAN AREAS

A PROJECT REPORT

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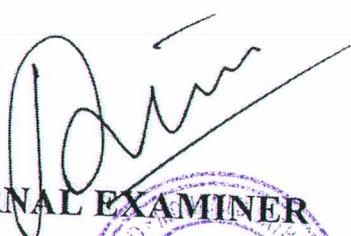
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## ABSTRACT

Noise is a conspicuous element of the environment comprising noise from road traffic, aircraft, rail road, industries, noise in building and consumer products. Noise created by rail transport is comparatively low to that of road transport. Due to improper laying of railway lines near the urban areas people living around it are largely affected by the noise produced by road transport. Noise pollution affects human health particularly in the densely populated urban areas which results in headache, fatigue, sleep disturbances, blood pressure, temporary or permanent deafness. The study is carried out at Velachery which is known for its holy place, historical eminence, international prominence and tourist attraction with compactly colonised area in Chennai. This survey regarding noise is carried out at four different location such as residence, school, hospital, and level crossing surrounding the railway line in Velachery. Consecutive readings are recorded in each locations for a weak at peak hours in the units of decibel using sound level meter. The minimum and maximum noise level is identified for each location between 7:00am- 10:00am and 5:00pm – 8:00pm and is then compared with the limits given by CPCB. Some of the beneficial measures are suggested and the readings are taken particularly in the area having maximum value by placing the solution. Finally the measured values are then compared with CPCB standards.



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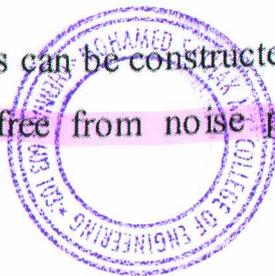
## CHAPTER 5

### CONCLUSION

The noise level at different localities are observed in Velachery. From the outcome data which is attained in our study, it is very clear that the people living around this area are suffering a lot of problems due to noise pollution. This is mainly accredited towards the dense population, improper laying of railway lines and poor urban planning. It is important to note that most of the values recorded in the selected four locations are all above 80 decibels. The noise level reaches up to the maximum of 112dB. By comparing all the locations, Level crossing and Residential locations are with more noise level. The maximum noise level recorded in location 4 is 112.5dB and for the location 1 is 102.5dB. and this will generate health related issues like stress, deafness, cardiovascular disease, fatigue, etc., to the people residing in this area. This noise pollution has been reduced by using acoustical materials. Modified glasswool, Anti-vibrating pads are some of the acoustic materials used in our study to reduce noise pollution. Tree plantation is also an other method to reduce noise.

- It has been observed that nearly 20 % of noise is reduced when the measurement is taken after the fixation of MODIFIED GLASS WOOL.
- About 10% - 15% of the noise level is minimised when the readings are taken by placing ANTI-VIBRATING PADS on the wall.
- Trees are the good sound absorbers and reflectors that reduces noise of about 12% which is measured from the wall located behind trees.

Thus, buildings can be constructed by using any one of the insulating materials so as to be free from noise pollution and protecting the buildings from vibrations.



BONAFIDE CERTIFICATE

This is to certify that "EXPERIMENTAL STUDY OF GROUND GRANULAR LAST FURNACE SLAG (GGBS) BRICKS" this project work is done by A.CHITRESWARAN (311814103013), V.GOWTHAM (311814103020), M.KISHORE KUMAR (311814103032), P.LOGESH (311814103033) of VIII Semester, CIVIL ENGINEERING Department in the academic year 2017-2018.



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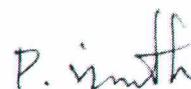
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## ABSTRACT

The need to conserve traditional building materials that are facing depletion has forced engineers to look for alternative materials. The use of waste as the brick material is a sustainable solution to solid waste management. It provide alternative raw material and an additional source of revenue. Recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. This paper reviews the recycling of different wastes into fired clay bricks and cement bricks.Industrial waste product ground granular blast furnace slag (GGBS) is a principal raw material for the manufacturing of bricks was studied. The bricks were developed using the quarry dust M-sand and natural River sand with cement as a binder. The raw materials ground granular blast furnace slag is collected from the industrial waste management are partially added to river sand and m-sand to attain compressive strength.The bricks also serve the purpose of industrial waste management and innovative sustainable construction material. The bricks can be used in local construction especially for semi loading and non-load-bearing structures. A wide range of successfully recycled materials and their effects on the physical and mechanical properties of bricks have been discussed.



  
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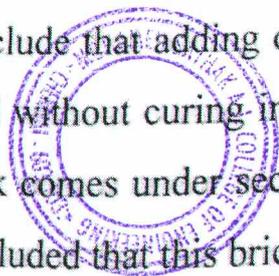
## CHAPTER- 7

### CONCLUSION

The various waste that are currently recycled in bricks manufacturing have been reviewed. The effect of those waste on the bricks properties are reviewed. Enhance performance in terms of making more environmental and an economical brick neither consumes energy resource nor emits pollutant gases gives an economical option to design the green building. Certain bricks are produced without firing which is an advantage over other manufacturing of bricks in term of low embodied energy material. The study is useful for various research involved using industrial or agricultural waste material to develop sustainable construction material.

From this project work the following points are concluded

- Ground granular blast furnace slag (GGBS) can be added in a higher percentage as compared to the other material used.
- The percentage of water absorbed is 44% which indicates that this brick comes under first class and second class brick and we can use less amount of water in cement mortar for construction of brick work.
- The GGBS is partially added with M-sand and River sand. The percentage ratio of GGBS is 10%,20%30% is added with m-sand and river sand casted bricks undergoes with and without curing. The compressive strength of bricks is found to be above 20% of GGBS increases the strength of bricks again in 30% of GGBS the strength instantly decreases.
- We conclude that adding of GGBS with 20% in M-sand and River sand with and without curing increases the strength of bricks. Which implies this brick comes under second class brick. From the code IS:1077-1992, it is concluded that this brick comes under second class brick type.



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- Thus the bricks can be said heavy duty bricks and internal walls.
- Hence the usage of these bricks in large construction company helps to achieve maximum profit potential and would result in sustainable development.



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## BONAFIDE CERTIFICATE

Certify that this project report "UTILIZATION OF RECLAIMED ASPHALT PAVEMENT IN MASTIC ASPHALT PAVEMENT" is the bonafide of GOWRI SHANKAR.T (311814103019), DIWAKARAN.K (311814103018), PAVITHRA LAKSHMIS (311814103053), ANSAR ALI.J (311814103006) of VIII semester, CIVIL ENGINEERING department in the academic year 2017-2018, who carried the project work (CE6811) under my supervision..



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## ABSTRACT

India is the third largest road network in the world with 0.66km of roads per square km. The increase in the construction of new roads increases the demand for the materials required for the new construction. In India, about 15,000 tons of aggregates are required per kilometer of highway. The use of alternative materials like plastic and rubber wastes have been implemented in some parts however the recycling of bituminous pavement is yet to popularize in India.

The deteriorated pavements are milled to partial or full depth depending upon its distress condition. The Reclaimed Asphalt Pavement (RAP) thus obtained is made of mineral aggregate covered with a thin film of bitumen and are usually dumped into landfills. The recycling of the RAP material is a logical and practical way of conserving the diminishing supply of the pavement material. In Chennai the old pavements are dumped in the landfills in Egmore and these wastes are degrading the environmental condition.

Less than 15% of these are used as RAP in road construction along with conventional aggregate and a large quantity of it is dumped in the yards. Hence there is a need to effectively utilize the old pavement material for the road construction. Hence in this study the 100% RAP material is used for designing a mastic asphalt pavement and since no virgin aggregates are used, apart from the reduction in cost of construction, also reduces emissions, traffic and energy associated with the transport and production of these materials and also provide good water proofing and skid resistance to the pavement surface.

Since many of the pavement gets deteriorated because of the seepage of ground water. And it can be minimized only by providing void less, water proofing pavements such as Mastic asphalt pavement. So alternative materials like RAP can be mixed with mastic asphalt to minimize the utilization of materials and also to provide a good-water-proofing surface.



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Mastic asphalt pavements are resistant to chemical attack, vermi proof and their durability is nearly 15 years. Hence the RAP waste can be greatly minimized and utilization of this waste material in mastic asphalt pavement is economical.



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## CHAPTER 5

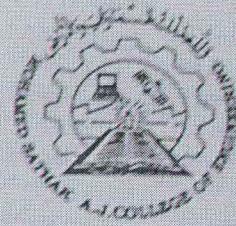
### CONCLUSION

#### SUMMARY AND CONCLUSION

- Reclaimed Asphalt Pavement (RAP) materials were used to design mastic asphalt pavement without the addition of virgin aggregates.
- Centrifuge extractor was done to retrieve the binder content in the RAP material and this was found to be 3.75%.
- Mastic Asphalt mix design was done using coarse aggregates passing 19mm and retained on 2.36mm sieve without any segregation in size between 19mm and 2.36mm.
- Four types of bitumen like CRMB 55, PMB 70, 60-70 and 30-40 were used for the same mix proportion of mastic asphalt.
- Five types of gradation using different proportions of RAP, fine aggregate, Lime Powder and binder content and tested for hardness test.
- 16% and 13% binder content made the bitumen puffy in the mastic asphalt design though the hardness number was high.
- Among all the types 30-40 grade bitumen alone met the requirements of mastic asphalt pavement as per IRC 107:1992.
- Skid resistance properties was tested for wet conditions was found to be low and hence it was decided to impregnate 12mm aggregates to the mastic asphalt pavement in order to avoid skidding of vehicles.
- The mix proportion mentioned in the table 4.11 with 40% RAP, 50% fine aggregate, 10% Lime powder and 13% binder content is best suited for urban conditions because the skid resistance value lies within the limit specified by IRC



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STUDY OF ULTIMATE TENSILE STRENGTH OF MARKET  
AVAILABLE HYSD BARS

A PROJECT REPORT

*Submitted by*

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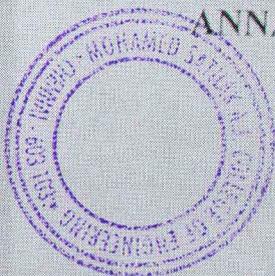
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CIVIL ENGINEERING

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ANNA UNIVERSITY, CHENNAI - 600 025

APRIL 2018



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Certify that this project report **"STUDY OF ULTIMATE TENSILE STRENGTH OF MARKET AVAILABLE HYSD BARS"** is the bonafide of **MOHAMED MOOSA.S (311814103043), SHAHANA.S (311814103065), SOLAI RAJ.M.P (311814103068), SUSMITHA.R (311814103071)** of **VIII** semester, **CIVIL ENGINEERING** department in the academic year 2017-2018, who carried the project work (**CE6811**) under my supervision..

  
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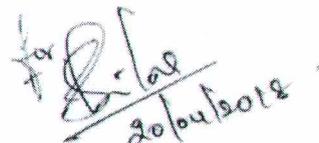
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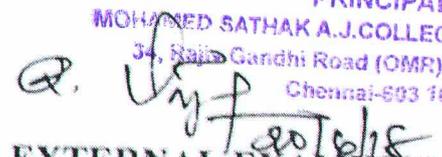


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## ABSTRACT

In this project we study about strength of steel (TMT bars). The strength of the beam, column and slabs are mainly depends upon the concrete strength and reinforcement. Mostly reinforcement steels place major role in framed structures. So from this, we collect varieties of TMT bars in different companies. From the above based companies the tensile strength test, rate analysis and microscopic study has been carried out in 10mm and 12mm bars for comparison purpose based on the original strength provided in such companies and cross section have also been carried out to study the harden layer of TMT bars by microscopic study.



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## CHAPTER 6

### CONCLUSION

From this experimental study we find out the **tensile strength of reinforcement bars** in few different companies in testing laboratory with graphical representation.

By comparison of 10mm bar maximum yield stress is obtained in KAMACHI TMT Bar( $535.317 \text{ N/mm}^2$ ) and the lowest yield stress is obtained in ARS TMT bar( $209.837 \text{ N/mm}^2$ ).

By comparison of 12mm bar maximum yield stress is obtained in ISTEEL TMT Bar( $578.448 \text{ N/mm}^2$ ) and the lowest yield stress is obtained in ARUN PLUS TMT bar( $251.709 \text{ N/mm}^2$ ).

By comparison of 10mm bar maximum elongation percentage is obtained in TATA TMT Bar (27.60%) and the lowest yield stress is obtained in TULSYAN TMT bar(15.80%).

By comparison of 12mm bar maximum elongation percentage is obtained in KAMACHI TMT Bar (22.00%) and the lowest yield stress is obtained in ARS TMT bar(16.67%).

By Comparing the chemical composition of steel with reference to the code book which are tested in testing laboratory.

The microscopic study has been carried out to refer about the surface of Thermo mechanically Treated Bar for denoting the corrosion layer in the reinforcement bar.

The study of pattern have been carried out for the purpose of proper boundary layer.

From all the above the difference in the strength and corrosion resistant of few TMT bars study have been have been carried out.



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**INFLUENCE OF NANO COPPER SLAG  
ON LIME STABILIZED SOIL  
PROJECT REPORT**

*Submitted by*

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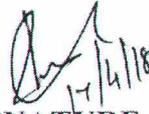
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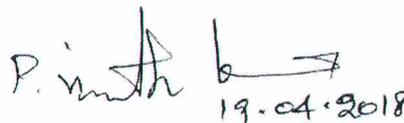
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Submitted for the University Examination held on 19.04.2018 .....

INTERNAL EXAMINER



EXTERNAL EXAMINER



19.04.2018



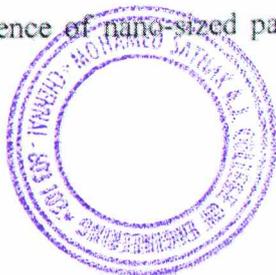
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## ABSTRACT

Nanotechnology is the understanding, control and restructuring of matter on the order of nanometers, i.e. less than 100nm, to create materials with fundamentally new properties and functions. It is a rapidly emerging technology with vast potential to create new materials with unique properties and to produce new and improved products for numerous applications. At scales of nanometer range, materials can exhibit unique properties different from their bulk state. Application of nanotechnology into field engineering was developed in recent two decades. Its application in construction industry has become an innovative approach. This will result in more efficient and effective use of basic resources at economical and environmentally sustained products with improved material properties. Thus, nanotechnological achievements has provided a modern approach in geotechnical engineering also.

This approach can be proposed in geotechnical engineering as two issues: (i) Studying the soil structure in nanometer scale and hence gaining a better understanding of soil nature, together with studying performance of soils with different nanostructure; (ii) Soil manipulation at atomic or molecular scale, which has currently been facilitated through addition of nanoparticles as an external factor to soil.

This study presents the attempts made to incorporate the recently emerging nanotechnology to the traditional and oldest lime stabilization technique, to study the influence of nano-sized particle on the index properties and strength of clayey soil.



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## CHAPTER 5

### CONCLUSION

To study the effect of nano copper slag on the lime stabilized soil, index tests, compaction tests and unconfined compressive strength tests were carried out. For a comparative study, tests was conducted on uncured and 7 days cured soil. Based on the analysis of the results, the following conclusions maybe drawn,

1. Addition of nano copper slag alters the index properties of soil with and without lime.
2. In both, uncured and cured conditions, the addition of nano copper slag to lime stabilized soil greatly increased the unconfined compressive strength of the soil.
3. Plastic limit increased from 34% to 44% respectively for 7 days cured lime stabilized soil.
4. Shrinkage limit increases from 10% to 24% on 7 days cured lime stabilized soil.
5. Optimum moisture content increased with the increase in the percentage of nano copper slag and maximum dry density of decreased from 1.6g/cc to 1.22g/cc for nano copper slag on lime stabilized cured sample.
6. For nano copper slag, the maximum unconfined compressive strength was attained for Soil + 5% Lime + 1% Nano Copper Slag, as 171.74 kN/m<sup>2</sup> and 255.95 kN/m<sup>2</sup> for uncured and cured sample respectively.

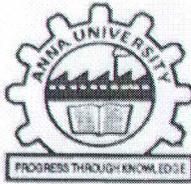


Nano particles provide larger surface area for reaction during curing period which results in high reactivity of soil and thus increases the strength to a great extent. Cured samples result in improved strength as the curing period ensures proper completion of pozzolanic reaction between soil and lime.



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# EFFECT OF PARTICLE PACKING OF FINE AGGREGATE USING MINERAL ADMIXTURES

A PROJECT REPORT

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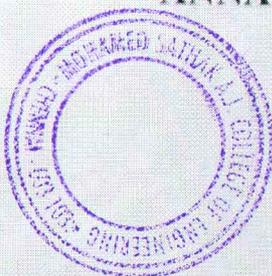
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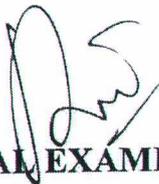
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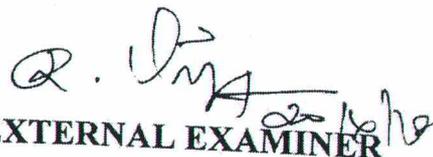
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## ABSTRACT

In this project work, we study about void content in aggregate (fine aggregate) and reduction of voids in aggregates. Concrete contain 60-70% of aggregates, so we have to give more attention on aggregate. Aggregate is a only material to give strength, stiffness, economy to make concrete and it is a material to make concrete denser. Major problem in concrete is its voids. Mainly voids in aggregate make the concrete weak in strength and that voids are mostly occur in aggregate cement mortar. Basically aggregate is a filler material, filler material of coarse aggregate is fine aggregate and cement be the filler material of fine aggregate and also it is a binding material in concrete. From our project we find out the particle packing of fine aggregate by using mineral admixtures and reduce the cement, also yield definite strength.



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## CHAPTER 6

### CONCLUSION

- From our experimental study we find the voids in fine aggregate and reduce that voids by using mineral admixtures.
- More voids are reduced by Metakaolin and GGBS when compared to silica fume, rice husk ash.
- By using this mineral admixtures we consume the cement content and also yield strength.
- Admixtures used in concrete mix consider as an cement replacement materials or components, and that material fill up the voids as well as yield effective strength and also consume cement used in concrete mix.
- By reducing cement content, we can consume the cost of cement and protect atmosphere carbon dioxide emission because due to manufacturing of cement  $\text{CO}_2$  gas can be highly released.



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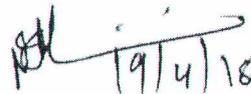
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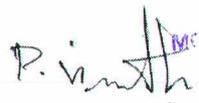
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INTERNAL EXAMINER



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## ABSTRACT

In this project we study about the water quality of pallikaranai marshy land. Marshy lands are one of the most living ecosystem for several living organisms. For marshy lands rainfall is the main aquifer. In Chennai there is a marshyland called as pallikaranai marshy land and it is degraded by dumping of wastes (domestic and industrial wastes). the marshy land contains several rare and endangered species and acts as breeding ground for thousand of migratory birds from various places. The surface water is polluted by dumping of wastes in marshy land and it affects the ground water also. The study area around perungudi dumping site has been studied with reference of toxic metals.

The metal analysed include Lead, Cadmium, Arsenic, Nickel and the physico-chemical parameters such as pH, Total dissolved solids, Electrical conductivity, Total hardness, BOD, COD. By taking of four samples around dumping site on the month of feb-march (2018) and tested in laboratory.

The results are compared with BIS 10500-2012. Most of the parameters are in higher concentration compared to the standards. It is inferred that the surface water is not good and safety for aquatic as well as for domestic life. Hence necessary management actions should be taken to control the quality of the surface water.



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## CHAPTER 8

### CONCLUSION

In heavy metal contamination result analysis Lead, Cadmium and Arsenic are within the permissible limits and there is no problem due to presence of these. Nickel exceeded the permissible limit of 0.005mg/l in sample 2 (0.416mg/l).

The colour and odour are exceeding the permissible limit which shows the water is contaminated with sewage disposal.

The values of  $P^H$  of the samples are in acidic level except sample 2. In sample 2 the  $P^H$  value is neutral. It causes kidney stone, skin irritation, gastro intestinal issues.

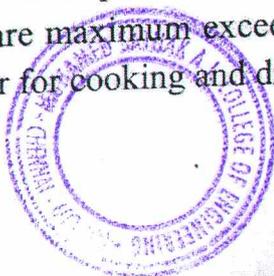
COD is an important water quality parameter and the values of COD exceeding the permissible limits it reduces the dissolved oxygen in water.

Total hardness is not within the permissible limit except sample 4 which is the result of metallic ions dissolved in the water. This decreases the lather formation of soap. Sewage contamination may also have increased total hardness.

In this study area with regard to total dissolved solids as crossed the permissible limit except sample 3 location. It shows the perungudi dump yard impacts are maximum which contaminate ground water which will affect the areas like perungudi, Oggiyamthuraipakkam. Due to TDS the water quality will be reduced which results in laxative effects and may give an unpleasant mineral taste to water.

Without any regard to proper care for the protection of surrounding environment, the solid wastes are dumping in Chennai at perungudi location. It is expected to become cause of serious ground water pollution.

The heavy metal nickel exceeds the limit which cause harmful health effects like chronic bronchitis, reducing lung function and lung cancer. Since the TDS value exceeds the BIS permissible limit of 2000mg/l. And the physico-chemical parameters are maximum exceeding the permissible limits. So it is not advised to use the water for cooking and drinking purposes nearby residential places.



It is suggested as a remedial measure is to shift municipal solid waste dump yard out of the pallikaranaimarshyland. If this cannot be done leachate effects can be minimized by using high density polyethylene sheets.



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# **ELECTROKINESIS STABILIZATION OF SOIL**

## **PROJECT REPORT**

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## ABSTRACT

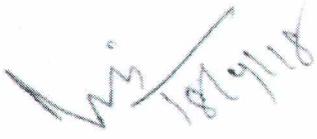
The application of chemical ground improvement using the electro stabilization (EKS) method has the potential to overcome problems in soft soil. The principles of EK treatment method involves applying a direct current or a potential gradient to electrodes inserted in the low permeable soils. The aim of this study was to evaluate the use of EKS as an effective method to stabilize soft clayey soil. The investigations were carried out in the laboratory using soil sample from locally collected clay soil. The cationic fluid used in EKS is calcium chloride ( $\text{CaCl}_2$ ) and the electrodes used in this process are graphites. EKS of soft soil was done by using graphite electrodes as anode and cathode. In above method of EKS the concentration of cationic fluid for each test run is 10, 15 and 20g/l of calcium chloride and the voltage maintained for each test run is 40 and 50 volt for 3 hours. Electro kinetically stabilized soil was tested for liquid limit test, plastic limit test and swell index test. The results shows that the Liquid Limit was reduced up to 45.27% from 67.45%, Plastic Limit increased from 36.11% to 37.4%, Plasticity Index decreased from 31.34% to 17.73% and Free Swelling Index was decreased to 2.9% from 17%. The results showed that the Graphite – Graphite electrode combination was efficient.



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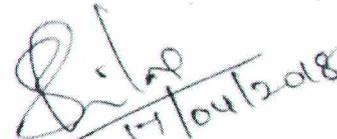
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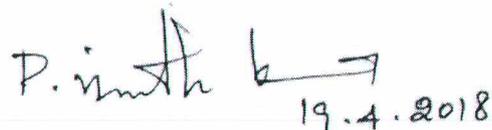
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## ABSTRACT

Due to increase in population and the attraction of human activities into urban region which in turn leads to the growth of vehicle ownership and use, there is demand for road space which has led to increase in the number of public transport operation. Consequently, the demand for road space is greater than the supply because the rate of provision of transport facilities is less than the rate of growth of vehicle ownership and use which result into traffic congestion. Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of transport system approaches capacity. Traffic congestion in Tamil Nadu, taking Shozhingnallur Road in Chennai as a case study has been analysed using experimental and theoretical approaches. These involve traffic counting and delay survey. In order to carry out effective research work on the case study road, the method adopted were traffic counting and traffic delay survey. The effect of traffic congestion on the study area are Waste of time, Delay movement, Accident, Inability to forecast travel time, Fuel consumption, Road rage and environmental pollution. Possible solutions to traffic congestion on the case study area is to: Dualize the Road, Provide Adequate Parking Space, Construct proper Drainage and Install Traffic Control Devices, implementing new bridge, improving public transport by reducing the private motor vehicles.



A handwritten signature in blue ink, appearing to be "M. Sathak", written over a horizontal line.

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## CHAPTER 6

### CONCLUSION

It was found that Sholinganallaur road is characterized with daily traffic congestion; thus, followings were recommended based on findings:

- Proper attention and management should be given to this road due to the importance of the road
- Bridge have been constructed – using the VISSIM software the problem has been rectified for future use
- Channelizing devices or traffic control devices should be installed especially as the junctions to aid flow as traffic wardens judgement is inaccurate.
- Separate bus lanes should be provided along the road
- The road should not be encroached with shops (market). Traffic survey can be efficiently used for traffic monitoring, traffic control and management, traffic control and traffic enforcement, traffic forecasting, model calibration and validation. The result of the study indicates that traffic control system have to be improved. The survey data and result may be used for further use.



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Certified that this project report **“STUDY ON PARTIAL REPLACEMENT OF RICE HUSK ASH WITH CEMENT IN BRICKS”** is the bonafide work of **“MOHAMED MANSOOR ALIA (311814103042), MOHAMED SHAJITH.S (311814103047), MOHAMED THARIK.M (311814103049), VEERAMANLS (311814103077)”** who carried out the project work under my supervision.



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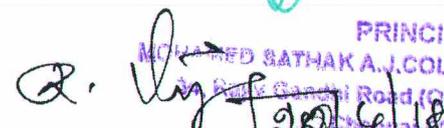


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## ABSTRACT

Increase in the demand of conventional construction materials and the need for providing a sustainable growth in the construction field has prompted the designers and developers to option for 'alternative materials' feasible for use in construction.

For this objective, the use of industrial waste products and agricultural byproducts are very constructive.

These industrial wastes and agricultural by products such as Fly Ash, Rice Husk Ash, Silica Fume, and Slag can be replaced instead of cement because of their pozzolanic behavior, which otherwise requires large tract of lands for dumping.

In the present investigation, Rice Husk Ash has been used as a replacement to cement in brick and its properties has been studied.

For normal brick, standard brick size is 190mm x 90mm x 90mm as per recommendation of BIS.

For replacement of rice husk ash 10%, 20%&30% with cement is selected and studied with respect to the replacement method.

The main aim for the project is to finding mechanical properties of bricks while adding rice husk ash on bricks at different proportion using m-sand.



  
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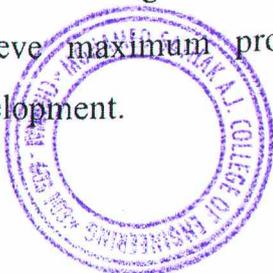
## CHAPTER 7

### CONCLUSION

The various waste that are currently recycled in bricks manufacturing have been reviewed. The effect of those waste on the bricks properties are reviewed. Enhance performance in terms of making more environmental and an economical brick neither consumes energy resource nor emits pollutant gases gives an economical option to design the green building. Certain bricks are produced without firing which is an advantage over other manufacturing of bricks in term of low embodied energy material. The study is useful for various research involved using industrial or agricultural waste material to develop sustainable construction material.

From this project work the following points are concluded

- Rice husk ash can be added in a different percentage as compared to the other material used.
- The percentage of water absorbed is nearly same percent for 10% and 20% of rice husk ash which indicates that this brick comes under first class and second class brick and we can use less amount of water in cement mortar for construction of brick work.
- The compressive strength of a rice husk ash brick of 10%, 20% is found to be slightly increase of strength, which implies this brick comes under first class brick. From the code IS: 1077-1992, it is concluded that this brick comes under first class brick type.
- Thus the bricks can be said heavy duty bricks and internal walls.
- Hence the usage of these bricks in large construction company helps to achieve maximum profit potential and would result in sustainable development.



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**MEASUREMENT OF NOISE LEVEL USING NOISE  
METER IN URBAN AREAS**

**A PROJECT REPORT**

*Submitted by*

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*of*

**BACHELOR OF ENGINEERING**

*in*

**CIVIL ENGINEERING**

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**APRIL 2018**

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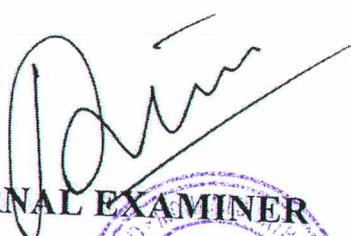
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## ABSTRACT

Noise is a conspicuous element of the environment comprising noise from road traffic, aircraft, rail road, industries, noise in building and consumer products. Noise created by rail transport is comparatively low to that of road transport. Due to improper laying of railway lines near the urban areas people living around it are largely affected by the noise produced by road transport. Noise pollution affects human health particularly in the densely populated urban areas which results in headache, fatigue, sleep disturbances, blood pressure, temporary or permanent deafness. The study is carried out at Velachery which is known for its holy place, historical eminence, international prominence and tourist attraction with compactly colonised area in Chennai. This survey regarding noise is carried out at four different location such as residence, school, hospital, and level crossing surrounding the railway line in Velachery. Consecutive readings are recorded in each locations for a weak at peak hours in the units of decibel using sound level meter. The minimum and maximum noise level is identified for each location between 7:00am- 10:00am and 5:00pm – 8:00pm and is then compared with the limits given by CPCB. Some of the beneficial measures are suggested and the readings are taken particularly in the area having maximum value by placing the solution. Finally the measured values are then compared with CPCB standards.



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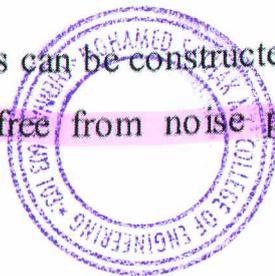
## CHAPTER 5

### CONCLUSION

The noise level at different localities are observed in Velachery. From the outcome data which is attained in our study, it is very clear that the people living around this area are suffering a lot of problems due to noise pollution. This is mainly accredited towards the dense population, improper laying of railway lines and poor urban planning. It is important to note that most of the values recorded in the selected four locations are all above 80 decibels. The noise level reaches up to the maximum of 112dB. By comparing all the locations, Level crossing and Residential locations are with more noise level. The maximum noise level recorded in location 4 is 112.5dB and for the location 1 is 102.5dB. and this will generate health related issues like stress, deafness, cardiovascular disease, fatigue, etc., to the people residing in this area. This noise pollution has been reduced by using acoustical materials. Modified glasswool, Anti-vibrating pads are some of the acoustic materials used in our study to reduce noise pollution. Tree plantation is also an other method to reduce noise.

- It has been observed that nearly 20 % of noise is reduced when the measurement is taken after the fixation of MODIFIED GLASS WOOL.
- About 10% - 15% of the noise level is minimised when the readings are taken by placing ANTI-VIBRATING PADS on the wall.
- Trees are the good sound absorbers and reflectors that reduces noise of about 12% which is measured from the wall located behind trees.

Thus, buildings can be constructed by using any one of the insulating materials so as to be free from noise pollution and protecting the buildings from vibrations.



BONAFIDE CERTIFICATE

This is to certify that "EXPERIMENTAL STUDY OF GROUND GRANULAR LAST FURNACE SLAG (GGBS) BRICKS" this project work is done by A.CHITRESWARAN (311814103013), V.GOWTHAM (311814103020), M.KISHORE KUMAR (311814103032), P.LOGESH (311814103033) of VIII Semester, CIVIL ENGINEERING Department in the academic year 2017-2018.



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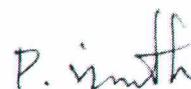
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Submitted for the Anna University B.E/B.Tech Final Review held on

..19/4/18



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**EXTERNAL EXAMINER**

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## ABSTRACT

The need to conserve traditional building materials that are facing depletion has forced engineers to look for alternative materials. The use of waste as the brick material is a sustainable solution to solid waste management. It provide alternative raw material and an additional source of revenue. Recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. This paper reviews the recycling of different wastes into fired clay bricks and cement bricks.Industrial waste product ground granular blast furnace slag (GGBS) is a principal raw material for the manufacturing of bricks was studied. The bricks were developed using the quarry dust M-sand and natural River sand with cement as a binder. The raw materials ground granular blast furnace slag is collected from the industrial waste management are partially added to river sand and m-sand to attain compressive strength.The bricks also serve the purpose of industrial waste management and innovative sustainable construction material. The bricks can be used in local construction especially for semi loading and non-load-bearing structures. A wide range of successfully recycled materials and their effects on the physical and mechanical properties of bricks have been discussed.



  
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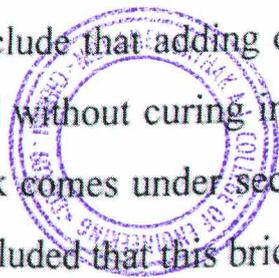
## CHAPTER- 7

### CONCLUSION

The various waste that are currently recycled in bricks manufacturing have been reviewed. The effect of those waste on the bricks properties are reviewed. Enhance performance in terms of making more environmental and an economical brick neither consumes energy resource nor emits pollutant gases gives an economical option to design the green building. Certain bricks are produced without firing which is an advantage over other manufacturing of bricks in term of low embodied energy material. The study is useful for various research involved using industrial or agricultural waste material to develop sustainable construction material.

From this project work the following points are concluded

- Ground granular blast furnace slag (GGBS) can be added in a higher percentage as compared to the other material used.
- The percentage of water absorbed is 44% which indicates that this brick comes under first class and second class brick and we can use less amount of water in cement mortar for construction of brick work.
- The GGBS is partially added with M-sand and River sand. The percentage ratio of GGBS is 10%,20%30% is added with m-sand and river sand casted bricks undergoes with and without curing. The compressive strength of bricks is found to be above 20% of GGBS increases the strength of bricks again in 30% of GGBS the strength instantly decreases.
- We conclude that adding of GGBS with 20% in M-sand and River sand with and without curing increases the strength of bricks. Which implies this brick comes under second class brick. From the code IS:1077-1992, it is concluded that this brick comes under second class brick type.



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