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ANNUAL REPORT 2023-24

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद
NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS
एनसीबी NCB
न हि ज्ञानेन सदृशं

National Council for Cement and Building Materials

(Under the Administrative Control of DPIIT, Ministry of Commerce and Industry, Govt. of India)

Annual Report 2023-24

1st April 2023 to 31st March 2024

National Council for Cement and Building Materials

(Under the Administrative Control of Ministry of Commerce & Industry, Govt of India)
34 KM Stone, Delhi-Mathura Road (NH-2), Ballabgarh-121004, Haryana

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Message from desk of Chairman

Dear Stakeholders, I hope that this message finds you in good health and high spirits. It gives me great pleasure to present the annual report of National Council for Cement and Building Materials (NCB), apex body for research, technology development & transfer, continuing education, calibration and testing services in the areas of in areas of cement, concrete and building materials. NCB's commitment to innovation and keeping up with latest developments for benefit of industry such as conservation of natural resources, energy & environment, productivity, quality control and assurance, is an encouraging sign of things to come ahead in near future. I'm glad to note that NCB have been working tirelessly to develop new low carbon cements, which will help in reduction of carbon footprint of cement industry.

With its multi-disciplinary expertise coupled with world class state of the art testing and evaluation facilities, NCB is actively engaged in providing valuable services to various industries through the execution of sponsored projects and conducting extensive material testing in its laboratories accredited by the NABL and recognized by BIS. In addition, calibration services, manufacture of Certified Reference Materials (CRMs) and Bharatiya Nirdeshak Dravya (BNDs) are also on offer.

NCB is also providing training and assistance in problem-solving whenever required. It is satisfying to know that NCB has successfully completed not only eight important Research Projects but also 130 Sponsored Projects during the previous financial year, in addition to conducting 42 Training Programs that have effectively disseminated knowledge and expertise to professionals within the industry.

Keeping the requirements of industry and stakeholders in mind, NCB has undertaken programmed projects specifically focusing on development of Portland dolomite cement and effective utilization of waste materials such as phosphogypsum, and lime sludge in cement manufacturing process. Additionally, NCB took the initiative to explore utilization of uranium tailing waste in cement manufacturing process.

To enhance alternative fuel utilization, NCB carried out research projects on RDF gasification and design of transfer chutes. NCB has also worked on application of artificial intelligence to develop predictive models which can enhance TSR through liquid AF in cement plant. Notable progress has also been made in the domain of serving as a Project Management Consultant (PMC) to international cement plants. This achievement has established NCB's position as a dependable consultancy service provider in this part of the world, catering to the global cement industry.

In the realm of concrete, NCB has been innovating for the construction and concrete industries by evaluating a variety of concrete-making materials and concrete mix designs for unique uses. NCB is skilled in assessing aggregates for the performance of integral crystalline water proofing compounds as well as possible alkali aggregate reactions. It has carried out a wide range of activities related to the assessment of new

and existing concrete structures, including studies on Normal and High Strength Concrete (HSC) using various indigenous aggregates for concrete grades ranging from M35 to M100. NCB has undertaken study on effect of fire on the residual mechanical properties of reinforcing bars and structural performance of reinforced concrete Beams in flexure & Shear.

NCB has been organizing its flagship event, the International Conferences on Cement and Building Materials since 1987, considered as one of the biggest event for cement and construction industry in this part of the world. NCB is putting all its efforts to organize the 18th NCB International Conference and Exhibition at a much larger scale at Yasho Bhoomi, IICC Dwarka, New Delhi in November 2024, which like its predecessor, is likely to bring all stakeholders of the industry to a single platform for mutual benefit and for benefit of the nation as a whole.

It is a matter of pride for all of us to win the bid to host the 17th International Congress on the Chemistry of Cement (ICCC) in New Delhi in 2027. Indian Cement Industry will be fully supporting efforts of NCB to bring together the leaders, experts, and innovators in cement sector from around the world. This event will also provide us with a unique opportunity to highlight the achievements and innovations within the Indian cement sector and demonstrate Indian cement industry as a global leader in sustainable cement production.

At this point, I would like to thank Department for Promotion of Industry and Internal Trade, Government of India for providing the financial support to research needs of NCB and look forward for continued and enhanced support from DPIIT in future for taking up new projects as well for timely completion of ongoing projects. I would also like to thank my fellow members in the Board of Governors and its Committees for their valuable advice and guidance in decision making on various issues from time to time. I am confident that NCB would continue to provide the much-needed technical support to the industry in the years to come.

Neeraj Akhoury
Chairman

October 2024

Message from desk of Director General

With the continued focus of Government of India on development of infrastructure and housing, emphasized in the budget of FY 2023-24 with outlay of Rs 11.11 lakh crore (3.4% GDP) for capital expenditure, the future growth of cement industry is inevitable. India has committed to become Net Zero by 2070 and cement industry with its 7% contribution also has an important role to play. To reduce its carbon footprint, the industry is striving towards cleaner and futuristic technologies like Carbon Capture and Utilization, Solar Thermal and Electrification of Cement Manufacturing Process.

I proudly present to the cement and concrete fraternity, government, academia, scientific institutions, civil society and all our stakeholders, the Annual Report for the year 2023-24. NCB is built on the pillars of knowledge, infrastructure, energy and drive of its people. NCB has provided to both new and its existing clients, reliable technical solutions over the past year by successfully completing 130 sponsored projects for the industry with an enterprising customer-centric approach. NCB is presently pursuing several programmed projects like utilizing industrial wastes, LCF & process optimization studies, energy conservation, environmental improvement, feasibility studies, diagnostic studies on distressed structures and quality audits just to name a few.

Centre for Cement Research and Independent Testing (CRT) completed 18 LCF studies, and undertaken development of Portland Dolomite Cement. The centre developed plant specific secondary standards of cement raw materials and finished products for 22 plants, cements using industrial waste and investigated mineral carbonation mechanism of industrial wastes and raw materials. Study undertaken on utilization of uranium tailing waste and chrome sludge in cement manufacturing. Also, more than 6,923 samples were tested by cutting-edge Independent Testing Laboratories in accordance with National and International Standards.

Centre for Mining, Environment, Plant Engineering and Operation (CME) successfully accomplished Project Management Consultancy services for our clients outside India and carried out sponsored studies like assessment of air pollution control equipment, energy audits, plant diagnostic studies, heat & gas balance studies, feasibility & detailed project reports as well as marketing reports for the utilization of FGD gypsum. Furthermore, the Centre undertook R&D projects like RDF gasification, designing a transfer chute and increase in Thermal Substitution Rate (*TSR*) by application of Artificial Intelligence (*AI*).

Centre for Construction Development and Research (CDR) under various programs is carrying out activities like material evaluation of wide range of concrete mix designs for special applications, alkali aggregate reaction studies, evaluation of integral crystalline waterproofing compound, carbonation induced corrosion for composite cement, utilization of CO_2 in Fresh Concrete and its properties, effect of fire on properties of reinforcing bars and reinforced concrete beams in flexure & Shear and

testing of coarse and fine aggregate materials. Further, research on cathodic protection to enhance service life of concrete structures, taken up. Condition of existing concrete structures is assessed as part of the structural assessment and rehabilitation process for concrete structures. The Centre aids to build durable infrastructure in India for prestigious projects of national importance by offering specialized services in quality assurance and control and durable repair strategies for distressed RCC structures.

Centre for Quality Management, Standards and Calibration Services (CQC) developed 21 Bhartiya Nirdeshak Dravyas (*BNDs*) in collaboration with CSIR-National Physical Laboratory (*NPL*), envisioned to boost "***Make in India***" program and fulfill the mission of "***Atmanirbhar Bharat***". Supply of 2791 CRMs and 1,227 sets of standard lime was continued. 1600 Calibration services were also provided where figure of 95% clients rating NCB's services as excellent, was retained in the past year.

Centre for Continuing Education Services (CCE) imparted training on cement, concrete and construction technologies through its various special, short-term and refresher courses. During the year 2023-24, 42 training programmes were successfully organized with multidisciplinary participants attending the programmes. CIS also organized webinars & workshops, disseminating information on technologies and services through various modes.

NCB along with IIT Delhi and IIT Madras has successfully won the bid to host the 17th International Congress on the Chemistry of Cement (ICCC) at New Delhi in October 2027. NCB will be organizing the flagship event of 18th NCB International Conference and Exhibition on Cement, Concrete and Building Materials from 27-29 November 2024 at Yasho Bhoomi Convention Centre, IICC Dwarka, New Delhi, India.

With great satisfaction, I'd like to mention that NCB's research and innovation initiatives, including decarbonization, adoption of a circular economy, enhanced sustainability are well aligned with the objectives of the government, industry and society. I thank all my colleagues for their exceptional effort, commitment and dedication during the past year and look forward to the same in the coming year as well.

I am grateful to DPIIT, MoC&I, Govt. of India, the Board of Governors and its Committees for their vision, direction and constant inspiration. I express gratitude to the industry for reinstating confidence in NCB and for its continued patronage, revitalizing our long-standing partnership, thereby enabling us to nurture our shared goal of advancing efforts towards societal betterment. We reaffirm our dedication to upholding the highest standards of integrity, quality and innovation. I hope that through our report, which is a testimony of the above-mentioned commitments, we will be able to showcase the evidence of our promise. Jai Hind!

Dr. L P Singh
Director General

October 2024

National Council for Cement and Building Materials

(A Premier R&D Organisation under the Administrative Control of Ministry of Commerce & Industry, Govt. of India)

Our Vision

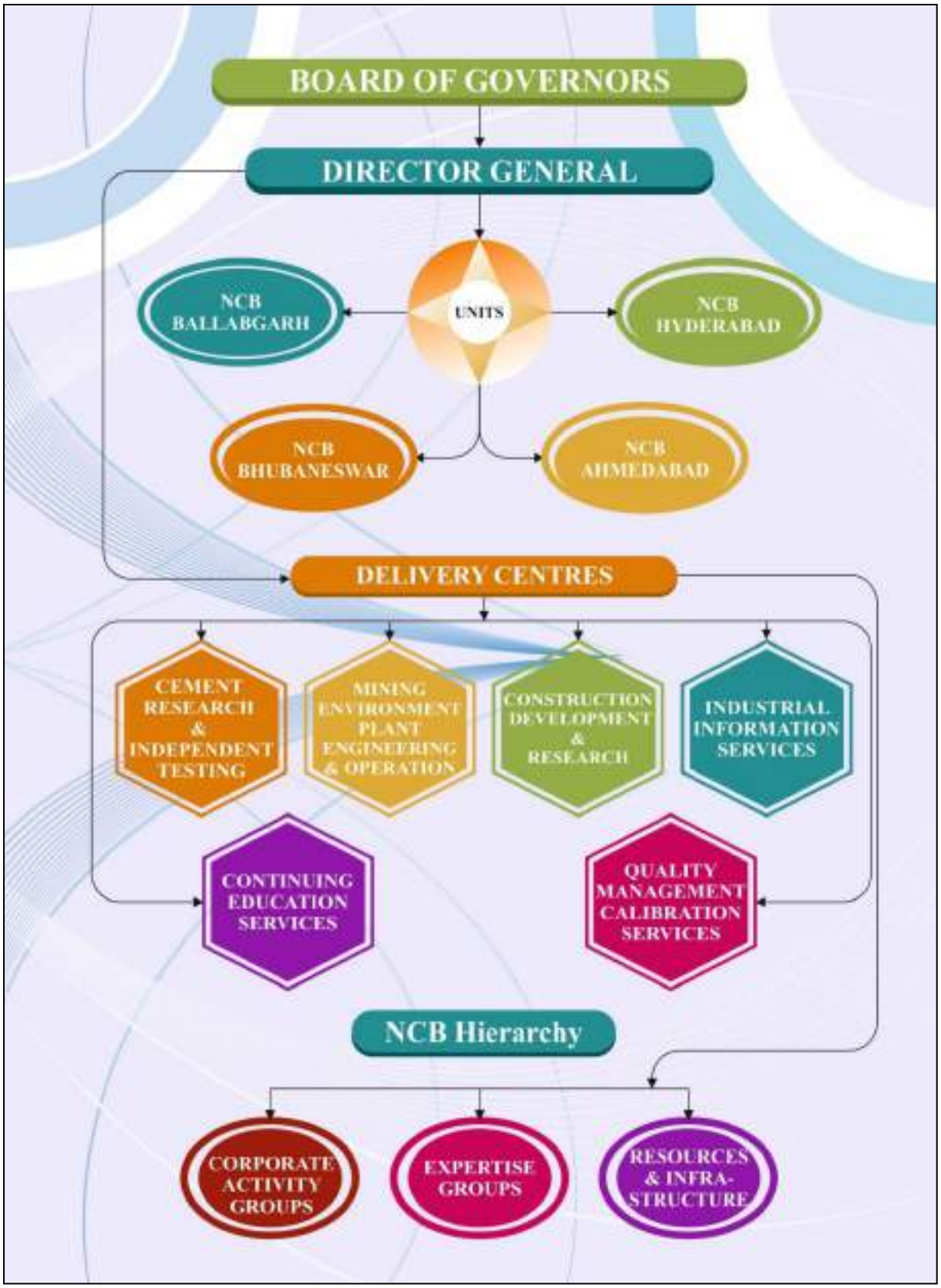
Be a preferred technology partner to cement and construction sectors in the sustainable development of a better infrastructure and housing.

Our Mission

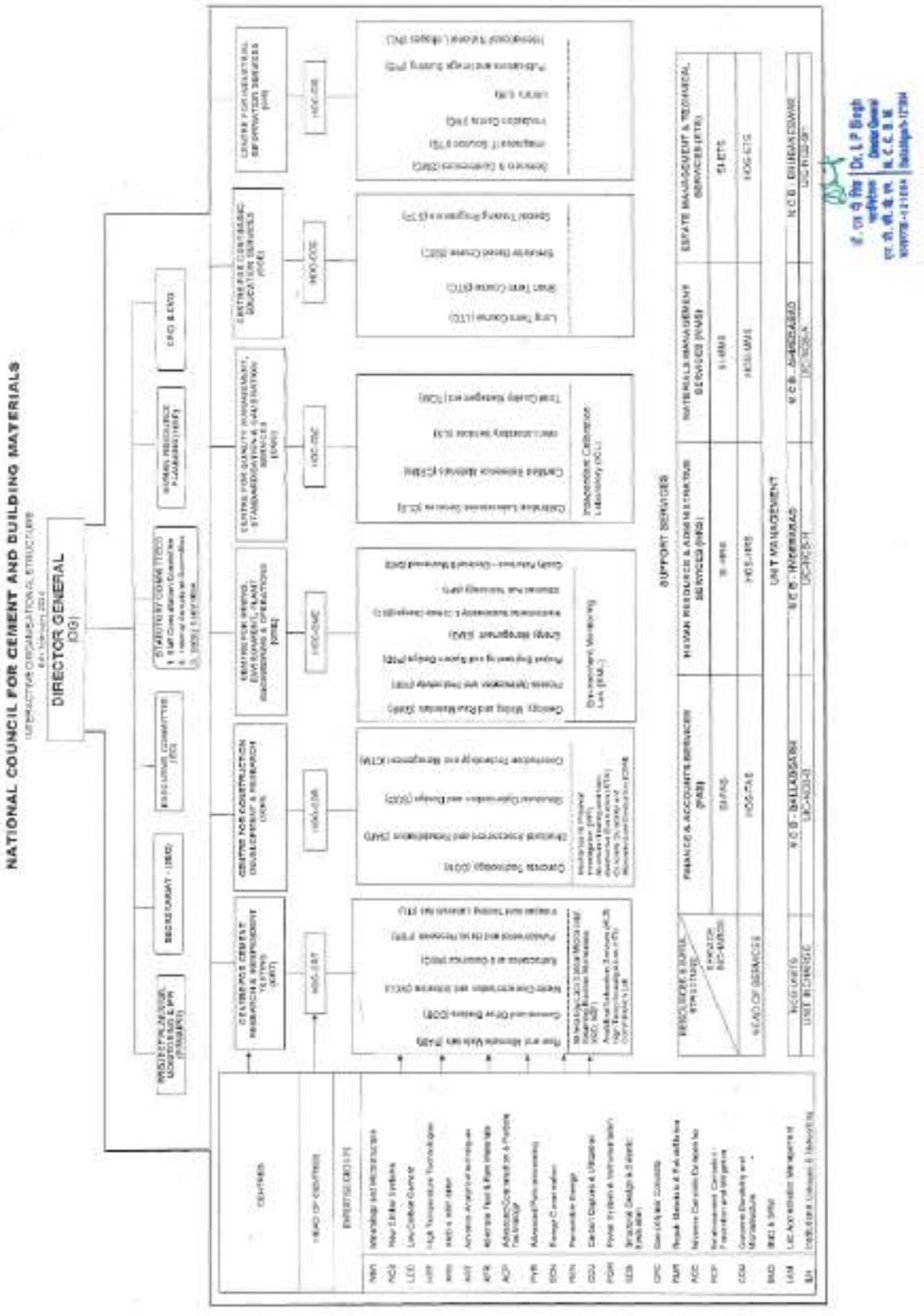
Research and Development of innovative technologies, their transfer and implementation in partnership with cement and construction industries.

- To enhance quality, productivity and cost-effectiveness
- To improve the management of materials, energy and environmental resources
- To develop competency and productivity in human resources
- To develop technologies for durable infrastructure and affordable housing

NCB Hierarchy



NCB Organization Structure



Introduction of NCB

National Council for Cement and Building Materials (NCB), the then Cement Research Institute of India (CRI) was founded on 24th December 1962 with the objective to promote research and scientific work, connected with cement and building materials trade and industry.

NCB is premier autonomous R&D organisation under the administrative control of Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Govt. of India, devoted to technology development &, transfer, continuing education and industrial services for cement and construction industries. It is registered as a society under the Societies Registration Act, 1860. NCB serves as the nodal agency for providing the Government with the necessary support for formulation of its policy and planning activities related to growth and development of cement industry.

It is devoted to protect the interests of consumers of cement and concrete in the country. NCB's stakeholders are Government, Industry and Society, who perceive NCB's role as discharging national responsibility, providing adequate technology support and improving the quality of life respectively. Geographically, NCB has its corporate unit and main laboratories located at Ballabgarh (near New Delhi) and regional units at Hyderabad (Telangana), Ahmedabad (Gujarat) and Bhubaneshwar (Odisha). The units of NCB-Ballabgarh, Hyderabad and Ahmedabad are ISO 9001:2015 certified.

NCB's areas of work span over the entire spectrum of cement manufacturing and usage starting with geological exploration of raw materials through the processes, the machinery, the manufacturing aspects, energy and environmental considerations to the final utilization of materials in actual construction, condition monitoring & rehabilitation of buildings and structures.

NCB provides ISO 17025:2017 accredited testing and calibration services and ISO 17043:2023 accredited proficiency testing (PT) services. It also develops and supplies certified reference materials (CRMs) to cement and construction sector as per ISO 17034:2016. For human resource development, NCB imparts training to professionals of cement, concrete and building materials sectors through short term and long-term courses. NCB's Post Graduate diploma in cement technology for one year duration is approved by AICTE. In the area of industrial information services, NCB organizes international seminars/conferences on cement, concrete and building materials. It has organised 17 editions of this seminar/conference so far.

All these activities of NCB are channelized through six corporate centres:

- **Centre for Cement Research & Independent Testing (CRT):** Centre is responsible for research activity in the areas of cement and other binders, waste utilization, refractory and ceramics, fundamental & basic research and raw & alternative materials. It also looks after testing activities of cement and cementitious materials and other building materials.

- **Centre for Mining, Environment, Plant Engineering & Operation (CME):** Centre carries out its activity in the area of geology, mining and raw materials, environmental sustainability & climate change, process optimization & productivity, energy management, project engineering & system design, advanced fuel technology and quality assurance (electrical & mechanical).

- **Centre for Construction Development & Research (CDR):** Centre is responsible for research activities in the area of structural assessment and rehabilitation, concrete technology, construction technology and management and structural optimization and design.

- **Centre for Quality Management, Standards & Calibration Services (CQC):** Centre provides services to the industry in the area of proficiency testing, standards reference materials, calibration services and total quality management.

- **Centre for Industrial Information Services (CIS):** Centre provides the IT infrastructure. Centre also looks after the publications, seminar and conferences, international and national linkage and image building of NCB.

- **Centre for Continuing Education Services (CCE):** Centre organizes need-based industry-oriented training programmes in the area of cement, concrete and construction sector.

NCB has the following four service groups to support the technical activities of above six corporate centres.

- **Finance and Account Services (FAS):** FAS is responsible for managing all day-to-day financial activities

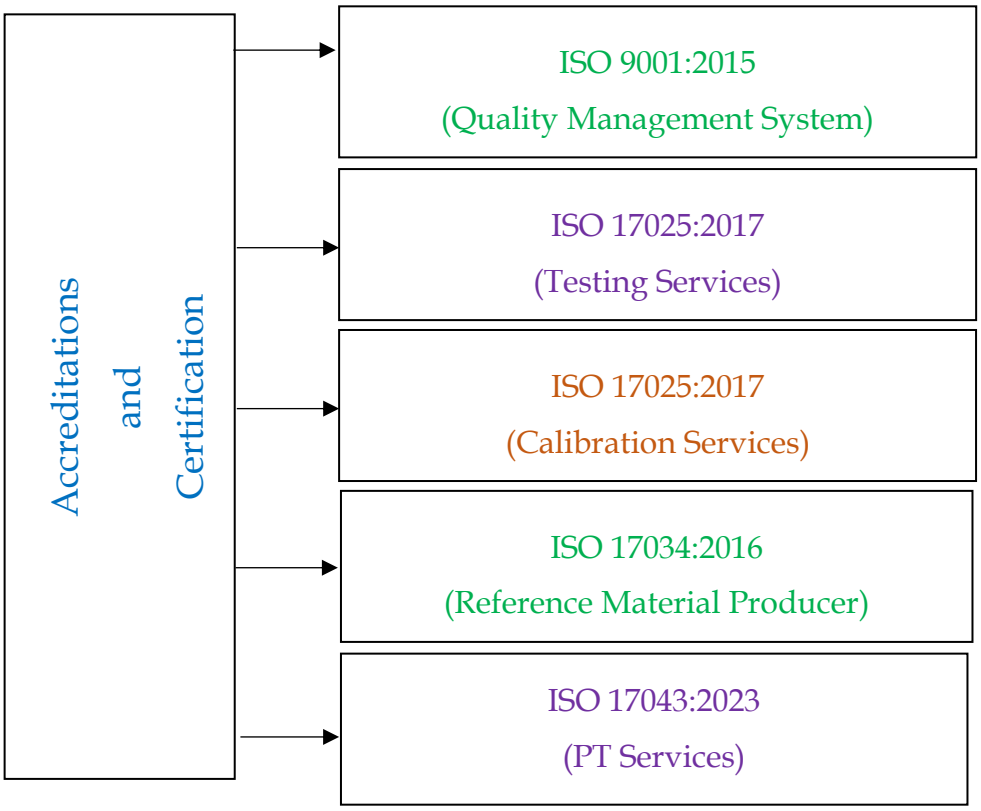
- **Human Resource and Administrative Services (HRS):** HRS-GEN provides the transportation resources and HRS-PER is responsible for human resources activity such as recruitment, promotion, appraisal etc.

- **Estate Management and Technical Services (ETS):** The infrastructure including resources such as workspace, utilities, equipment and communication technology infrastructure are maintained by ETS.

- **Materials Management Services (MMS):** MMS is responsible for purchase of materials including raw material as well as equipment as per the requirements of different departments of organization.

NCB's Commitment to International Quality Standards

NCB in its commitment to achieve excellence has adopted world class practices and implemented international standards for Quality Management System. NCB's quality management system is certified as per ISO 9001:2015. NCB provides world class Testing, Calibration, Proficiency Testing and Reference Material Producer. Activities which are accredited as per International Standards.



Quality Management System Certification as per ISO 9001:2015

ISO 9001 is international standard published by International Organization for Standardization which specifies requirements for quality management system with the aim to enhance customer satisfaction, ability to provide reliable products and services meeting customer's requirements and expectations. NCB implemented ISO 9001 since 2002. NCB-Ballabgarh, NCB-Hyderabad and NCB-Ahmedabad units are ISO 9001:2015 certified.

Quality Objectives

We commit ourselves to:

1. **Pursue global standards of excellence in all our endeavours, covering: Research, Design and Development, Technology Transfer, Continuing Education, Calibration and Testing Services in the areas of Cement, Construction and Building Materials.**
2. **Satisfy all our stakeholders- Government, Industry and Society.**
3. **Continually improve the Quality Management System.**
4. **Comply with the requirements of ISO 9001:2015 Quality Management System and other applicable requirements.**


BVMS CERT

CERTIFICATE OF REGISTRATION

National Council for Cement and Building Materials

ISO 9001:2015

ISO 17025:2017- Testing Services

ISO/IEC 17025:2017 is international standard published by International Organization for Standardization and International Electro Technical Commission. ISO/IEC 17025:2017 specifies the general requirements for the competence, impartiality and consistent operation of laboratories involved in testing, calibration and sampling. NCB implemented ISO/IEC 17025 for its testing services since 1998. NCB provides complete physical, chemical, mineralogical and micro-structural analysis of various types of raw materials, cement, clinker, pozzolana, aggregate, concrete, admixtures, water, refractory, bricks, coal, lignite, Environment parameters etc. & Non-Destructive Testing as per National and International standards.

Quality Policy

Testing laboratories of National Council for Cement and Building Materials, Ballabgarh are committed to provide reliable and accurate test results to the total satisfaction of customers in accordance with the stated methods and customer's requirement.

National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS (TESTING LABORATORIES)

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

in the field of

TESTING

Signed for and on behalf of NABL

N. Venkatramanan

ISO 17025:2017 – Calibration Services

ISO/IEC 17025:2017 is international standard published by International Organization for Standardization and International Electro Technical Commission. This standard specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling. NCB implemented ISO/IEC 17025 for its calibration services since 1998. NCB provides quality calibration services in the field of force, mass, pressure, volume, rpm and dimension fields.

Quality Policy

Independent Calibration Laboratories of National Council for Cement and Building Materials, Ballabgarh, are committed to provide reliable, accurate, calibration results to the total satisfaction of customers in accordance with the stated methods and customers' requirements. The laboratories are committed for ensuring impartiality, integrity and confidentiality of customer data, with efforts for continual improvement of management system and consistent operations.

Quality Objectives

1. **Providing reliable calibration services, accurately and timely, to the satisfaction and requirements of customers;**
2. **Laboratory personnel are committed to carry out laboratory activities in an consistent and competent manner with utmost integrity, impartiality and ensuring confidentiality of customer data;**
3. **Continual improvement of effectiveness of management system, continual training of laboratory personnel and up gradation of services and facilities in accordance with changing customer requirements and relevant specifications;**
4. **Continual improvement of customer satisfaction; To meet the above objectives, the laboratories follow the management system appropriate to scope of their activities and meet the requirements of NABL criteria of accreditation and IS/ISO/IEC 17025:2017 – "General requirements for the competence of testing and calibration laboratories" and are provided with necessary resources.**

ISO 17034: 2016 – Reference Material Producer

ISO 17034:2016 is international standard published by International Organization for Standardization. This standard specifies "General Requirements for the Competence of Reference Material Producers" for the Development of Certified Reference Material. NCB implemented ISO 17034:2016 since March 2021. NCB provides Certified Reference Materials in the area of cement and cementitious materials including solid fuel (Coal).

Quality Policy

Standard Reference Material of National Council for Cement and Building Materials, Ballabgarh, are committed to provide highest quality of Certified Reference Materials to customers, to produce RMs which conform to the requirements as per International Standard, to conduct all testing and calibration in support of the production of RMs in compliance with ISO/IEC 17025.

SRM programme are also committed to follow good professional practices and continually improve the effectiveness of the management system. All personnel concerned with SRM programme activities shall familiarize themselves with quality documentation and implement the policies and procedures in their work.

Quality Objective

1. **To increase resource generation**
2. **To provide efficient and reliable services, to the satisfaction and requirements of customers;**
3. **To continually improve and upgrade SRM programme services;**
4. **To improve feedback of participants and customers.**
5. **To analyze and improve the management system, CRM development and customer service.**


National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

STANDARD REFERENCE MATERIAL, NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

ISO 17034: 2016

"General Requirements for the Competence of Reference Material Producers"

REFERENCE MATERIAL PRODUCER

ISO 17043:2023 – Proficiency Testing Services

ISO/IEC 17043:2023 is international standard published by International Organization for Standardization and International Electro Technical Commission. This standard specifies general requirements for the competence of providers of proficiency testing schemes and for the development and operation of proficiency testing schemes. NCB implemented ISO/IEC 17043 since 2013. NCB provided proficiency testing services in testing of various building materials like cement, clinker, fly ash, limestone, coal/coke, granulated slag, water, steel, aggregate etc.

Quality Policy

Interlaboratory Services of National Council for Cement and Building Materials, Ballabgarh, are committed to provide highest quality of proficiency testing services to participants and other customers.

Quality Objectives

1. **To provide efficient and reliable proficiency testing services, to the satisfaction and requirements of proficiency testing participants and other customers.**
2. **To continually improve and upgrade proficiency testing services.**
3. **To improve feedback of participants and customers.**
4. **To analyze and improve the management system, proficiency testing schemes. And customer service.**

National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

INTERLABORATORY SERVICES, NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

ISO/IEC 17043: 2023

"Conformity Assessment - General Requirements for the Competence of Proficiency Testing Providers"

PROFICIENCY TESTING PROVIDER

Board of Governors (BOG)
Composition of BOG

Chairman

Shri Neeraj Akhoury
President-CMA and
Managing Director
Shree Cement Ltd.

Members

Shri Rajendra Chamaria
Vice Chairman-NCB
Vice Chairman & Managing Director
Star Cement Limited

Smt. Arti Bhatnagar
Additional Secretary & Financial Advisor, DPIIT, Ministry of Commerce & Industry, Govt. of India

Shri Sanjiv
Joint Secretary (Cement Division)
DPIIT, Ministry of Commerce & Industry, Govt. of India

Shri Santosh Kumar Yadav, IAS
Chairman
National Highways Authority of India

Shri Abhay Bakre
Director General
Bureau of Energy Efficiency

Shri K C Jhanwar
Managing Director
UltraTech Cement Limited

Shri Ajay Kapur
CEO (Cement Business)
Adani Group

Shri M S Gilotra
Managing Director & Non-Independent Executive Director
Saurashtra Cement Ltd.

Shri Deepak Khetrapal
Managing Director & CEO
Orient Cement Limited

Shri Jayakumar Krishnaswamy
Managing Director
Nuvoco Vistas Corp. Ltd.

Shri Madhav K Singhania
Dy. Managing Director & CEO
J.K. Cement Ltd.

Shri Mahendra Singhi
Strategic Advisor to Managing Director & CEO
Dalmia Cement (B) Limited

Chairman
NAREDCO

Dr L P Singh
Director General-NCB

Meetings of Board of Governors (BOG)

Board of Governors (BOG) is the highest decision-making body of NCB and is aided by various Committees like Administrative and Finance Committee (AFC), Infrastructural Development Committee (IDC), Research Advisory Committee (RAC) and Advisory Committee for Hyderabad & Bhubaneswar (ACH) of NCB to make informed decisions on multiple issues relating to finance, manpower, service matters and rules.

BOG of NCB for the years 2023 & 2024 has been constituted by DPIIT, Ministry of Commerce and Industry, Government of India on 29th November 2023.

The 125th meeting of Board of Governors (BOG) was held on 10th January 2024 under the Chairmanship of Shri Neeraj Akhoury, Chairman-NCB, President-CMA and Managing Director, Shree Cement Ltd at Vanijya Bhawan, New Delhi.

125th BOG Meeting on 10th January 2024

Corporate Advisory Committees

Research Advisory Committee (RAC)

RAC advises on all aspects pertaining to Programmed R&D and industrial support services in NCB, with particular reference to technology forecasting, technology planning, programmes, strategies and methodologies and the overall project programme of NCB. RAC comprises eminent and learned technocrats representing Indian cement and concrete industry, technology suppliers, officials from Ministry of Commerce and Industry, Government of India, academia, Bureau of Indian Standards (BIS), and Director General-NCB etc. The RAC members meet twice in a year. The detailed composition is given below:

Chairman

Shri M S Gilotra
Managing Director & Non-Independent Executive Director
Saurashtra Cement Ltd.

Members

Prof. S K Bhattacharya
Vice Chairman (RAC)
Vice Chancellor
Shiv Nadar University, Chennai

Prof. Shashank Bishnoi
Professor (Civil Engg.)
Indian Institute of Technology Delhi

Director (Cement)
DPIIT
Ministry of Commerce & Industry,
Govt. of India

The Director
Central Building Research Institute
Roorkee

The Deputy Director General
Geological Survey of India

Prof. R G Pillai
Professor (Civil Engg.)
Indian Institute of Technology Madras

Shri Ashwani Pahuja
Chairman & MD
NextCem Consulting Pvt. Ltd.

Dr. Awadhesh Singh
Sr. VP & Head (Product Assurance)
UltraTech Cement Ltd.

Shri Arun Kumar
Director (Civil Engg.) & Head
Bureau of Indian Standards

Dr. Rajeev Goel
Chief Scientist
Central Road Research Institute

Shri Satish Upadhyay
Executive Director - NTPC Limited
Mission Director - Samarth National
Biomass Mission, Ministry of Power,
Govt. of India

Secretary General
Cement Manufacturers' Association

Dr. S K Saxena
Unit Head
J K Lakshmi Cement Ltd.

Shri Raju Goyal
Chief Technology Officer
Ultratech Cement Ltd.

Shri Pankaj Kejriwal
Director
Star Cement Ltd.

Shri Shaswattam
CGM, NTPC Ltd. (Netra)

Shri J P Vrati
Astt. ED, Quality
Dalmia Cement Bharat Ltd.

Dr. L P Singh
Director General - NCB

Head of Centres of NCB

Dr. Manish V Karandikar
Vice President
Adani Cement Ltd.

Ms. Lopamudra Sengupta
Vice President - Technical Services
JSW Cement Ltd.

Dr. Pranav Desai
Vice President (Technical & Development)
Nuvoco Vistas Corp. Ltd.

Dr. Neelima Alam
Scientist (F)
Climate Change in Clean Energy
Division, DST, Govt. of India

Dr. Mukesh Kumar
Associate VP
Technical Walling Solution

Shri Amit Trivedi
Member Secretary, RAC - NCB

Shri Brijesh Singh
Coordinator, RAC - NCB

Advisory Committee for NCB–Hyderabad & Bhubaneswar

In an endeavor to reach out to the cement and construction sectors in South India and for sharing NCB's Research and Innovative initiatives, Advisory Committee for NCB-Hyderabad & Bhubaneswar has been constituted. The committee deliberates on various aspects of development of NCB–Hyderabad & Bhubaneswar and its activities. It focusses in particular on the development & utilization of infrastructural facilities of the Units and industrial & training services rendered by it.

The Composition of NCB-Hyderabad & Bhubaneswar has officials from Central/State Government Departments: Cement & Construction Industry, Research Institutes (IIT/NIT/BITS). The detailed composition is given below:

Chairman

Shri Rakesh Singh
Executive President
The India Cements Ltd.

Members

Shri Anil Gupta
Chief Manufacturing Officer
ACC Ltd.
Unit: Wadi Cement Works

Shri Anoop Kumar Saxena
Chief Executive Officer
Bharathi Cement Corp. Pvt. Ltd.

Shri Seetharamulu Ch
Unit Head
Chettinad Cement Corp. Pvt. Ltd.

Shri S Venkateswarlu
Director-Works
Deccan Cements Ltd.

Shri Umashankar Choudhary
Plant Head
J K Cement Ltd.

Shri Hari Kumar, IAS
Managing Director
Malabar Cements Ltd.

Shri K Subbulakshmanan
Unit Head
Ambuja Cements Ltd.
Unit: Maratha Cements Works

Shri B M Mahana
HOD-Production
Cement Corporation of India Ltd.

Shri Mukesh Kumar Sinha
Plant Head
Dalmia Cement (B) Ltd.

Shri Navneet Chauhan
Plant Head
JSW Cement Ltd.

Shri V S Narang
Director (Technical)
My Home Industries Pvt. Ltd.

Shri D Lakshmikantham
Director-Technical
Penna Cement Ind. Ltd.

Shri Jashvanth Krishna
CEO & MD
Parasakti Cement Industries Ltd.

Shri S Sreekanth Reddy
Joint Managing Director
Sagar Cements Ltd.

Shri Madhusudhan Rao
Vice President
The K C P Ltd.

Shri Ashish K S
Plant Head
The Ramco Cements Ltd.

Shri G N B Rao
Plant Head
Zuari Cement Ltd.

Dr. V Ramachandra
Vice President (Technical) - South
UltraTech Cement Ltd.

Shri Kantilal Nanda
Plant Head
NU Vista Ltd.

Shri Chetan Shrivastav
Executive Director
OCL India Ltd. (Dalmia Cement)

Govt. Organisations & Educational Institutes:

Shri K V Rao
Scietist-F & Head
Bureau of Indian Standards

Prof. K V L Subramaniam
Indian Institute of Technology

Shri P Ravinder Rao
Engineer-in-Chief, State Roads & CRN
R&B Department

Shri Cheeti Muralidhar
Engineer-in-Chief
Irrigation & CAD Department
Govt. of Telangana

Shri V G Venkata Reddy
Director of Mines & Geology
Govt. of Andhra Pradesh

Shri B R V Susheel Kumar
Director, Mines & Geology
Govt. of Telangana

Shri P Satyanarayana Reddy, IAS
Member Secretary
Telangana State Pollution Control Board

Dr. Dinakar Pasla
Associate Professor
School of Infrastructure
Indian Institute of Technology-Bhubaneswar

INFRASTRUCTURAL DEVELOPMENT COMMITTEE (IDC)

Infrastructural Development Committee (IDC) advises the Board of Governors on various aspects of land, building services, equipment and facilities at the various NCB Units and to cause these infrastructural developments to be carried out at the various NCB Units and to assist in conducting the affairs of the unit in such a manner as to fulfill the set objectives with the programmes, policies and guidelines laid down by the board. The composition of the committee is given below:

Chairman

Shri M K Singhania
Dy. MD & CEO
J.K. Cement Ltd.

Members

Prof. Umesh Sharma
Professor (Civil Engineering)
Indian Institute of Technology Roorkee

Dr. Rakesh Kumar
Chief Scientist
Central Road Research Institute

Dr. Manish V Karandikar
Vice President
Adani Cement Ltd.

Shri Sanjay Mehta
President (Procurement & Corporate Affairs)
Shree Cement Ltd.

DG-NCB

An NCB Official nominated by DG-NCB – Member-Secretary

Joint Directors and Heads of concerned Service Groups

ADMINISTRATION AND FINANCE COMMITTEE (AFC)

Administration and Finance Committee (AFC) advises the Board of Governors on issues relating to financial planning, budgets, accounts, manpower growth plan and service matters including various rules of NCB. To take decisions on behalf of the Board of Governors on individual personnel cases and on issues of administrative nature as may be referred to it, by the Board or by the Director General-NCB. All such decisions are reported to the Board at its immediate next meeting through the relevant status report. The composition of the committee is given below:

Chairman

Shri Rajendra Chamaria
Vice Chairman & Managing Director
Star Cement Limited

Members

The Director (Cement)
DPIIT, Ministry of Commerce & Industry, Govt. of India

The Director
Integrated Finance Wing
DPIIT, Ministry of Commerce & Industry, Govt. of India

Shri K K Jain
Vice President (Finance)
Shree Cement Limited

Shri C K Bagga
Vice President (Fin. & A/Cs)
JK Lakshmi Cement Ltd.

Shri Dharmender Tuteja
Chief Financial Officer
Dalmia Cement (Bharat) Ltd.

DG-NCB
Joint Directors and Heads of concerned Service Groups

An NCB Official nominated by DG-NCB – Member-Secretary

ANNUAL GENERAL MEETING (AGM)

Chairman

Shri Neeraj Akhoury
Managing Director
Shree Cement Ltd.

Members

Shri Rajendra Chamaria
Vice Chairman-NCB
VC& MD, Star Cement Limited

Shri M S Gilotra
Managing Director
Saurashtra Cement Ltd.

Shri Madhav K Singhania
Dy. Managing Director & CEO
J.K. Cement Ltd.

Shri Mahendra Singhi
Strategic Advisor to Managing Director & CEO, Dalmia Cement (B) Limited

Shri Sunil Khandare
Director, BEE

Shri N K Wadhwa
Director, DPIIT

Ms Aparna Dutt Sharma
Secretary General, CMA

Dr V Ramachandra
UltraTech Cement Ltd

Dr Manish Karandikar
Adani Group

Shri J P Vrati
Dalmia Cement (B) Ltd.

Shri Madhusudan Rao
KCP Ltd.

Ms Lopamudra Sengupta
JSW Cement

Shri Awadhesh Kumar
NHAI

Dr Abhishek Rai
Shree Cement Ltd.

Shri Pranav Desai
Nuvoco Vistas Corp Ltd.

Dr S K Handoo
My Home Industries Pvt. Ltd

Shri S K Jain
Star Cement Ltd

Shri Deepesh Gupta
DPIIT

Dr L P Singh
Director General, NCB

Dr S K Chaturvedi
Secretary & Joint Director, NCB

Dr D K Panda
Joint Director, NCB

Shri P N Ojha
Joint Director, NCB

Dr B P R Rao
Joint Director, NCB

Shri Amit Trivedi
Joint Director, NCB

Shri G J Naidu
General Manager, NCB

Dr Sanjay Mundra
General Manager, NCB

Shri Anil K Popuri
General Manager, NCB

Shri Anand Bohra
Manager, NCB

Executive Committee (EC)

With a view to achieve the objectives of collegiate management and to assist the Director General to deal with the various functions, the Executive Committee, comprising heads of various Divisions of activities with the Director General as its Chairman. The composition of the committee is given below:

Chairman

Dr. L P Singh

Director General-NCB

Secretary

Dr. S K Chaturvedi

HOC-CRT & UIC- NCB-Ballabgarh

Members

Dr. D K Panda	HOC-CME, HOC-CCE & HOS-HRS
Shri P N Ojha	HOC-CDR, UIC NCB-Ahmedabad & CVO
Shri Amit Trivedi	HOC-CQC & HOS-MMS
Dr. B Pandu Ranga Rao	UIC - NCB-Hyderabad & NCB-Bhubaneswar
Dr. Sanjay Mundra	HOS-FAS
Shri G J Naidu	HOC-CIS
Shri A K Popuri	HOS-ETS#
Shri Brijesh Singh	HOS-ETS*

#till 15th January 2024 *from 16th January 2024

Corporate Advisory Committee Meetings

Corporate Advisory Committee Meetings

76th Meetings of Research Advisory Committee (RAC)

76th Research Advisory Committee (RAC) meeting was held on 21st March 2024 under the chairmanship of Shri M S Gilotra, Managing Director, Saurashtra Cement Ltd. at NCB-Ballabgarh. Research and Development (R&D) by NCB is taken up through the recommendations of RAC.

RAC is composed of the experts from the cement industry, government, academia and society which advises on all aspects pertaining to programmed R&D and industrial support services in NCB, with particular reference to technology forecasting, technology planning, programmes, strategies and methodologies and the overall project programme of NCB.

During the meeting, outcomes of 08 completed R&D projects, progress of 06 nos. ongoing R&D projects, and 11 nos. new project proposals to be taken up from FY 2024-25 were presented.

76th RAC Meeting

52nd Meeting of Infrastructural Development Committee (IDC)

The 52nd meeting of Infrastructure Development Committee (IDC) of NCB was held in hybrid mode on 18th June 2024 under the chairmanship of Shri Madhav K Singhania, Deputy MD and CEO, J K Cement Ltd. The meeting was attended by Prof. Umesh Sharma, Professor (Civil Engineering), Indian Institute of Technology, Roorkee; Dr. Rakesh Kumar, Chief Scientist, Central Road Research Institute, New Delhi and Head of Centres/Service Groups of NCB. The committee deliberated on upgradation of NCB's infrastructure and laboratory facilities to further improve customer satisfaction and its research capabilities.

IDC is one of the sub-committee of Board of Governors (BOG) of NCB to advise the Board of Governors on issues related to various aspects of land, building services, equipment and facilities to fulfill the set objectives with the programme, policies and guidelines laid down by the board of NCB.


52nd IDC Meeting

67th Meeting of Administration & Finance Committee (AFC)

The Virtual meeting of 67th Administration & Finance Committee (AFC) meeting was held on 5th June 2024 under the Chairmanship of Sh. Rajendra Chamaria, Vice - Chairman & Managing Director, Star Cement Ltd.

The Committee took vital decisions on behalf of the Board of Governors on individual personnel cases and on issues of administrative nature which were referred to it by the Board and by DG-NCB.

Virtual meeting of 67th AFC

60th Annual General Meeting (AGM)

During the 60th Annual General Meeting (AGM) of National Council for Cement and Building Materials (NCB) held today, Dr L P Singh, DG-NCB introduced the newly elected Chairman-NCB Shri Neeraj Akhoury, Vice-Chairman-NCB Shri Rajendra Chamaria and all members of newly formed BOG.

Shri Neeraj Akhoury, Chairman-NCB, President-CMA and MD, Shree Cement Ltd. addressed the 60th AGM of NCB and highlighted the achievements of NCB during the year. He stated that NCB's current Research projects are well aligned to national priorities besides addressing current R&D requirements of cement industry. He lauded the role played by NCB in skill development of cement professionals and for

providing certified reference materials to cement industry. He informed that NCB has won the bid to organise the 17th ICCC at New Delhi in 2027.

Representatives of cement industry congratulated the newly elected Chairman-NCB, Vice-Chairman of NCB and members of BOG. They appreciated the services rendered by NCB for Indian cement industry.

60th AGM Meeting

NCB's Programmes and their Fulfilment

The Corporate Programmes

NCB continues to be a preferred research & consultancy partner for the cement and construction industry. With its state-of-art laboratories and addition of modern and latest scientific equipment, reinforced by the enthusiastic experienced scientists and engineers and pro-active leadership, NCB has been providing innovative technological solution to overcome the hurdles faced by industry and nation at large.

Govt. of India Schemes and Missions		NCCBM's Activities
Skill India	Pradhan Mantri Kaushal Vikas Yojana (PMKVY)	NCCBM's Centre for Continuing Education (CCE) and Centre for Industrial Information Services (CIS) through its 22 expertise has been organizing various industry oriented training programmes for professionals of all levels & students and Seminars / Workshops / Online Training/Webinars for cement, concrete, construction and building material sectors. Beneficiaries: Entire Cement Industry, IAF, RBI, BRO, Indian Post, Indian Railways, CPWD, PWD & Water Resources Department of various State Governments, BPCL, HPCL, IOCL, DMRC, NBCC India Ltd., NHPC Ltd., Power Grid Corp. of India Ltd., NTPC, GAIL India Ltd.
MAKE IN INDIA	Make in India	NCCBM's Centre for Quality Management, Standards & Calibration Services (CQC) is promoting "Atma Nirbhar Bharat" and "Make in India" programs by developing 18 Bhartiya Nirdeshak Dravya (BNDs) for cement and cementitious materials to reduce the import of foreign Standard Reference Materials. CQC provides Proficiency Testing services as well as Calibration services traceable to National / International Standards in various fields of force, temperature, mass & volume, dimension, pressure and RPM.
COP26	Target to Achieve Net Zero by 2070	NCCBM's Centre for Cement Research and Independent Testing (CRT) has undertaken extensive research for Clinker Substitution to reduce specific CO_2 emissions of cement by development of: • Low Carbon Clinker • Portland Composite Cement based on fly ash and Limestone • Portland Limestone Cement and • Portland Dolomite Cement • Multi component blended cement
PAT SCHEME	PAT Scheme of BEE under National Mission for Enhanced Energy Efficiency (NMEEE)	NCCBM's Centre for Mining, Environment, Plant Engineering and Operations (CME) has carried out over 200 Energy Audits of cement plants for improving Energy Efficiency under the Perform Achieve & Trade (PAT) scheme of Bureau of Energy Efficiency (BEE), Ministry of Power, Govt. of India. CME is also carrying out research on ways to maximize Waste Heat Recovery and utilize Renewable Energy in cement related operations
	Smart Cities Mission	NCCBM's Centre for Construction Development and Research (CDR) has undertaken research projects such as high strength concrete & Ultra High Performance concrete and is providing reliable technical services to ensure durable and sustainable infrastructure by undertaking Third Party Quality Assurance and Audit of Construction Projects such as Convention Centres, Buildings, Bridges, Tunnels, Roads etc. Beneficiaries: CPWD, PWD, IDCO Odisha, Telangana, Power Grid Corp. Ltd., ITPO (Pragati Maidan), International Convention Centre Dwarka, Ambedkar Memorial, NTPC, Bhakra Dam, AIIMS, MCD, DDA etc
	Swachh Bharat Mission	NCCBM's Centre for Construction Development and Research (CDR) has done extensive research on utilization of C&D waste as well as other industrial waste as iron slag, copper slag, bottom ash ferrochrome slag etc. as an alternative to natural fine and coarse aggregates; utilization of sintered flyash as coarse aggregate in structural light weight concrete and development of Geopolymer Cement and Concrete systems. NCCBM's Centre for Cement Research and Independent Testing (CRT) & Centre for Mining, Environment, Plant Engineering and Operations (CME) are actively working with cement industry for utilization of various wastes as Alternative Fuels and Raw Materials to enhance %TSR from 4% to 25% by 2030.

Services were provided in the areas of development of newer products, optimal utilization of resources be it limestone, gypsum or industrial waste, Alternate Fuel & Raw materials (AFR), circular economy, process optimization, energy studies, plant maintenance, structural assessment and rehabilitation, quality assurance in construction, concrete technology, materials evaluation, application of nanotechnology, dissemination of information through seminars & training programmes and total quality management.

NCB has carried out Limestone Consumption Factor (LCF) studies for cement plants from all over the country and so far established the same for 275 cement plants. During the year, LCF studies were completed for 18 cement plants from Madhya Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu, Odisha and Karnataka. NCB developed plant specific secondary standards of cement raw materials and finished products. The study has been carried out so far for 22 cement plants covering 40 matrices. This year the study has been carried out for 6 cement plants from Karnataka, Rajasthan, Madhya Pradesh, Maharashtra and Andhra Pradesh.

NCB has taken up R&D for utilization of Lime sludge from Indian Paper Industry to achieve circular economy for Indian Cement Industry. High MgO limestone or dolomitic limestone shows synergetic effect on the performance of different cements (blended cements). These materials are abundantly available with cement plants of some region. The main objective of the study is to investigate the feasibility of using dolomite in development of Portland Dolomite Cement in order to formulate new Indian standard for its commercialization along with lowering in clinker factor in cement for environmental sustainability. To carry out the study, different Portland Dolomite Cement blends were prepared by inter-grinding of varying percentages of dolomite collected from different parts of the country with OPC clinker and gypsum. OPC and Portland Limestone Cement (PLC) blends were also prepared as control samples. The cement blends were prepared from raw materials of central, western, southern and north-eastern region of the country and performance characterization was studied.

The collaborative efforts of BARC-UCIL and NCB have resulted in commencement of a phased project that aims to utilize tailing waste in the cement manufacturing process. The laboratories are equipped with state-of-art instruments and trained competent staff to carry out the testing activities as per National and some International standards. During the year, assignments were carried out for samples from neighboring countries also. The number of samples tested during the period was 6,923.

In the areas of process & productivity, NCB provided project management consultancy services for installation of tyre chips to M/s Oman Cement Company SAOG, Sultanate of Oman. Further, capacity assessment study was successfully conducted for M/s Goldstone Cement Limited, Meghalaya. NCB carried out diagnostic study on corrosion of various ducts and chimneys of M/s KCP Ltd. NCB conducted heat balance & energy consumption optimization study in cement kilns for M/s Kesoram Industries Ltd., unit - Vassavadatta Cement, Sedam, Karnataka and provided recommendations for improving thermal energy performance of the kiln system.

In the areas of energy management, NCB has carried out more than 250 detailed energy audits till date in various cement plants. Energy audit studies in cement plants include assessment of energy management, monitoring and target setting, detailed heat balance and gas balance studies, identification of potential for thermal and electrical energy savings and recommendations for remedial measures, techno economic feasibility studies for waste heat recovery system (WHRS) etc. A R&D project was taken in the year 2020 and experimental trail runs were taken in the downdraft gasifier at BITS Pilani setup. A MAT lab model has been developed for RDF gasification to predict the Syn gas quality and further techonomic analysis is being carried out.

In the areas of project engineering and system design (PSD), Project Monitoring and Control (PMC) Consultancy Services is provided for setting up a 600 tpd Cement Plant in RoC for Government of Republic of Congo, preparation of marketing report for

utilization of Flue Gas Desulphurization Gypsum (FGD) of NTPC power plants located in Vidhyanchal, Singrauli and Rihand (collectively known as VSR region). NCB successfully completed R&D project for design and development of the transfer chute and developed the design parameters for transfer chute to prevent the chute jamming and a flexible arrangement for cleaning the chute incase if it gets jammed.

In the areas of advanced fuel technology (AFT), A tripartite agreement have been signed with M/s Livnsense Technologies Pvt. Ltd. and M/s J K Lakshmi Cement to develop predictive models to enhance TSR through liquid AF in the cement plant. The forecasting model was developed and validated with real time data. The accuracy of developed model for temperature forecasting with 5 minutes' interval is 95%. The achieved accuracy is more than the requirement (>80%) of tripartite agreement for real time prediction. However, for outliers i.e. 5% values above +/- 9 deg C, the Accuracy with 5 minutes' interval is around 50%.

In the areas of environment sustainability & climate change (ESC), Life cycle assessment of five different cement products of a cement plant was undertaken. The impacts were calculated in terms of Global Warming Potential, Acidification Potential, Eutrophication Potential and Abiotic depletion potential. GHG assessment was carried out for four years covering Scope I and Scope II emissions. Water Footprint Assessment carried out for five years based on the data provided by the plant and verification of the data during plant visit. To measure the efficiency of Top Cyclones of Pre-heater, the return dust measurements were carried out at two cement plants. Under these studies, the dust concentration is measured in the pre-heater downcomer and the efficiency of Top Cyclone is calculated using the dust load and kiln feed rate.

The Quality Assurance Group (QAG) comprises pool of Electrical, Mechanical and Instrumentation engineers who are primarily involved in Third Party quality assurance of electrical & Mechanical services of various types of infrastructure and nation building projects such as Hospitals, Schools, Convention centers, Street lighting works, Sewage Treatment Plant, Effluent treatment plant etc.

In the areas of Concrete Technology, NCB has conducted evaluation of wide range of concrete making materials such as natural coarse and fine aggregates, cement, flyash, GGBS, alternative aggregates like geo-polymer flyash sand etc. and has successfully carried out important projects for prestigious clients. During the period of 2023-24, more than 12 sponsored projects of material characterization and about 41 mix designs were completed. Concrete mix designs for special applications such as Self-Compacting Concrete (SCC), Under Water Pumped Concrete & Roller Compacted Concrete (RCC) have been carried out successfully for various clients. NCB over the years has developed expertise and competencies to evaluate aggregates for potential alkali aggregate reaction which includes both alkali silica reaction and alkali carbonate reaction. About 18 numbers of coarse and fine aggregates were evaluated for various prestigious clients. NCB over the years has developed the necessary expertise and competency to evaluate aggregates for potential alkali aggregate reaction which includes both alkali silica reaction and alkali carbonate reaction. NCB has also developed mechanism for the assessment of integral crystalline waterproofing

compounds and their performance in concrete as well as mortar. NCB has evaluated 6 numbers of crystalline water proofing compounds for various industrial clients like Xypex, Asian paints and government clients like CPWD, PWD etc.

NCB undertook the study to investigate the effect of new cementitious systems over the progress of carbonation front and corrosion rate in field as well as laboratory environment. The study was carried out at two w/c ratios of 0.40 and 0.60 and 124 concrete mixes were designed with various combinations of fly ash, slag, and limestone. For the field study, based upon climatic zones of India, Exposure classes for structures exposed to carbonation is being categorized into 4 (as proposed for revision of IS 456). For the field study 11 cementitious blends were selected. About 260 RCC specimens were prepared for the field study. 42 RCC Samples for field study at NCB Ballabgarh campus is already kept in unsheltered environment.

NCB is carrying out R&D Project titled "Utilisation of CO_2 in Fresh Concrete and Study on Fresh and Hardened Properties of CO_2 induced Concrete". The aim of the project is to study the potential of CO_2 utilisation in concrete and its effect on fresh and hardened properties of concrete. NCB has been working on various research projects that aims to enhance the utilisation of different cementitious and industrial bi-products (such as BF slag, LD slag, ferrochrome slag, bottom ash, electric arc furnace slag etc.) as one of the constituent materials in cement concrete as binder or aggregate.

In the areas of Structural Optimization & Design, effect of fire on the residual mechanical properties of reinforcing bars and structural performance of reinforced concrete Beams in flexure & Shear, were studied.

In the areas of Structural Assessment & Rehabilitation, a wide range of activities related to assessment of new and existing concrete structures are carried out which includes condition assessment of existing concrete structures including fire damaged concrete structures, investigation of material properties of hydraulic structures such as dams, application of non-destructive testing for conformity of quality and condition assessment of concrete structures, preparation of repair estimates including cost estimates and detailed schedule of items for repair and rehabilitation works, consultancy services involving quality inspection and third party quality assurance of repair and rehabilitation works of concrete structures, Research & Development Projects on modern repair technologies, & load testing of RCC structures like bridges, underground RCC conduits, buildings, etc.

In the areas of Construction Technology and Management, NCB provides Third Party Quality Assurance services for the wide range of construction projects such as buildings, convention centres, flyovers, dam, barrage, roads, bridges and tunnels, construction utility projects, special construction activities like pre-engineered steel structures etc. built by the various central / state / autonomous organizations across India through NCB. The scope of Third-Party Quality Assurance / Audit includes inspections, lifting and testing of samples, witness of field and laboratory testing done at site / fabrication yard, review of quality system and documents including Non-

Destructive Testing (NDT) wherever applicable. The centre continues to provide specialized services in the area of quality assurance/control and thereby contributing to the durable and sustainable infrastructure in India.

NCB's SRM programme is accredited under ISO 17034:2016 as Reference Material Producers. NCB has developed Certified Reference Materials (CRMs) in the areas of cement, building materials and solid fuels (coal and pet coke). NCB's CRMs have been quoted in IS 4031(Part-2), IS 4031(Part-15) and IS 1727.

In addition, 21 Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs) were developed in collaboration with CSIR-National Physical Laboratory (NPL). NCB's CRMs are being used in India by almost all cement & construction, cement plants, commercial lab, educational institutes etc. and SAARC countries (Nepal, Bhutan, Bangladesh, Sri Lanka etc.) and Middle east country etc. During the year, total 2,791 units of different CRMs and 1,227 sets of standard lime were supplied to 1079 customers of cement plants, testing laboratories, public sector undertakings, R&D institutions including Nepal, Bhutan, Kenta, South Korea etc. More than 1600 equipment/instrument including Proving ring, Compression testing machine, Vibrating machine, Dial gauge, Blaine cell, Weights, Glassware, Pressure gauge, Test sieve, Liquid in glass thermometer, Environmental chambers, Hot air oven, Muffle furnace, Weighing balance, Rebound hammer etc. were calibrated at NCB's testing laboratories and at customer's site. The calibration services are being provided to various Central Govt., State Govt., PSUs, Cement & Construction Industries and have shown remarkable growth. It is pertinent to mention that 95% customers rated our services as excellent in the last financial year. NCB's Interlaboratory Services (ILS) is accredited under ISO/IEC 17043:2010, thus NCB is first accredited PT provider in India. In 2023-24, NCB completed 15 PT schemes. The participants were mainly from reputed private laboratories, cement plants, govt. laboratories, public sector laboratories etc.

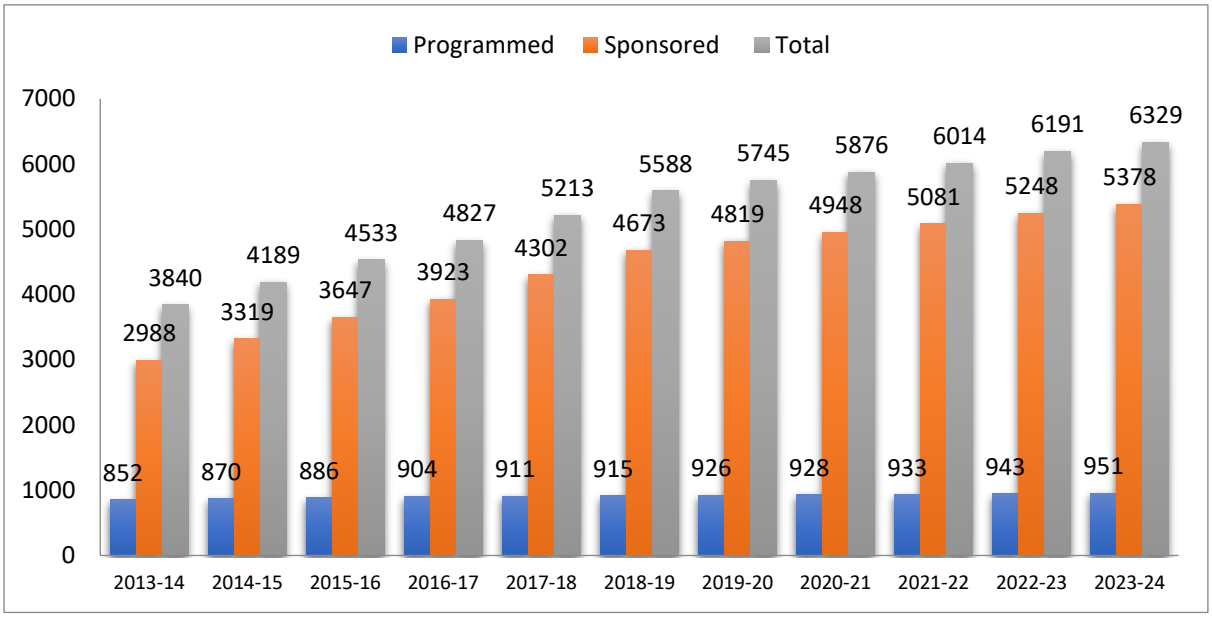
India wins bid to host 17th International Congress on the Chemistry of Cement in 2027. International Congress on the Chemistry of Cement is the largest and most prestigious event of its kind which reviews the progress of research in the area of Cement and Concrete. National Council for Cement and Building Materials (NCCBM) along with IIT Delhi and IIT Madras successfully presented the India's bid before the Steering Committee members of the ICCC during the 16th ICCC at Bangkok, Thailand.

Considering the training needs of the industry, NCB imported training programmes on cement, concrete and construction technologies. During the year 2023-24, 42 training programmes (offline/online) were successfully organized with a total of 636 participants attending the programmes.

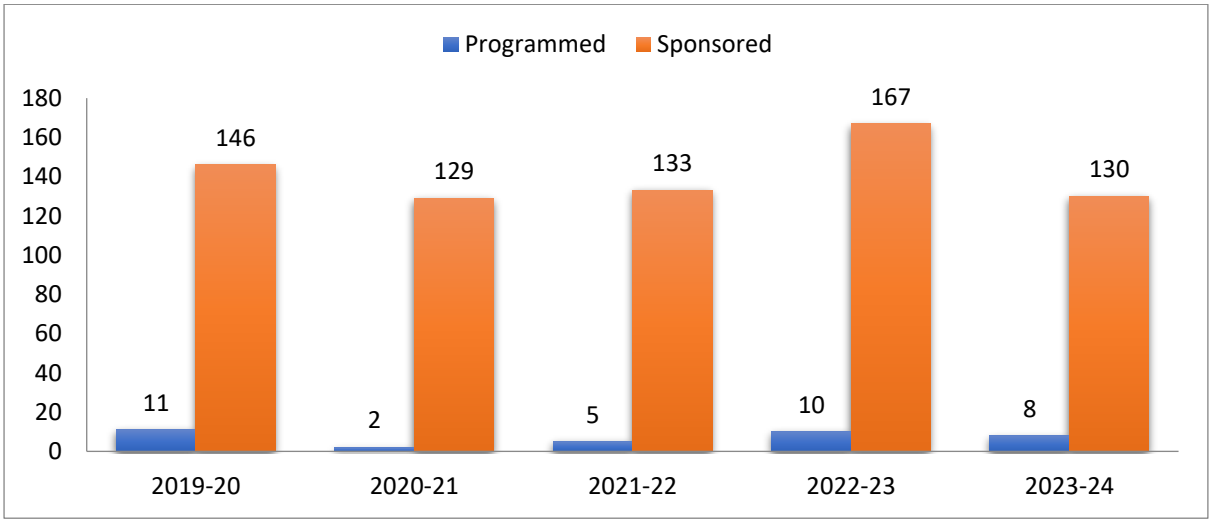
Framework of Institutional Efforts

The activities of the Council were carried out under the six Corporate Centres at NCB's Units/project offices, situated in Ballabgarh, Ahmedabad, Hyderabad and Bhubaneswar. While the infrastructure is physically distributed over these Units, all the Units are involved in the execution of projects or services as necessary following the matrix approach.

During the year, 08 R&D projects and 130 Sponsored projects were completed as listed in Appendices II and III respectively. The programmed projects carried forward along with the new ones taken-up, comprised the R&D Programme for 2023-24, as given in Appendix IV. The broad activities carried out by the six Corporate Centres are highlighted in the following sections.



Projects Completed by NCB (Cumulative)



Project Completed by NCB

NCB Ballabgarh

Centre for Cement Research and Independent Testing–(CRT)

The Centre executes its activities through six programmes viz. Cements and Other Binders, Wastes Utilization, Refractories and Ceramics, Fundamental and Basic Research and Independent Testing. During the year, 49 Sponsored Projects and 4 Programmed Projects were completed and 2 Programmed Projects were pursued.

Cements and Other Binders

Establishing Limestone Consumption Factor (LCF)

LCF studies are very important from the point of view of rationalization of limestone consumption in production of cement, estimating royalty payable to state for the limestone mined from their respective captive mines besides internal material audit of the concerned cement plants. NCB has carried out Limestone Consumption Factor (LCF) studies for cement plants from all over the country and so far, established the same for 275 cement plants. During the year, LCF studies were completed for 18 cement plants from Madhya Pradesh, Chattisgarh, Andhra Pradesh, Rajasthan, Tamil Nadu, Orissa and Karnataka.

Development of Plant specific secondary standards for XRF calibration

Accuracy of XRF depends on the standards used for calibration. Standard reference materials are used for this purpose. Secondary standard is a compound / chemical that has been standardized against a primary standard. Secondary standards are commonly used to calibrate analytical methods. Secondary standards are required as only limited no. of primary standards is available (one to four), range of the primary standards is not adequate, matrix and mineralogy may be different, evenly spaced samples across the calibration curve not achieved. NCB has taken up studies for development of plant specific secondary standard materials.

NCB develops plant specific secondary standards of cement raw materials and finished products. The study has been carried out so far for 22 cement plants covering 40 matrix. This year the study has been carried out for 6 cement plants from Karnataka, Rajasthan, Madhya Pradesh, Maharashtra and Andhra Pradesh.

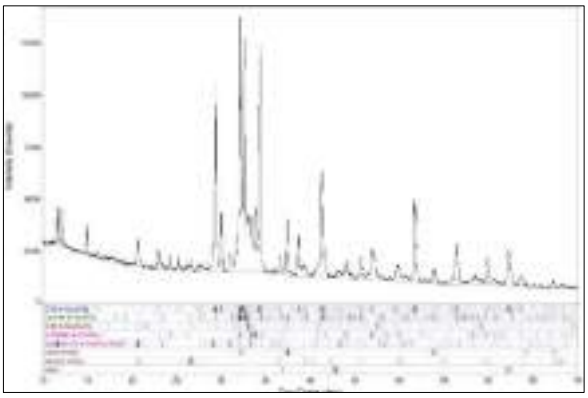
Validation of Lime Sludge Generated from Paper Industry in Cement Manufacture

Lime sludge (LS) waste is generated form pulp and paper industry during chemical recovery section of the paper industries. In this process, lime sludge produced during the conversion of green liquor into the white liquor through causticization reaction. The smelt (Na_2CO_3) of green liquor reacts with CaO to form NaOH, which is known as white liquor, and residue of the reaction ($CaCO_3$) precipitated in the form of lime sludge. Pulp and paper mill produces 1.63 tons of lime sludge per ton production of paper. The lime sludge generation in such large quantities puts the pulp and paper industries among most polluting industries. Approximately 4.5 million tons of sludge in total is generated annually. It is calculated that paper sludge generated from Indian paper industry is 5.0 MTPA. The chemical composition of LS sample showed that it

contains CaO, SiO_2, Fe_2O_3, Al_2O_3 along with alkalis and SO_3 content. MgO content in LS samples were less than 1% with no adverse effects. The iron oxide and alumina contents and the minor volatiles like (Na_2O, K_2O, Cl-, SO_3) were also less than 1% by weight in the samples.

Studies showed that the limesludge has potential application in cement manufacture as raw mix upto 30% LS as well as 5% performance improver for OPC preparation. This experiments result has concluded that compressive strength of mortars remains intact for 30% in cement manufacture and 5% replacement of cement by using raw lime sludge with no significant adverse effect in soundness and setting time. The lab experiment results clearly define that lime sludge can be used for cement manufacture, as a minor additive or performance improver for OPC manufacturing conforming to IS 269: 2015 [Ref Case Studies in Chemical and Environmental Engineering *Journal* ***(Elsevier)*** Vol. 9, June 2024, 100557]. So, the utilization of lime sludge of paper industry is recommended as replacement material of limestone for cement. This will also beneficial for reducing environmental wallop and subsequently contributing towards sustainable development and circular economy. The optimal micrograph of lime sludge and X-ray diffractogram of lab fired clinker with 30% limesludge is given below:

Figure (a): Optical micrograph of Lime sludge



b) XRD pattern of lab fired clinker using 30wt% lime sludge

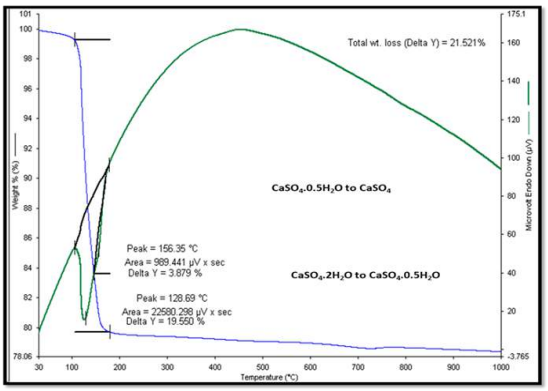
Investigation on Mineral Carbonation Mechanism of Various Industrial Waste and by products

This project aims at identifying various industrial waste/by-product having adequate quantity generation and having desired chemistry for mineral carbonation. Solid industrial waste/by-product which are generally alkaline, inorganic, and rich in Ca can applied as an additional feedstock for mineral carbonation. Accordingly, material such as various types of steel slag, C&D waste, phosphogypsum, FGD Gypsum etc. were utilized for mineral carbonation study.

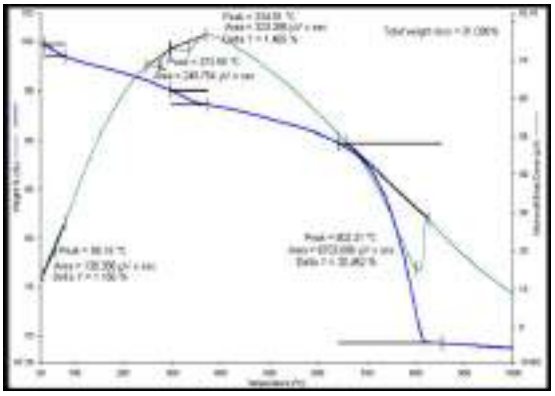
To achieve mineral carbonation, samples were kept in carbonation chamber for different time period and then the carbonated samples were analyzed chemically as well as mineralogically with different analytical techniques.

Mineral Carbonation through wet route (in slurry form) shows significant carbonation in different types of steel slag like EAF Slag, LD slag, AOD slag etc. both in neutral condition and alkali medium (1% NaOH).

FGD Gypsum and Phosphogypsum do not show any carbonation reaction in neutral and alkali medium (1% NaOH). However, addition of Ammonium Hydroxide Solution results in mineral carbonation reaction in FGD Gypsum and Phosphogypsum**.** The TG/DTA images of phosphogypsum (original or without mineral carbonation) and after mineral carbonation are given below:



Phosphogypsum (original)



Phosphogypsum (carbonated)

TG/DTA image showing original Phosphogypsum sample and carbonated Phosphogypsum sample

The study shows that mineralogy or the presence of different phases in the industrial waste/by-products play crucial role towards the Mineral Carbonation Reaction.

Development of Portland Dolomite Cement

The main objective of the study is to investigate the feasibility of using dolomite in development of Portland Dolomite Cement in order to formulate new Indian standard for its commercialization along with lowering in clinker factor in cement for environmental sustainability. To carry out the study, different Portland Dolomite Cement blends were prepared by inter-grinding of varying percentages of dolomite collected from different parts of the country with OPC clinker and gypsum. OPC and Portland Limestone Cement (PLC) blends were also prepared as control samples. The cement blends were prepared from raw materials of central, western, southern and north east region of the country and performance characterization were studied. The trend of compressive strength development showed enhancement in compressive strength of Portland Dolomite Cement at all ages with (1-5)% dolomite addition in comparison to Portland Limestone cement blends. At higher addition levels of upto 25% dolomite there is enhancement in compressive strength in comparison to Portland Limestone Cement blends. The 28 day compressive strength of PDC blends at varying clinker replacement levels is given below:

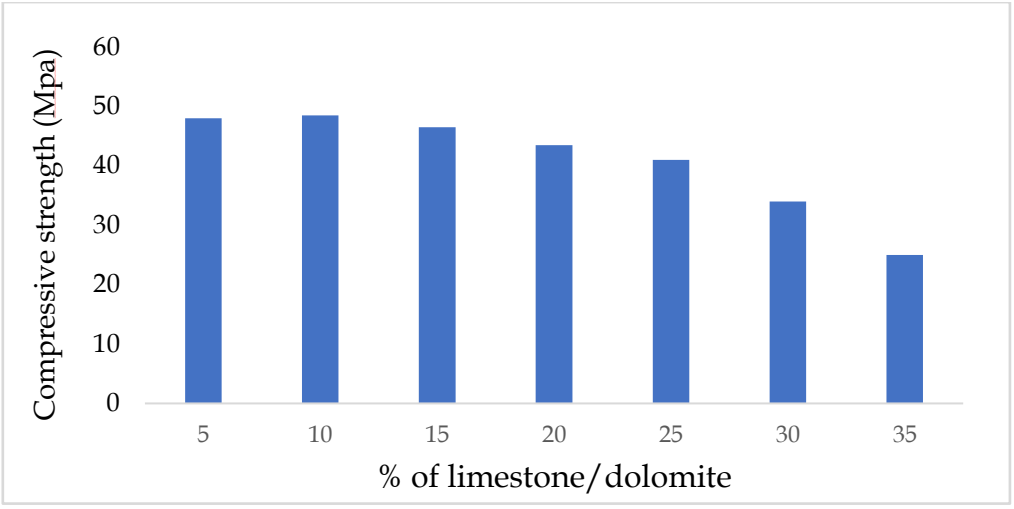


Fig 1. 28 day compressive strength of PDC blends at varying replacement levels

NCB, BIS & CMA joint visit to Sand Mines

A joint visit of NCB and BIS was arranged by M/s Tamil Nadu Minerals (TAMIN) Ltd, Chennai for assessment of new sand deposits for cement industry. A team of experts comprising of Sh Suresh Vanguri, Quality Manager and Ms Richa Mazumder, Geologist from NCB and Sh Jose Kurian, Chairman CED 02, BIS, Sh Babu convener, WG, BIS, Sh Arun Kumar, Dr A K Singh representatives from CMA, representatives from NCB, attended the meeting at Tamil Nadu Minerals Ltd, Chennai and also visited the sites at Mudaliar Kuppam (existing and proposed) and Vada-Agaram on 23 March 2023 and Neyveli Lignite Corporation's Sand Mines on 24 March 2023 towards ascertaining the availability and quality of sand and suitability as per IS 650 as well as IS 383. The pictures of joint discussion of officials at Mudalliarkuppam and Nayveli sand mines is given below:

Joint discussion of officials in the Mudalliarkuppam and Nayveli Sand Mines, Tamil Nadu

Technical Suitability of utilization of copper slag in manufacture of cement

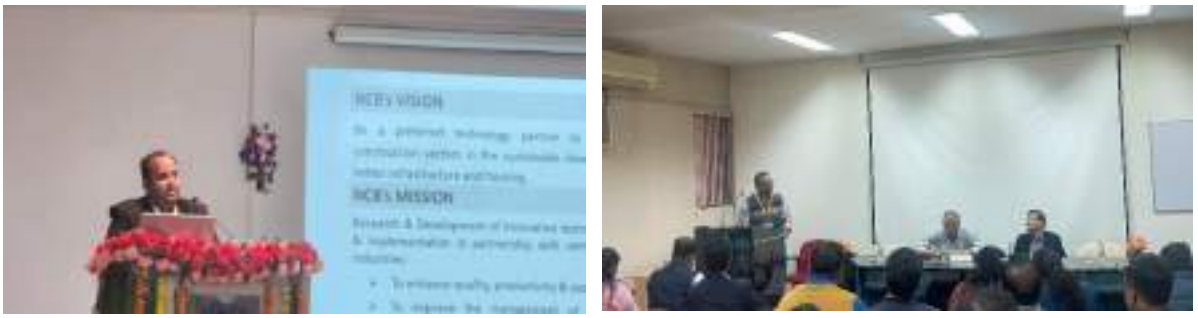
In this project copper slag samples were provided by M/s Adani enterprieses, to study its technical suitability for utilization in manufacture of cement. Detailed chemical, mechanical, physical, mineralogical and microstructural studies were performed on the received samples of copper slag. Chemico-mineralogical analysis showed that the copper samples contained majorly (90%) iron silicates. Heavy element analysisi by ICP-MS depicted that elements like arsenic, mercury, cadmium, nickel,

chromium, vanadium and strontium etc. were present in traces. The grindability index results depicted that the samples were hard in nature. The diffractogarm depicted major hump corresponding to the amorphous content along with crystalline phases of fayalite and magnesioferrite and it also conforms to the requirement of the slag activity index (SAI) as per relevant code. The glass content determined with optical micrograph was very less. Studies on performance characteristics of cement with copper slag samples are underway

BARC and UCIL jointly organized theme meeting

A team consisting of Dr. Toney Moses Rajan and Sh. Suresh Vanguri, both members of the NCB, conducted a visit to the Jaduguda uranium mines in Jharkhand from 3rd to 6th December, 2023. The team was present at a theme meeting hosted jointly by BARC (Bhabha Atomic Research Centre) and UCIL (Uranium Corporation of India Ltd) in Jaduguda, Jharkhand. The Jaduguda mines hold the distinction of being India's first uranium mines. The mines aim to find a solution for the 7500 tons of tailings they generate. UCIL has comparable establishments in multiple states, including Karnataka, Rajasthan, Telangana, etc. Dr. Rajan introduced a proposal for an innovative utilization of mine tailings in cement and building materials, which garnered appreciation from BARC and UCIL. Both organizations have expressed interest in collaborating with NCB on this significant socioeconomic initiative.

The collaborative efforts of BARC-UCIL and NCB have commenced a phased project that aims to utilize tailing waste in the cement manufacturing process. The project requires the presence of an authorized individual to visit a strategically significant site with a uranium deposit and retrieve the necessary milling material for the production of cementitious materials, in accordance with national priorities. The project has commenced and authorities are carrying out research. The pictures of CRT officials attending BARC-UCIL theme meetings is given below:



Dr Rajan and Sh. S. Vanguri attending the theme meeting and briefing about the possibility of utilizing tailing materials.

Utilization of chrome sludge in cement manufacturing

Chrome sludge is a hazardous waste generated by industries producing chromium based chemicals. Studies included chemico-mineralogical evaluation of chrome sludge along with other conventional raw materials. Leachability studies of chrome sludge as per TCLP was also carried out. Preliminary investigations were performed for suitability of hazardous waste for co-processing as per CPCB guidelines 2017. Raw mix design studies using the byproducts of the chromium industry revealed that

development of clinker phases in terms of granulometry, distribution and quantity in the clinker samples prepared from raw mixes with chrome sludge up to 3.0% was found to be comparable with that of control clinker sample at temperatures of 1400 & 1450 ^{o}C.. OPC prepared from the bulk clinker met all the requirements of OPC 53 Grade, as per IS 269-2015.

Participation in the G20 India Presidency

Discussions during the G 20 India Presidency Meeting, Mumbai

Dr S K Chaturvedi, HOC-CRT, was invited to participate in the session on "Sharing global policies and best practices to decarbonize "Hard to Abate" sectors" during the 3rd G20 Energy Transition Working Group Meeting in Jio World Convention Centre, Mumbai on 16th May. Dr Chaturvedi deliberated on the most challenging aspects of industry transition and examining issues such as policy alignment and formulation, technology collaboration, finance mobilization, capacity and skill development and various aspevts of industrial decarbonisation. He also focused on cooperation between industrial sectors of G 20 nations for net zero future.

16th International Congress on Chemistry of Cement, Bangkok, Thailand

The 16th ICCC was held in Bangkok, Thailand from 18 to 22 September 2023 with the theme of futher reduction of CO_2 emission and circularity in cement and concere industry. Dr L P Singh, DG, NCB and Dr S K Chaturevedi, HOC-CRT attended 16th ICCC from NCB.

Felicitation for winning the bid to host ICCC 2027 by India

During the conference, NCB along with IIT Delhi presented India's bid to host the 17th ICCC 2027 before the Steering Committee members of ICCC. Besides India, other bidders were from Switzerland and UAE. The Indian bid was presented by Dr L P Singh, Director General, NCCBM, Dr S K Chaturvedi, Joint Director, NCCBM and Dr Shashank Bishnoi, Professor (Civil Engg.), IIT Delhi. India has won the bid to host the

prestigious International Congress on the Chemistry of Cement (ICCC) at New Delhi in October 2027

National conference on Strategic Solutions & Opportunities for Cement Industry

Sh Suresh Vanguri and Dr Varsha Liju presented technical deliberations on the topics of "Current R & D on blended cements" and "Use of alternate materials for clinker production" respectively in the National conference on "Strategic Solutions & Opportunities for Cement Industry" jointly organised by NCB & IIT-Hyderabad on 24-25 August 2023 at NCB-Hyderabad. The Chief Guest of the occasion was Sh Sunil Sharma, IAS, Spl. Chief Secretary (Energy), Govt. of Telangana and Guest of honour was Sh Krishna Aditya Sriramsetti, IAS, Member Secretary, TSPCB. The National Conference and technical exhibition were inaugurated by the chief guest, guest of honour, Prof KVL Subramaniam, IIT-Hyderabad, Dr L P Singh, Director General-NCB, Dr S K Chaturvedi, Joint Director NCB and Dr B Pandu Ranga Rao, Joint Director & Unit In Charge, NCB Hyd. The presentation was followed by various queries and active discussion on the topic.

Presentation during the NCB-IIT joint National Conference, Hyderabad

International Training on X-ray Diffractometer

A 10-day training on X-ray diffractometer was organized by Rigaku Corporation Limited, Tokyo, Japan. A two-member team consisting of Sh Suresh Vanguri & Sh Gaurav Bhatnagar visited the training facility Centre of Rigaku at Tokyo from Oct 14 2023 to Oct 29, 2023. The training was co-ordinated by Akira Hachihama and imparted by Mr Miki Kasari. Introduction to powder X-Ray diffraction & Instrumentation, methodology of sample preparation of different matrices, operating procedures of XRD software (SMARTLAB Studio II), Search/ Match strategies & peak identification for quantitative phase analysis were discussed. Experiments with optimization of different measuring conditions viz. scan speed, step size, scan rate, incident slit size were performed with & without knife edge & filters. Impact of

XRD trainers with NCB official in Rigaku, Japan

optimizing the said parameters on XRD results was also discussed. A hands-on training session was organized on sample preparation, equipment handling & software operations and working with different libraries such as ICDD, PDF 4+ and the Rigaku database for cement phase identification.

FSAET 2023

The 4th International Conference on Futuristic and Sustainable Aspects in Engineering and Technology (FSAET) 2023 was held in GLA University, Mathura from 28th -30th Nov 2023. Dr S K Chaturvedi, HOC-CRT, was invited as the keynote speaker of the conference and a pertsentation on Sustainable and Futuristic Aspects in Engineering and Technology was delivered by him. The conference was attended by students and faculty member.

Falicitation of Dr S K Chaturvedi for delivering the keynote lecture in GLA, Mathura

Independent Testing

Independent Testing Laboratories of NCB undertake complete physical, chemical, mineralogical, micro-structural thermal analysis of various types of raw materials, cement, clinker, pozzolana, aggregate, concrete, admixtures, water, refractory, bricks, coal, lignite etc. as per National and International standards. These labs also perform testing of internal samples for CRM and BND preparation, PT sample preparation and R&D/ SP projects.

The INT laboratories established in 1977 on a Test House pattern, undertake testing jobs for cement, construction, and allied industries. NCB testing laboratories achieved a landmark when NABL accredited them in the year 1997 as per ISO 17025 quality system that is continued since then. These labs are also recognized by BIS for testing of 19 cement and related products. The laboratories are equipped with state-of-art instruments and trained competent staff to carry out the testing activities as per National and some International standards. This year the NABL accreditation audit was conducted successfully between 7th to 14th Feb 2024 and the ISO/IEC 17025-2017 certificate of accreditation was awarded to NCB. During the year, assignments were carried out for samples from neighboring countries also. The number of samples tested during the period was 6923

Centre for Mining, Environment, Plant Engineering & Operation–(CME)

Centre for Mining, Environment, Plant Engineering and Operation carried out its activities through six Programmes viz. Process Optimization and Productivity; Energy Management; Project Engineering and System Design; Environment Sustainability & Climate Change; Advanced Fuel Technology, Geology, Mining & Raw Materials and Quality Assurance Group and completed 36 sponsored projects along with 2 R&D projects during the year.

Process Optimization and Productivity (PRP)

- **NCB provided project management consultancy services for installation of tyre chips to M/s Oman Cement company SAOG, Sultanate of Oman.**

  The activities under this project in this financial year are given below

  - Review and approval of Design Engineering of the system
  - Review and approval of Civil drawings
  - Review and approval of Mechanical drawings
  - Review and approval of Electrical & instrumentation drawings
  - Review and approval of process flowsheets and Technical specifications
  - Conducting Project review meeting with contractor and customer
  - Approval of Detailed drawings
  - Inspection of Civil Works and Local Fabrication
  - Inspection of Erection and Commissioning of Mechanical Erection, Installation of electrical, control, instrumentation & automation systems

- **Heat balance & energy consumption optimization in cement kilns for M/s Kesoram Industries Ltd., Telengana and Karnataka**

  - Heat Balance study of Kiln by assessing the thermal performance of kiln system.
  - Formed recommendations for improving thermal energy performance of the kiln system.

- **Heat balance & energy consumption optimization in cement kilns for M/s Kesoram Industries Ltd., unit - Vassvadatta Cement, Sedam, Karnataka**

  - Heat Balance study of Kiln by assessing the thermal performance of kiln system.
  - Formed recommendations for improving thermal energy performance of the kiln system.

- **Diagnostic Study on Corrosion of Various Ducts and Chimneys of Line-1 and Line-2 of M/s KCP, Muktyala Cement Plant, Andhra Pradesh**

  The activities involved are:

- Assessment of raw materials and fuels being used in the corrosion affected circuits (Pre-heater downcomer, Coal Mill & Kiln Bag House).
- Study the data on the quality of raw materials, kiln feed, bag house dust and fuel as fired.
- Analysis of the water samples (used in the circuit & samples collected from the coal mill stack & bag house stack) and chimney flakes.
- Collection of relevant samples (raw materials, fuels, kiln bag house dust, kiln feed etc) for laboratory investigations.
- Measurements of process parameters like temperature, draft and gas composition (O_2, CO, SO_2, NOx etc.) at various locations (pre-heater downcomer, coal mill stack, across kiln bag house, kiln stack)
- Measurement of moisture in flue gases at various points in circuit related with chimney operation.
- Assessment of existing practices in operating/process conditions in the corrosion affected circuits.

➢ **Capacity assessment for M/s Goldstone Cements Limited, Meghalaya**

- Plant has approached NCB for assessment of plant production capacity of grinding unit in order to submit the report to state government for claiming transport subsidy applicable as per the North East policy.
- During this study, NCB collected the historical data of production, process, quality and Breakdown analysis of the equipment installed.
- NCB inspected the plant to verify the current operational data and potential capacity of the installed equipment.

Consultancy services for installation of tyre chips for M/s Oman Cement Company, Oman

Measurements of process parameters at M/S KCP, Muktyala Cement Plant, Andhra Pradesh

ENERGY MANAGEMENT (EMG)

1. Sponsored Projects Completed during the F.Y. 2023-24:

Project Title	Sponsor
Mandatory Energy Audit	M/s Ultratech Cement Ltd-Baga Cement Works, Himachal Pradesh

Mandatory Energy Audit	M/s Ultratech Cement Ltd-Manikgarh Cement Works Unit-I, Chandrapur (MH)
Mandatory Energy Audit	M/s Ultratech Cement Ltd-Manikgarh Cement Works Unit-II, Chandrapur (MH)
Mandatory Energy Audit	M/s Ultratech Cement Ltd-Bara Cement Works, Khan Semra (UP)
Mandatory Energy Audit	M/s Ultratech Cement Ltd - Ginigera cement Works, Karnataka
Mandatory Energy Audit	M/s Ultratech Cement Ltd – Dankuni Cement Works, West Bengal
Mandatory Energy Audit	M/s Ultratech Cement Ltd – Dhar Cement Works (MP)
Mandatory Energy Audit	M/s Birla White cement, Kharia Khnagar (RJ)

2. Sponsored Projects Continued in F.Y. 2023-24:

Project Title	Sponsor
Mandatory Energy Audit	M/s Saurashtra Cement Ltd, Veraval (GJ)
Mandatory Energy Audit	M/s Saurashtra Cement Ltd, Sidheegram (GJ)

Project Engineering & System Design (PSD)

1. Sponsored Projects

- **Project Management Consultancy services for installation of 600 tpd Green Field Cement Plant Project at the Republic of Congo**

NCB is working as a Project Management Consultant (PMC) to the Government of the Republic of Congo for monitoring and controlling the project implementation activities and providing the support for project supervision. Package-I (Mine development & Mining Equipment Supply) is completed successfully in first week of November 2023 and taken over by Contractor for of Package-II and activities for Package-II (Engineering, Construction and Supply of Machineries for setting up the cement plant at Louvakou district, Department of NIARI, Republic of Congo are going on.

Cement plant erection team along with NCCBM officials at the Republic of Congo

- **Site Deputation/Site visits of engineers of NCCBM for project monitoring and Control for setting up a 600 tpd green field cement plant on a turnkey basis at Tao Tao, RoC" at M/s The Government of the Republic of Congo.**

  To effectively monitor the progress of Package-II (Engineering, Construction and Supply of Machineries for setting up the cement plant at Louvakou district, Department of NIARI, Republic of Congo), the program has deputed one mechanical engineer at site from November 2023 onwards.

- **Technical study for installation of multichannel burner for Malabar Cement Ltd. Kerala**

  M/s Malabar Cements Ltd. has awarded a project to the program to carry out the technical feasibility of installing a new multi-channel burner in their cement plant at Walayar.

- **Preparation of Marketing Report for utilization of Flue Gas Desulphurization (FGD) Gypsum of power plants in VSR region for NTPC Ltd.**

  The program has successfully completed the report covering the outcome of visits in the Vindhyachal, Singrauli and Rihand region to estimate the potential of sale/ utilization of Flue Gas Desulphurization (FGD) Gypsum from the units of NTPC in the VSR region. Specific purpose of this report is to provide an overview of the various gypsum specific consumer sectors that have been identified during the study.

- **System design audit for existing pond ash handling system from loading to final usage in plants at Ras & Beawar for M/s Shree Cement Ltd.**

  The program has successfully completed the project covering audit findings and recommendations in the system for the existing pond ash handling system for the plants.

List of Completed Projects during the F.Y. 2023-24: Sponsored Projects: 2 (*two*)

List of Ongoing Sponsored Projects during the F.Y. 2023-24: 03 (*Three*)

Project no	Project Title	Sponsor
4249	PMC for setting up a 600 tpd cement plant in RoC for Government of RoC.	The Government of the Republic of Congo
6607	Site Deputation/Site visits of engineers of NCCBM for project monitoring and Control for setting up a 600 tpd green field cement plant on a turnkey basis at	The Government of the Republic of Congo

	Tao Tao, RoC" at M/s The Government of the Republic of Congo.	
6608	Technical study for installation of multichannel burner for Malabar Cement Ltd. Kerala	M/s Malabar Cements Ltd.

2. R&D Projects

- **Design and Development of Transfer Chute to handle Alternate Fuels and their mix in Indian Cement Plants**

  To resolve one of the major system design related issue (transfer chute jamming) while handling multiple types of alternative fuels in Indian cement plant, NCB started working on a R&D project for design and development of the transfer chute and successfully developed the design parameters for transfer chute to prevent the chute jamming and a flexible arrangement for cleaning the chute incase if it gets jammed. Project is successfully completed and outcome was presented in front of Indian Cement Industry during Research Advisory Committee meeting. The validation of developed transfer chute was carried out on working setup installed at NCB Ballabgarh by operating the chute with 19 types alternative fuels and their mix.

Experimental setup at NCB Ballabgarh

Validation of Transfer Chute Design Parameters

Advanced Fuel Technology (AFT)

R&D Projects

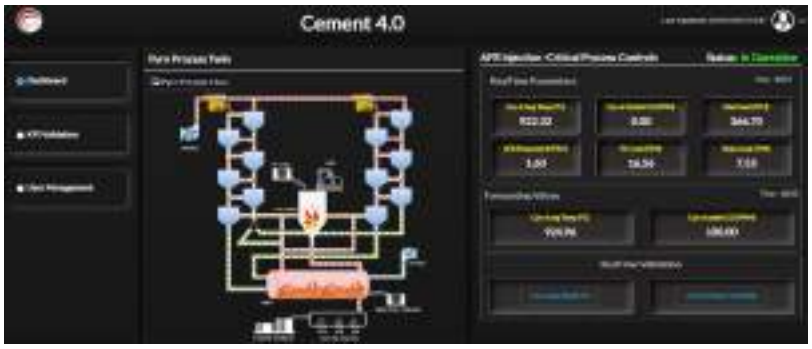
Improvement in clinker quality and increase in % TSR by the application of artificial intelligence (AFT-01)

NCB took up a R&D project in 2022 to apply artificial intelligence in Indian cement industry. A tripartite agreement was signed with M/s LivNSense Technologies Pvt. Ltd. and M/s J K Lakshmi Cement to develop forecasting models to enhance TSR through liquid alternative fuel in the cement plant. JKLC is using 1-2 m^3/hr of liquid hazardous waste from different sources and looking to enhance its utilization by 20-25%. The objective is to forecast the average cyclone 6 temperature (old & new) & new cyclone 6 outlet CO at every 5 min interval which will support CCR operator to increase the liquid AF flow rate.

Accordingly, historical kiln and quality data was collected on kiln operation for Line-2. A prediction model was developed in which data cleaning and feature engineering was done to select the features that are mostly correlated to TSR. Various supervised machine learning techniques were used to forecast the process parameters to assist CCR operator. Main coal tph, kiln feed, Ph fan rpm, kiln speed, PC coal tph are some of the key identified input parameters for model development.

The forecasting model was developed and validated with real time data. The accuracy of developed model for temperature forecasting with 5 minutes' interval is 95%. The achieved accuracy is more than the requirement (>80%) of tripartite agreement for real time prediction. However, for outliers i.e. 5% values above +/- 9 deg C, the Accuracy with 5 minutes' interval is around 50%.

A recommendation engine has also been developed which forecasts the AF quantity and other process parameters. The model shall assist the CCR operator to do the necessary process changes (to take action immediately by changing the temperature set point within the PID loop) and ultimately support in decreasing the variations in process parameters and increased % TSR. A dashboard was developed for the forecasting model and deployed in plant CCR for continuous monitoring.



Dashboard for forecasting model

ENVIRONMENT SUSTAINABILITY & CLIMATE CHANGE (ESC)

- **Life Cycle Assessment (LCA) Study of Cement, GHG Assessment and Water Footprint Assessment**

  Life cycle assessment of five different cement products of a cement plant was undertaken. The impacts were calculated in terms of Global Warming Potential, Acidification Potential, Eutrophication Potential and Abiotic depletion potential. GHG assessment was carried out for four years covering Scope I and Scope II emissions. Water Footprint Assessment carried out for five years based on the data provided by the plant and verification of the data during plant visit.

- **Measurement of Return Dust**

  To measure the efficiency of Top Cyclones of Pre-heater, the return dust measurements were carried out at two cement plants. Under these studies, the dust concentration is measured in the pre-heater downcomer and the efficiency of Top Cyclone is calculated using the dust load and kiln feed rate.

QUALITY ASSURANCE GROUP (Electrical & Mechanical)

List of Ongoing Sponsored Projects in FY 2023-24

S. No.	Sponsored Project Title
1.	TPQA of replacement of Conventional luminaries with LED Luminaries in EDMC
2.	C/o Indian International Convention Centre.
3.	Redevelopment of International Exhibition cum Convention Center (IECC) at Pragati Maidan
4.	Implementation of LED lighting works in Vidisha cluster (M.P)
5.	Pre-Dispatch Inspection of Laboratory Equipment at Manufacturer/Seller premises
6.	D/o Land at Sector G-7/G-8, Narela Sub city.SH- Design Supply installation and construction including operation of integrated packaged type sewage treatment plant (totaling 7.87 MLD Capacity) on MBBR Based technology STP in Pocket 5,6 and 7 of Sector G-7/G-8, Narela Complete on turnkey basis
7.	Comprehensive operation and maintenance contract of 2 Nos. super sucker units in the jurisdiction of North DMC for further 3 months.
8.	SITC of Electrical Pumps along with E&M allied works at storm water pump house at Pocket-03, Bindapur, Dwarka with operation & maintenance under SDMC.
9.	Construction of 20 Nos Class rooms, 1 office, 1 computer rooms, 1 sports room and toilets blocks for (Boys and Girls on each floor) in M.C. Pry. School E-4 J.J Colony Bawana in ward no. 30 after demolishing of Existing structure in Narela zone. Sub Head: P/o EI and other allied works
10.	Construction of 12 Nos Class rooms, 2 Nursery room, 3 offices, 2 computer rooms, 1 science room, 1 sports room and toilets blocks for (Boys and Girls on each floor) in M.C. Pry. School B-2 J.J Colony Bawana in ward no. 30 after demolishing of Existing structure in Narela zone. Sub Head: P/o EI and other allied works
11.	SITC work of existing fixed type towers (unserviceable) with new HM towers (07 nos.) 20mtr. Height along with the provision of 250 watt LED flood light fittings 9 nos. in HM towers at DTC Dichau Kalan Depot, BBM Depot, Shadi Pur Depot and Wazir Pur Depot.
12.	Construction of permanent Administrative Block Building at DTC Hasanpur Depot.
13.	Construction of permanent Administrative block building at Rohini Depot-III.
14.	Renovation /Up-gradation and dismantling work of existing old unserviceable electrical installation at DTC CWS- I for creation new Bus Depot

15.	Construction of Permanent Administrative Block Building at DTC Gazipur Depot. Sub Head Electrification and firefighting works of New Admin Building at DTC Gazipur Depot.
16.	SITC of Pumpsets and allied equipments at Ghumanhera Pumping station under Najafgarh Zone,MCD
17.	SITC of Pumpsets and allied equipments at Dariyapur Pumping station under Najafgarh Zone,MCD
18.	Construction of 9 nos. class room, 2 nos. rooms 1nos. Hall (Equivalent to 02 rooms) and an 8 nos. Toilet block on MC pry. School at Vishnu Garden in Ward no. 007 in west zone (Part B: Dismantling of existing old structure. Part C: P/o EI fans and compound lighting. Part D: Fire-fighting work and Part E: Grid tied rooftop Solar Power Plant)
19.	Construction of new academic block for chemistry department including internal E1, HVAC, firefighting, electrical substation, DG set, lift installations & development works on EPC basis at IIT Roorkee
20.	Construction of 572 seater student EWS hostel (Phase-1) including internal E-1, HVAC, firefighting, electrical substation, DG set, lift installation & development works on EPC basis at Vigyan Kunj, IIT Roorkee
21.	Construction of western academic block building at IIT Roorkee
22.	Redevelopment of General Pool Residential colony at Kasturba Nagar New Delhi (Phase-I) - Construction of 1206 nos. Type-II, 1200 nos. Type-III including Two Level Basement, podium parking and social Facilities including all development works
23.	Construction of 24 Nos Type-V Qrs (G+6) i/c Water Supply, Sanitary Installation & Electrical work at IARI Pusa Complex New Delhi
24.	C/o Delhi Cycle Walkway Phase-I, C/o on Grade Cycle walk of Neelgai line
25.	Construction of Girls Hostel of 500 Capacity & Food Court including water supply, sanitary installation, internal electrical installation, Fire Fighting System, Fire Alarm system, Lifts, CCTV, Access control system and solar PV system at IARI Pusa, New Delhi.
26.	Redevelopment of general pool Residential Colony at Srinivaspuri Newc Delhi
27.	C/o New Building Nigam Pratibha Vidyalay at GTB Nagar in C-14N/CLZ.
28.	Construction and providing and laying of sewerage lines chambers 1mld sewerage treatment plant in the campus of LUVAS Hisar
29.	Construction and providing estate water supply sewerage arrangements in LUVAS at Hisar

30.	Contruction of two nos. hostel boys and girls at new campus LUVAS Hisar
31.	Construction of 5 nos. of residential block of 20 nos. flat in each block at new campus of LUVAS Hisar
32.	Const. of multi storey office building at Shahdara SZ office complex at Karkardooma Institutional area, Delhi
33.	TPQA for the Integrated Transit Corridor Development plan in and Pragati Maidan
34.	Redevelopment of International Exhibition cum convention center at Pragati maidan
35.	TPQA of EWS,2BHK Housing in sector 14 Dwarka
36.	C/O Indian International Convention Centre, Dwarka
37.	Construction of Veterinary & Animal Sciences,Hissar
38.	Construction of VC & Admin block,Hissar
39.	Making Good the Street light deficiency of Community Centre, KP Block, Pitampura under KPZ. Sub Head: Improvement of Street lighting arrangement of Community Centre, KP Block, Pitampura under KPZ
40.	Provision of street light poles with LED lights at various locations in ward no. 65S under south Zone
41.	Providing and fixing of 5 mtr long GI Octagonal poles and 12 mtr long semi High Mast pole along with LED Light fitting and allied accessories in various Co-operative Group Housing Societies, parks and other Dark Spots in ward no. 20-S Vikas puri under West zone.
42.	Renovation/up-gradation work of electrical installation of DTC Central workshop-II for creation of new DTC depot
43.	Renovation work of existing tower light fitting and flood/ Street light fitting installed in the various unit of DTC depot
44.	Provision of Street Light Poles with LED lights in Shaheed Bhagat Singh Park, Park near Shivpuri Kallad, municipal park Shivpuri Khasra no 224 and some different locations in Sagarpur west, ward no 31 S under Najafgarh zone.
45.	Construction of Hostel Block for Boys and Girls in Medical college at Hindu Rao Hospital in C-280 CLZ. Sub Head: P/o Sub-station, bus riser, LT panels, Earthing, Lighting conductor and External Lighting (part 2 and 3)
46.	Provision of CNG based Crematoria Qty. 03 nos. at Punjabi Bagh and Qty. 01 no. at Sarai Kale Khan Cremation Grounds with 05 year of operation Comprehensive maintenance support.

47.	A/R and M/O of Lifts in Hindu Rao Hospital. Sub Head: Annual Contract for operation of lifts for the period of one year
48.	Repair, Comprehensive, Maintenance of Fire hydrant system installed in OPD, Emergency, Nursing Home, Ward and Adm. Block etc. at Hindu Rao Hospital.
49.	Establishment of CNG based cremation units at Ghazipur, Shahdara South Zone." Subhead: Tender for Design, Supply, Installation, Testing, Commissioning and maintenance of Compressed Natural Gas (C.N.G.) based Cremation units
50.	Supply, Installation, Testing and Commissioning with post Commissioning 05 years Operation & Comprehensive maintenance of Electric furnace at Sarai kale khan Cremation Ground in ward no. 56-S under CNZ.
51.	Improvement of fire fighting and detection system installed at Kasturba Hospital under CSPZ Ward No.85.
52.	TPQA for Administrative cum Academic block at RBIPMT in C 281/CLZ/ Sub Head: SITC of Fire alarm and fire detection system
53.	P/o Fire Fighting arrangement in EDMC Primary Schools Sabhapur Gujran, Ankur Enclave, Rajeev Nagar (Urdu), Biharipur, Mustafabad, Mansarovar Park, Jagatpuri, East Rohtash Nagar and Seelampur Hindi in ward No. 61-E, 62-E and 64-E and 58-E, 38-e, 37-e and 39-E under Shahdara (North) Zone.
54.	Construction of administrative- cum- academic block at RBIPMT HOSPITAL Sub Head: SITC Of Air Conditioning System
55.	Annual Comprehensive operation and maintenance contract of MEP equipments at Multilevel underground parking at J-8 Rajouri Garden under West Zone
56.	P/o Fire-fighting system in M.C. Pry. School Asalatpur, B-2 Raghubir Nagar Chanchal park , D-1/A Janakpuri , Hari Nagar Ghanta Ghar, JJ Hastsal no. 02 Nangal Raya New JJ Hastsal No. 01,Razapur Khurd no. 02,03,04 Shivaji park T.C. Camp Raghubir Nagar and Uttam Nagar old under West Zone.
57.	Annual Contract for operation of lift at 250 ward and Casualty block at Hindu Rao Hospital for the period 2019-2020.
58.	Construction of administrative- cum- academic block at RBIPMT Hospital Sub Head: SITC of Fire Fighting System.
59.	Fire Alarm & PA system @ Balakram Hospital
60.	Survey, Design, Supply, Installation, Testing & Commissioning with post commissioning 5 years operation and comprehensive maintenance of one Biogas Electricity Generating System for a capacity of 05 tonnes per day

	(TPD) Bio-degradable Waste at 'Waste to Wonder', Millennium Park, Sarai Kale Khan, New Delhi Central Zone under SDMC.
61.	Construction of 200 Bedded Balak Ram Hospital Ward Block at Timar Pur, New Delhi. Sub Head:- S.I.T.C of Fan and Fittings

Centre for Construction Development and Research-(CDR)

Centre for Construction Development and Research (CDR) is contributing immensely in the development of durable and sustainable civil infrastructure for the nation. The Centre provides services to the cement, concrete and construction sector through four programs namely Concrete Technology (CON), Structural Optimization and Design (SOD), Structural Assessment and Rehabilitation (SAR), Construction Technology and Management (CTM). The centre has start-of-the-art facilities for mechanical, physical and durability testing of concrete making materials and Non -destructive testing through advanced equipment. The Centre completed 45 sponsored projects during the year.

CONCRETE TECHNOLOGY (CON)

A. Material Evaluation and Concrete Mix Designs

Characterization of physical and chemical properties of concrete making materials, i.e., cement, fly ash, silica fume, GGBS, water, fine and coarse aggregates and chemical admixtures are essential for determination of their suitability for making concrete along with relative proportion with the objective of producing an economical concrete of required strength, durability and workability. Various government/semi government/private organizations like NTPC and its subsidiaries, NHPC and its subsidiaries, NBCC, CPWD, BHEL, SJVN ITD Cementation, UJVN Limited, L&T Limited, Kalika group Nepal, song da corporation Vietnam, BG Shirke and other private agencies approached NCB to study the performance of different concrete making materials and to provide recommendations for the required grade of concrete ranging from M10 to as high as M50. During the period of 2023-24, more than 12 sponsored projects of material characterization and about 41 mix designs were completed.

B. Concrete Mix Design for Special Application

- **Design of Self-Compacting Concrete**

  Self-Compacting Concrete (SCC) of grades M45 to M50 were designed by NCB for Central-Vista Project (client CPWD) and SSB Residential Colony Project (Client - CPWD, Faridabad) during the period of 2023-24.

- **Pavement Quality Concrete**

  Pavement Quality Concrete of Grade M35 & M40 was designed by NCB for PVUN Ltd. & L&T Ltd. during the period 2023-2024

- **Design of Roller Compacted Concrete**

  Design of Roller Compacted Concrete is in progress using Portland Composite Cement for NHPC Dibang during the period of 2023-24.

- **Design of Dry Lean Concrete**

  Dry Lean Concrete (DLC) was designed by NCB for BHEL, CPWD during the period of 2023-2024.

C. Alkali Aggregate Reaction (AAR) studies on aggregates

Alkali-silica reaction (ASR) in concrete structures is a major concern for the construction industry. It is one of the leading causes of deterioration in concrete structures, second only to reinforcement corrosion. Aggregates that are susceptible to ASR contain reactive silica. When these aggregates come into contact with alkali in the concrete, hydrophilic alkali-silica gel, known as ASR gel, is formed. The ASR gel itself does not cause cracking, but when it comes into contact with water, it has the potential to swell, exerting pressure greater than the concrete can withstand, leading to cracks in the concrete. ASR is a chemical reaction between the alkalis in Portland cement and certain siliceous aggregates, resulting in the formation of a silica gel. It is well known that the alkalis in Portland cement react with silica found in certain types of aggregates. NCB has developed expertise in evaluating aggregates for potential alkali aggregate reaction, including both alkali silica reaction and alkali carbonate reaction.

The following tests are carried out to evaluate the potential Alkali Aggregate Reactivity of aggregates:

- Petrographic and Mineralogical Analysis as per IS: 2386 Part VIII.
- Accelerated Mortar Bar Test as per ASTM C1260.
- Mortar bar test as per IS: 2386 Part VII.
- Prism Bar Test as per ASTM C 1293

During 2023-2024, about 18 number of coarse and fine aggregate samples were evaluated for petrographic and mineralogical analysis as per IS: 2386 Part VIII, accelerated mortar bar test as per ASTM C1260 and mortar bar test as per IS: 2386 Part VII for various prestigious clients like NTPC, CPWD, BHEL, UVNL, NHPC Ltd, L&T Ltd, during the period of 2023-24.

D. Evaluation of Integral Crystalline Waterproofing compound

Integral crystalline waterproofing is a technology that involves the development of crystals to achieve watertight concrete structures. The basic idea behind crystalline waterproofing is to prevent the movement of water through the concrete by plugging or blocking the natural pores, capillaries, and micro-cracks found in concrete. Over the last 8-9 years, the NCB, with the help of its expert scientists and engineers, has developed core competency in the performance evaluation of integral crystalline waterproofing compounds. The NCB has also developed methodology for the assessment of integral crystalline waterproofing compounds and their performance in concrete as well as mortar. This includes various testing techniques and methods as per various Indian and international standards. The center has testing facilities to evaluate their performance in terms of the following parameters.

- Resistance against water penetration into concrete (cyclic loading and high hydrostatic pressure of 16 bar) as per IS: 516 (Part-2/ Sec1) and ACI 212.3R
- Resistance against water penetration into mortar as per IS: 2645
- Resistance against chloride ingress into concrete as per ASMT C 1202, NT build 492, SIA 262/1-B, ASTM C 1556

- Resistance against CO2 ingress into concrete as per IS: 516 (Part2/ Sec4), ISO 1920 Part12, SIA 262/1-I
- Determination of coefficient of permeability using Mercury intrusion porosimetry techniques and as per ASTM C 642
- Utilization of Scanning electron microscopy (SEM) technique for determining the presence of integral crystals in concrete specimen

NCB has evaluated 4 numbers of crystalline water proofing compounds for various industrial clients like ITD Cementation India Ltd., and Pidilite Industries limited at various grade of concrete and recommendations have been given in comparison to control samples to help the construction industry.

E. Evaluation of Bipolar Corrosion inhibiting admixture compound in concrete

A corrosion inhibiting admixture can delay the onset of corrosion or reduce the rate of corrosion for embedded steel in concrete that contains chlorides above the accepted corrosion threshold value for untreated concrete. Corrosion is an electrochemical process, similar to that of a battery or fuel cell but in reverse. It involves anodic and cathodic reactions that result in the formation of corrosion products. In the anodic reaction, electrons are removed from the iron atoms in the steel, while in the cathodic reaction, those electrons are consumed.

Bipolar corrosion inhibiting admixtures are effective in both cathodic and anodic locations. Aggressive substances such as chloride and carbonation can compromise the passivation layer of iron hydroxides on the steel surface, leading to eventual corrosion. Therefore, admixtures that mitigate the corrosion process are useful in extending the life of concrete structures. These admixtures form a protective layer around the reinforcement and decrease the permeability of the concrete, which resists the movement of oxygen and water.

The National Council for Cement and Building Materials (NCB) has developed expertise in evaluating the performance of bipolar corrosion inhibiting admixtures over the last 8-9 years. NCB assesses their performance using various testing techniques and methods based on Indian and international standards. Some of the parameters evaluated at NCB laboratory:

- Immersion Test for 720 hrs. (Rebar weight loss method)
- Modified Accelerated Corrosion Test (Based on Japanese Standard JIS Z1535)
- Effect of Corrosion inhibiting admixture on fresh and hardened concrete.
- Polarization Test by Tafel Polarization with 3.5 % NaCl, for 20 days
- Effect of Corrosion inhibiting admixture in resisting chloride ion penetration as per AASTHO T259
- Effect of Corrosion inhibiting admixture in resisting chloride ion penetration as per ASTM C1202
- Long Term Corrosion Test as per G-109

NCB has evaluated 2 numbers of Corrosion inhibiting admixture for various industrial clients like Laal chemicals, Apple Chemie India Private Limited etc. at various grade of concrete and recommendations have been given in comparison to control samples to help the construction industry.

F. Hydraulic Abrasion Resistance Test as per ASTM C1138

The abrasion test method is designed to assess the relative abrasion resistance of concrete surfaces exposed to water movement in hydraulic structures. These surfaces are subject to direct abrasion from waterborne materials such as sand, gravel, or larger rock particles. The method involves placing a concrete disc specimen, approximately 300 mm in diameter and 100 mm thick, into a cylindrical steel tank for testing. The tank, which is 450 mm in height, has a diameter slightly larger than the specimen's diameter, facilitating insertion and removal using a steel basket. To simulate erodent waterborne particles, 70 steel balls with three different diameters (approximately 13 mm, 19 mm, and 25 mm) are placed on the surface of the concrete specimen (refer to Fig. 1). The tank is filled with water to a suitable depth and the water is rotated at a specified speed of 1200 rpm using a specially designed rotating agitation paddle. The test apparatus used for the underwater abrasion test according to ASTM is shown in Fig. 2. The abrasion weight loss is evaluated at 12-hour intervals by weighing the specimens before and after the test.

Fig. 1. The test disc specimen and the steel balls.

Fig. 2. ASTM C1138 abrasion testing machine.

This test is done for the client Fosroc Chemicals India Pvt. Ltd and currently under progress.

G. Some of the Important Completed R&D and sponsored Projects

- **Utilization of GGBF slag as a replacement of conventional fine aggregates in concrete**

  Blast furnace slag is a by-product of metallurgical processes used in the production of pig iron in blast furnaces. It is a non-metallic material containing alumino silicates of calcium and magnesium, as well as other compounds such as sulfur, iron, manganese, and other trace elements. The slag is produced in a

hot molten state and then rapidly quenched under water to obtain Granulated Blast Furnace Slag. JSW processes Granulated Blast Furnace Slag with a fraction below 4.75 mm, which can be used as a fine aggregate in concrete.

The IS: 383-2016 "Coarse and Fine Aggregates for Concrete- Specification" permits the use of blast furnace slag as an aggregate for concrete. It has been allowed to be used up to 50% in plain concrete, 100% in lean concrete, and 25% in reinforced concrete as a replacement for both coarse and fine conventional aggregates. This study aims to investigate the possibility of increasing the current permissible limits for the utilization of Granulated Blast Furnace slag sand as a replacement for conventional fine aggregates in concrete.

The study is experimental and involves characterizing Granulated Blast Furnace Slag sand for its suitability as a fine aggregate in concrete. Concrete mixes of different grades were prepared by replacing 0, 25, 50, 75, and 100% of conventional fine aggregates with Granulated Blast Furnace slag sand, and the mixes were evaluated for different hardened and durability properties of concrete.

The study found that the physical and chemical properties of GBFS sand fine aggregate met the various requirements specified in IS: 383-2016, except for slightly higher alkali content, which did not have any adverse effects on the volumetric change occurring in GBFS sand. The hardened properties of concrete mixes containing different proportions of GBFS sand as fine aggregates, in replacement of conventional fine aggregates, were either better or at least comparable to the corresponding properties of concrete mixes made with conventional fine aggregates.

Replacing conventional fine aggregates with GBFS sand up to 100% in a concrete mix did not have any negative or detrimental effects on the durability properties of concrete. The behavior of both control mixes and experimental mixes containing GBFS sand as fine aggregate was either better or comparable. Based on studies conducted on fresh, hardened, and durability properties of concrete mixes by replacing conventional fine aggregates with GBFS sand as fine aggregates, GBFS sand has been found suitable for its use as a fine aggregate in reinforced cement concrete by up to 100% replacement of conventional fine aggregate with GBFS sand.

- **Study of Carbonation and Carbonation induced reinforcement corrosion in new cementitious system**

Supplementary cementitious materials (SCMs) have already a long history of being used as partial replacement of ordinary Portland cement (OPC) in concrete. When focusing on the durability of high-volume SCM concrete, special attention should go to environments subject to atmospheric CO_2 ingress and carbonation-induced steel corrosion. In OPC concrete, CO_2 dissolves in the pore solution to form carbonic acid which reacts with $Ca(OH)_2$ (CH) and hydrated silicates in the cement paste, forming mainly $CaCO_3$. Although the latter results in a denser microstructure, the carbonation reaction also implies

a significant drop in pore fluid alkalinity which can disrupt the protective passivation layer on embedded steel and cause active corrosion. To achieve sustainability in construction sector, it is essential to adopt low clinker cements. The most challenging issue with the utilization of low clinker cement is the problem arising due to carbonation and carbonation induced reinforcement corrosion. Since, most of the early studies focused on the determination of carbonation depth under accelerated environmental conditions for evaluating the performance of different cementitious systems. However, effect of carbonation and carbonation induced reinforcement corrosion under natural environmental conditions have not been dealt with explicitly. Therefore, this project aims to fill those research gaps & to study the microstructure of individual new cementitious systems that primarily correspond to low clinker cement.

The study investigates: The Effect of new cementitious systems over the progress of carbonation front and corrosion rate in field as well as laboratory environment. In this study, new cementitious systems that were investigated are as follows:

Cementitious system	Provisions	
	Laboratory study	Field study
Fly ash slag Composite Cement	y	y
Portland limestone cement	y	y
High Volume Fly ash Cementitious system	y	x
Fly ash limestone Composite Cement	y	y
Slag limestone composite Cement	y	x

LS= Limestone

The study was carried out at two w/c ratios of 0.40 and 0.60 and 124 concrete mixes were designed with various combinations of fly ash, slag, and limestone. The experiments were carried out in laboratory as well as in field conditions. The laboratory study corresponds to accelerated environment whereas field study corresponds to natural environment.

Laboratory study (under accelerated environment): It aimed to quantify the progress of carbonation front at various exposure period

Field study (under normal environment): It aimed to determine various parameters influencing the ingress of carbonation front and corrosion rate.

Following parameters needs to be recorded during field study

- CO_2 concentration
- No of Rainy days / sunshine days
- Relative humidity
- Temperature

- **Fly ash slag composite cement**

  The study was carried out on two different sets of materials. About 20 mortar samples and 72 concrete mixes were studied. The study envisages the effect of various combination as specified above on the cement mortar and concrete properties. Based on the mechanical as well as durability test results, especially carbonation as well as carbonation induced reinforcement corrosion, it was recommended to keep OPC content at least 50% or clinker content at least 45%, fly ash in the range of 10-25% and GGBS in the range of 25-40 % to achieve performance equivalent or better than PPC.

- **Portland limestone cement (PLC)**

  The study on Portland limestone cement (PLC) was carried out on 8 concrete mixes. The findings of the PLC study are as follows:

  1. Minimum requirement of Fineness of the Limestone = 600 m2/kg
  2. Overall fineness of PLC blends ≥ 425 m2/kg

  If all the above criteria are met, Performance of the concrete designed with PLC blends (limestone content up to 15%) will be at par to that of concrete made with OPC.

- **High Volume Fly Ash cement (HVFA)**

  The study conducted on high volume fly ash cement (HVFAC) where high volume fly ash cement has been designed at 40 % and 45 % fly ash content shows that fineness of the cement blend has a significant effect on the mechanical and durability properties of the concrete. Based on the carbonation depth and corrosion rate, High volume Fly ash cement with Blaine's Fineness=400-410 m2/kg, and fly ash content up to 40 % performance at par with PPC (35 % fly ash ,Blaine's Fineness= 300 m2/kg)

- **Fly Ash Limestone Composite Cement**

  A total 24 mixes were cast. Type of limestone used = Cement grade (L) and Dolomitic limestone (D) with overall fineness of cement was kept in the range of 400-410 m2/kg.

  Based on the mechanical as well as durability test results, especially carbonation as well as carbonation induced reinforcement corrosion, it was recommended to keep OPC content at least 65% or clinker content at least 60%, fly ash in the range of 15-30% and limestone in the range of 5-10 % to achieve performance equivalent or better than PPC.

- **Slag Limestone Composite Cement**

  A total 16 mixes were cast. Type of limestone used = Cement grade (L) and Dolomitic limestone (D) with overall fineness of cement was kept in the range of 400-410 m2/kg. Based on the mechanical as well as durability test results, especially carbonation as well as carbonation induced reinforcement corrosion, it was recommended to keep OPC content at least 45% or clinker content at least 40%, slag in the range of 40-50% and limestone in the range of 5-10 % to achieve performance equivalent or better than PPC.

For the field study, based upon climatic zones of India, Exposure classes for structures exposed to carbonation is being categorized into 4 (as proposed for revision of IS 456) and different locations have been selected accordingly, refer to below table.

For the field study 11 cementitious blends were selected. About 260 RCC specimens were prepared for the field study.

42 RCC Samples for field study at NCB Ballabgarh campus is already kept in unsheltered environment.

1. Hot and Dry Environment
Ambuja Unit, Nagaur
2. Warm humid and temperate Environment
NCB Hyderabad and NCB Bhubaneswar
3. Composite Environment
NCB Ballabgarh
4. Coastal Environment
JSW ltd, Khar Karavi



RCC samples kept in NCB Hyderabad

RCC samples kept in NCB Ballabgarh


RCC samples kept in NCB Hyderabad

RCC samples kept in Ambuja Unit, Nagaur

RCC samples kept in JSW Ltd, Khar Karavi


RCC samples kept in NCB Bhubaneswar

- **Performance Evaluation of Integral Crystalline Waterproofing Admixture (Fosroc conplast crystalline) in Concrete of M30 grade concrete at 2 dosages for ITD Cementation India Limited, site office, sewa nagar, kotla mubarakpur, railway station, New Delhi.**

  NCB carried out performance evaluation of integral crystalline admixture products in M30 grade concrete at two dosage. Concrete specimens of M30 grade, both with and without the addition of the integral crystalline admixtures in specified dosage, were cast using proportions based on mix design carried out previously in NCB. In order to test the performance of the integral crystalline admixtures, the samples were tested for parameters such as water penetration depth at the end of 4 cycles of 5 bar hydrostatic pressure and subsequent reduction in coefficient of water permeability w.r.t control specimens. In addition, water penetration depth under 16 bar hydrostatic pressure was also carried out.

- **Evaluation of concrete making materials and concrete mix design for concrete of grades M10, M15, M20, M25, M30, M35 & M40 with two different brands of cement.**

  In this study, the concrete, making materials such as cement aggregate etc. were evaluated for various physical and chemical properties. Complete physical and chemical evaluation of cement samples as per the requirement of IS 269 and complete evaluation of aggregate samples as per the requirements of IS 383 was carried out. Further, complete evaluation of admixture and water sample as per requirements of IS 9103 and IS 456 was also done. Based upon the above, recommendation regarding suitability of raw materials for making concrete were given. Thereafter, concrete mix designs of grades M10, M15, M20, M25, M30, M35 & M40 were carried out and recommendations on mix proportions were advised.

H. Some of the on-going R&D and sponsored projects

- **Evaluation of concrete making materials, Mix design trials of Roller Compacted Concrete and semi–adiabatic test of selected concrete mixes.**

  Roller-compacted concrete (RCC) has been used in dam construction since the late 1970s. This concrete has zero-slump consistency and is placed and compacted with equipment typical of earth-moving or paving operations. The use of RCC usually results in a shorter construction schedule due to higher production rates compared to conventional or mass concrete construction. A shorter construction schedule minimizes the hydrologic risks involved with dam construction and allows the contractor to reduce contingency costs for potential flood damages.

  In this regard, NCB recently took up the sponsored project titled "Evaluation of concrete making materials, Mix design trials of Roller Compacted Concrete and Semi–adiabatic test of selected concrete mixes." The project aims to test the suitability of concrete-making materials such as cement, natural coarse aggregate, fine aggregate (Natural/Crushed), Fly ash, etc. as per the

requirement of relevant Indian Standards and to perform the mix design trials for roller compacted concrete using the tested concrete making materials. To perform the mix design trials for roller-compacted concrete, the criteria for mix proportioning to design roller-compacted concrete will be finalized, and based on the finalized mix proportions, the tested materials will be used to perform the concrete mix trials for roller-compacted concrete.

After the finalization of the concrete mix design of roller-compacted concrete, the concrete mix will be tested for various fresh and hardened concrete properties such as workability, compressive strength, tensile strength, etc. Further, a Semi-Adiabatic test will be conducted on 03 nos. selected concrete mixes. Under this study, a rise in temperature under close to adiabatic condition will be studied using thermocouples installed in 4 different layers as per the testing protocol designed for the study. This study and evaluation will be useful from the point of view of limiting the thermal gradients inside the concrete which is of critical importance in mass concrete structures.

- **Utilization of CO_2 in Fresh Concrete and Study on Fresh and Hardened Properties of CO_2 induced Concrete**

  India has updated its Nationally Determined Contribution (NDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) based on the commitment of Honourable Prime Minister at the 26th session of the Conference of the Parties (COP26) held in Glasgow in November 2021. India presented to the world five nectar elements (Panchamrit) of India's climate action into enhanced climate targets. The new climate action targets **"Panchamrit"** by India included:

  - A Net Zero target for India by the year 2070
  - Achieving carbon intensity reduction of 45% over 2005 levels by 2030
  - reducing 1 billion tonnes of projected carbon emissions from now till 2030
  - Installing non-fossil fuel electricity capacity of 500 GW by 2030 and
  - Sourcing 50% of energy requirement from renewables by 2030

  Recently, Inter-governmental Panel on Climate Change (IPCC) published a report on global warming. The report highlighted that for limiting the increase in global temperature to 1.5°C requires achieving net zero carbon dioxide emissions globally in the early 2050s. As per IPCC report, major transitions in the energy and industrial sector will be required to limit global warming such as:

  - substantial reduction in fossil fuel use,
  - widespread electrification,
  - improved energy efficiency,
  - use of alternative fuels (such as hydrogen),

- using materials more efficiently,
- reusing and recycling products and
- Minimizing waste.
- Newer technologies like Renewable Energy, Novel Cements, Carbon Capture, Utilization & Storage (CCUS)

Globally, cement sector generates about 7% of the total anthropogenic emissions. Indian Cement Industry is the second largest in the world after China. In India, the energy consumption and process emissions from cement industry contributed about 4.20% and 2.10% of the total Greenhouse Gas (GHG) emissions of 2531.10 million tonnes CO_2 equivalent in 2016 (Source: 3rd biennial update report of India to UNFCCC). Therefore, cement sector in India has an important role to achieve the committed climate targets. Global Cement and Concrete Association (GCCA), CEMBUREAU and Portland Cement Association (PCA) have announced roadmap to achieve Carbon Neutrality across the cement and concrete value chain by 2050 with major contribution from Carbon Capture and Utilization (CCU). Indian Cement Industry have already taken steps on four levers out of five identified in low carbon technology roadmap. However, to achieve the target of Net Zero, cement industry will have to go for implementation of CCU technologies.

In this area, NCB recently took up the R&D Project titled "Utilization of CO_2 in Fresh Concrete and Study on Fresh and Hardened Properties of CO_2 induced Concrete". The aim of the project is to study the potential of CO_2 Utilization in concrete and its effect on fresh and hardened properties of concrete. Accelerated carbonation of the cementitious phases of concrete is much more viable to contribute on a short term to mitigation of climate change than natural carbonation. Research includes not only the carbonation processes but also the properties in terms of fresh properties, concrete mix design, mechanical properties and durability.

An experimental setup prepared for injecting CO2 in fresh concrete

In this R&D project, eighteen mixes optimized at water binder ratio 0.45 and 0.30 for three cementitious systems (OPC, OPC+25% Fly ash and OPC+60% Slag) with and without CO_2 has been used. Fresh, Mechanical and Durability properties of 18 mixes is studied to determine effect of CO_2 injection in fresh concrete. The Fresh Properties results of concrete at water-binder ratio – 0.45 & 0.30, indicates that:

- Workability (Initial Slump) Decreases and Air Content Increases with increase of CO_2 dosage in the Mix.
- Density of the concrete decreases with increase of CO_2 dosage in the Mix.

The mechanical properties results indicate the following:

- For water-binder ratio 0.45, the early day compressive strength of CO_2 induced concrete is higher than the control samples. Whereas for concrete at water-binder ratio 0.30, the early day compressive strength of CO_2 induced concrete is lower than the control samples.
- The flexural strength, drying shrinkage and MoE (Modulus of Elasticity) of CO_2 induced concrete is slightly higher than the control samples at both w/b – 0.45 & 0.30.

- **Permeability Characteristics of "CORROSTOP-15" in Concrete**

  NCB has carried out the performance evaluation study of CORROSTOP-15 in concrete. To study the effect of CORROSTOP-15 on the Permeability Characteristics of the concrete (M30 and M35 grade of concrete) following tests will be carried on concrete mixes made with and without CORROSTOP-15 at the dosage provided by the sponsor. The details are mentioned below:

  - Rate of water absorption or sorptivity test as per ASTM C 1585
  - Volume of permeable voids, bulk density, water absorption (after immersion) as per ASTM C 642
  - Water permeability test as per IS 516 Part 2/ Sec1
  - Performance assessment studies are being currently in progress.

- **Performance Evaluation of E5® Internal Cure admixture in concrete**

  NCB has carried out the performance evaluation study of E5® Internal Cure admixture in concrete for H.R Organo Chem Pvt. Ltd. The internal curing admixture /compound was tested for various fresh, mechanical and durability properties of the concrete. From the preliminary study, it was observed that the addition of E5® Internal Cure admixture did not have any negative effect on the fresh and hardened properties of the concrete provided that the influencing properties were controlled the during mix design stage. The durability aspect of internal curing compound on various concrete properties is under progress.

I. Evaluation of new cementitious material and industrial by-products for durable concrete structures

The construction industry is a big user of natural resources like rocks, limestone, and clay. However, due to concerns over climate change and the limited nature of these resources, there's pressure on construction firms to reduce their environmental impact. One solution is to use industrial waste or by-products as aggregate or cementitious material. The Centre for Construction Development and Research is conducting research to enhance the use of different cementitious and industrial by-products, such as BF slag, LD slag, ferrochrome slag, bottom ash, and Electric Arc Furnace slag, in cement concrete as binder or aggregate. These materials are evaluated for their physical, chemical, mineralogical, and microstructural characteristics to determine their potential use. The centre also assesses the performance of cementitious and non-cementitious materials for their suitability in structural concrete.

STRUCTURAL OPTIMIZATION & DESIGN (SOD)

Effect of Fire on the Residual Mechanical Properties of reinforcing bars and Structural Performance of Reinforced Concrete Beams in flexure & Shear

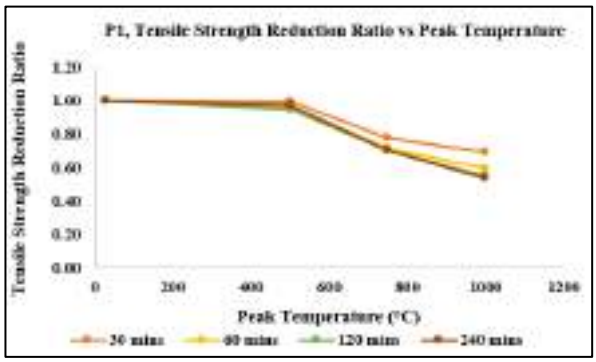
Most buildings and structures continue to face one of the most significant potential hazards i.e. fire. Because concrete with steel reinforcement is one of the most utilized materials for construction, the performance of reinforced concrete structures in fire demands special consideration. The study of the impact of fire on reinforced concrete (RC) structures is crucial, as it directly affects the safety and integrity of buildings during and after a fire event. Fire resistance of concrete structures is mainly dependent on the cover. Spalling of this concrete cover can occur at temperatures as low as 250-300°C, which exposes the reinforcing steel bars to direct fire.

Sample of reinforcing bars kept in furnace

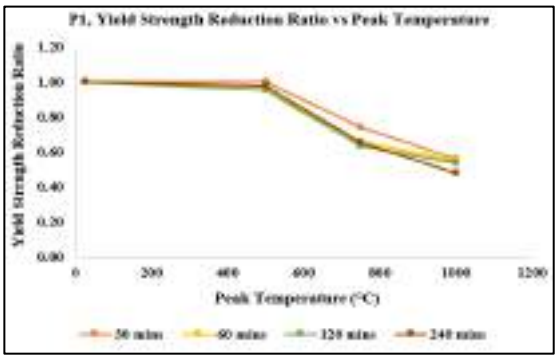
There has been various experimentation on the concrete properties at elevated temperatures, but there is limited data on indigenous steel rebars manufactured by different manufacturers in India. To study the effect of fire on reinforcing bars, ring test was conducted on primary and secondary brands of steel, to assess the uniformity of the tempered martensite ring in TMT bars from various manufacturers. Martensite refers to the hard outer surface, while ferrite and pearlite refer to the softer inner core that imparts ductility. Primary bars showed a continuous, concentric, and uniformly thick peripheral tempered martensite ring, while secondary bars showed a

discontinuous and non-uniform tempered martensite ring. The bars were tested at elevated temperatures of 500°C, 750°C, and 1000°C for different soaking periods of 30, 60, 120, and 240 minutes to study residual mechanical properties.

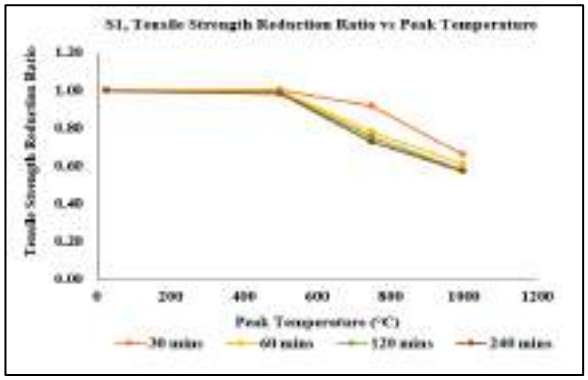
The residual properties of the bars were tested after cooling to ambient temperature. The study showed that the soaking period's effect on the residual properties is less significant compared to the peak temperature after 500°C. The yield strength and ultimate strength do not change until 500°C, but as the temperature increases further, it showed a strength reduction due to the disappearance of the harder outer core, which gets converted to ferrite-pearlite, causing an increase in ductility. At higher temperatures, this transformation was more pronounced, leading to the complete disappearance of the hard martensite ring and conversion to ferrite and austenite phases at 750°C and a 60-minute soaking period. At 1000°C, the microstructure shows the development of coarser ferrite and pearlite portions compared to samples subjected to 750°C. The bars tested after cooling to ambient temperature reported a reduction of up to half of their initial ultimate strength, depending on the peak temperature.



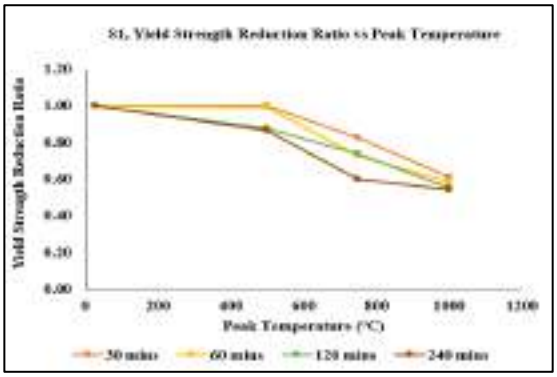
Variation of residual mechanical properties of primary reinforcing bars in terms of tensile strength reduction ratio at different soaking period



Variation of residual mechanical properties of primary reinforcing bars in terms of yield strength reduction ratio at different soaking period



Variation of residual mechanical properties of secondary reinforcing bars in terms of tensile strength reduction ratio at different soaking period



Variation of residual mechanical properties of secondary reinforcing bars in terms of yield strength reduction ratio at different soaking period

The percentage of elongation increase mainly starts beyond the peak temperature of 500°C, showing similar behavior to that of yield and tensile strength. Further studies on the flexural and shear performance of Reinforced Concrete (RC) beams of two different grades post-exposure to elevated temperatures under a standard fire

scenario are planned. It will focus on Fire-Induced Effects, Beam Deformation, Residual Properties, and Failure Analysis at elevated temperatures and its analysis for a better design of retrofitting schemes for RCC subjected to elevated temperatures.

Structural Assessment & Rehabilitation (SAR)

Under the umbrella of Structural Assessment and Rehabilitation Program, a wide range of activities related to assessment of new and existing concrete structures are carried out. These involve:

- Condition assessment of existing concrete structures including fire damaged concrete structures
- Investigation of material properties of hydraulic structures such as Dams
- Load Testing of RCC structures like bridges, underground RCC conduits, buildings, etc.
- Application of Non-Destructive Testing for conformity of quality and condition assessment of concrete structures
- Preparation of repair estimates including cost estimates and detailed schedule of items for repair and rehabilitation works
- Consultancy services involving quality inspection and third party quality assurance of repair and rehabilitation works of concrete structures
- Research & Development Projects on modern repair technologies

A. Condition Assessment & Non-Destructive Testing

In-service structures, especially commercial, industrial and residential buildings, bridges, tunnels, dams, high-rise buildings, etc. require periodical assessment to ascertain whether they can perform satisfactorily for the intended service life. The distress in any form, such as cracks, spalling of concrete, corrosion of reinforcement, seepage, etc., not only disturbs the aesthetic appearance but also reduces the safety and integrity of the structures under use. For condition assessment of structures, investigations are done to figure out the root cause of distress and formulate effective strategies for repair & rehabilitation along with strengthening if required. The investigation process involves elaborate visual, information and documentation surveys, non-destructive evaluation techniques and collection of in-situ samples for further processing & testing at laboratory.

SAR program is well supported by a state-of-the-art non-destructive testing laboratory that has adequate facilities for carrying out Non-Destructive Testing and evaluation of concrete structures. The Non-Destructive Testing Lab has NABL accreditation and ISO 17025: 2017 certified test facilities for Ultrasonic Pulse Velocity Testing and Rebound Hammer Testing of Hardened Concrete. Besides this, the lab also has facilities for evaluation of other parameters such as Surface Electrical Resistivity of Concrete using Four-Point Wenner Probe method, Evaluation of Air Permeability of Cover Concrete using Torrent Air Permeability Tester, Pull-Off Tester to assess the adhesion of repair materials bonded to concrete substrates, Half-Cell

Potential Test to assess the corrosion condition of embedded rebars, Electromagnetic rebar and concrete cover detector, concrete core extraction kits with high quality diamond concrete core bits of various diameters, portable crack width measurement microscope & DFT meter. UAV aided Infrared thermography camera can be helpful in accessing the tall RCC structures. All these facilities are made use of extensively in non-destructive tests on new concrete structures for quality assessment as well as in condition assessment works of existing and aged structures. Besides this NCB also has facilities for chemical analysis (for evaluation of pH, Chlorides, Sulphates etc.) of hardened concrete samples collected from the site and testing of reinforcement bars. Corrosion of embedded reinforcement bars is the most widespread cause of the deterioration of reinforced concrete structures. NCB specializes in assessment of corrosion damaged reinforced concrete structures and providing cost effective solutions for their repair and rehabilitation. NCB also has adequate experience and testing infrastructure to carry out assessment of fire damaged structures. State of the art testing techniques such as Mercury Intrusion Porosimetry (MIP), Differential Thermal & Thermo-Gravimetric analysis (TG-DTA), X-Ray Diffraction (XRD) Analysis, Scanning Electron Microscopy (SEM) Imaging with elemental analysis, etc., are made use of in microstructural analysis of concrete from time to time to assess material properties of concrete in various kinds of structures like dams, bridges, etc. and also to assess the extent of fire damage and provide cost effective solutions for repair of damage caused due to fire.

Some of the photographs of the SAR projects monitored by NCB

Determination of load carrying capacity by Load Testing of railway over bridge as per IRC SP-37 in progress at a sponsored project site

Left: On-site inspection of a Educational building of K.V. School

Right: Various Testing done on IDCT Cooling Tower with the help of Hydra-Lifter

- **Preparation of detailed estimates for repair and rehabilitation works including detailed item specifications**

SAR program offers services for preparation of detailed repair estimates including detailed item specifications for repair and rehabilitation works. This is done based upon the detailed condition assessment report on the subject structures. The detailed repair estimates are also supported by rate analysis of the non-schedule repair items.

- **Consultancy services of repair and rehabilitation works of concrete structures**

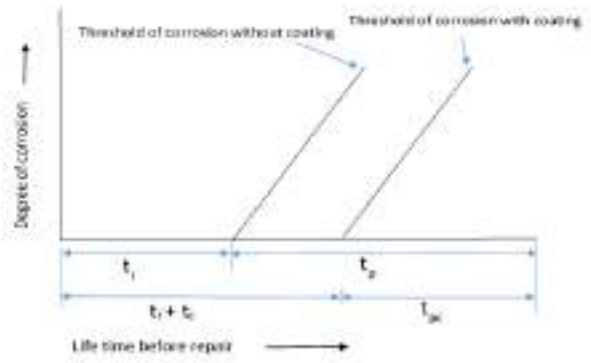
  SAR program offers consultancy services for quality inspection and quality assurance of ongoing repair and rehabilitation works. Sampling and testing of repair materials is done for source approval as well as intermediate quality checks on the input materials. Non-destructive tests are done at site for post repair quality inspection of repaired areas. On-site inspections are carried out during execution of repair and technical guidance is provided for effective implementation of repair methodology as per specifications.

B. R&D Project

On-Going R&D Project

- **Evaluation of Concrete Surface Coatings for their effectiveness in service life enhancement of RCC elements under: Carbonation induced corrosion & Chloride Induced Corrosion**

  The aim of the study is to evaluate performance of coating in delaying corrosion in the embedded reinforcement under (a) carbonation induced corrosion environment and (b) chloride induced corrosion environment. The expected modification in Tutti service life model for corrosion in RCC members by application of protective coating is shown as below,



  Based on the literature survey, it is envisaged to carry out the experimental study on five types of coatings. The identified six coatings will be as follows:

  i. Epoxy resin
  ii. Polyurethane resin
  iii. Acrylic resin
  iv. Polymer Solution

v. Polymer modified cement composition

- **Performance Evaluation of Coatings under different types of environmental conditions:**

  a. **Carbonation:** Study will be done on uncoated control samples and coated concrete/mortar samples made with OPC & PPC which will be subjected to accelerated carbonation test. The uncoated & coated samples shall be maintained in an environment with a relative humidity of more than 90% to allow the corrosion of embedded steel. For carbonation induced corrosion environment, ingress of CO_2, oxygen and moisture have to be restricted, therefore following properties will be evaluated:

     - Resistance to CO2 ingress will be measured through Accelerated Carbonation Resistance Test
     - Carbonation induced corrosion rate measurement by Half-cell Potential, Electrical Resistivity & Linear Polarization Resistance.
     - The transport properties will be evaluated by Water Vapor Permeability/Diffusion test, Air Permeability test and Water Absorption test.

  b. **Chloride ingress:** For studying the effectiveness of coatings for preventing corrosion due to external chloride ingress, uncoated and coated samples of concrete/mortar made with OPC & PPC will be used. The study will be done on both samples, i.e., samples cast with admixed chloride and plain concrete samples subjected to alternate wetting (using 3% NaCl solution) and drying cycles. For ingressed chloride induced corrosion environment, ingress of chloride, Oxygen and Moisture have to restricted, therefore following properties will be evaluated:

     - The transport properties will be evaluated by water permeability/diffusion test and water absorption test.
     - Durability properties will be evaluated by chloride ponding test & RCPT.
     - Chloride induced corrosion rate measurement by Half-cell potential, electrical resistivity & Linear Polarization resistance.

  c. **Inbuilt chloride:** For in-built chloride induced corrosion environment, ingress of Oxygen and Moisture have to restricted, therefore following properties will be evaluated:

     - The transport properties will be evaluated by water permeability/diffusion test, air permeability test and water absorption test.
     - Chloride induced corrosion rate measurement by Half-cell potential, electrical resistivity & Linear Polarization resistance

Completed R&D Project

- **Cathodic Protection to Enhance Service Life of New and Existing Concrete Structures**

  Normal patch repairs in corrosion damaged concrete often have lesser durability than expected as the reinforcement steel is within two chemically different environments. Cathodic protection addresses the problem of corrosion from the fundamental electrochemical aspects. It has the potential to offer a much greater increase in service life of corrosion affected reinforced concrete structures as compared to other methods such as coatings, sealers, corrosion inhibitors, etc. Currently following mentioned three cathodic protection systems are widely used:

  - Sacrificial anode cathodic protection system (SACP)
  - Impressed current cathodic protection
  - Hybrid System

  SACP systems typically have a shorter design life (15-20 years) relative to ICCP systems. However, they have significantly lower design, installation and monitoring costs compared to ICCP systems. ICCP systems are complex and require proper maintenance of its constituent parts. Use of discrete sacrificial anodes has been gaining popularity in the repair and rehabilitation industry due to the ease of their installation and the potential increase in service life they offer. At present, no Indian standards or guidelines on the use of these systems in reinforced concrete exist. Further, the available data in international literature on the performance of these systems in different cementitious systems is scant. Therefore, NCB took up a project on the evaluation of the effectiveness of such commercially available sacrificial anodes in increasing the service life of reinforced concrete structures made with different cementitious systems.
  The objective of the project is:

  - To evaluate the performance of discrete sacrificial anodes in enhancing the service life of reinforced concrete structures under different corrosion mechanisms and in different cementitious systems.
  - To come out with guidelines on the use of sacrificial anodes in reinforced concrete.
  - To frame specification for best practices on the use of sacrificial anodes in reinforced concrete.

  The experimental part of the project was bifurcated into two phases, “Laboratory Study” and “Field Study”. The laboratory studies were done on specimens cast with different cementitious systems.

Laboratory Studies

The following systems were used:

OPC, OPC+Fly Ash, OPC + GGBS, OPC + Fly Ash + GGBS

The Laboratory studies aimed at evaluating the effectiveness of anodes w.r.t corrosion control as well as corrosion prevention.

The effectiveness in corrosion control was evaluated for anodes for carbonation induced as well as chloride induced corrosion in specimens where corrosion had already initiated. For corrosion prevention, the effectiveness of the anodes in preventing initiation of corrosion was evaluated where the anodes were embedded in chloride contaminated specimens in the casting stage itself.

Commercially available zinc based sacrificial Anodes from two manufacturers (Anode A and Anode B) were used in the laboratory studies. The corrosion rate in the specimens were monitored with the help of Linear Polarisation Resistance Technique and the effectiveness of the anodes in reducing the corrosion rate was studied.

Corrosion Control

Chloride Induced Corrosion

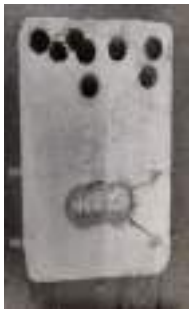
Carbonation Induced Corrosion

Specimens under chloride induced corrosion

Wetting cycle by ponding with 3% NaCl solution

Specimens Under Carbonation Induced Corrosion

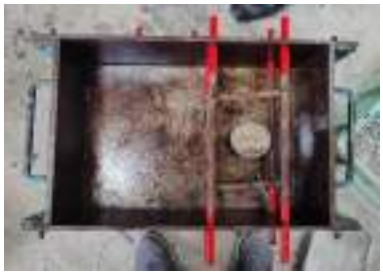
Measurement of corrosion rate using LPR



Specimens for installation of anodes

Measurement of corrosion rate using LPR

control specimen

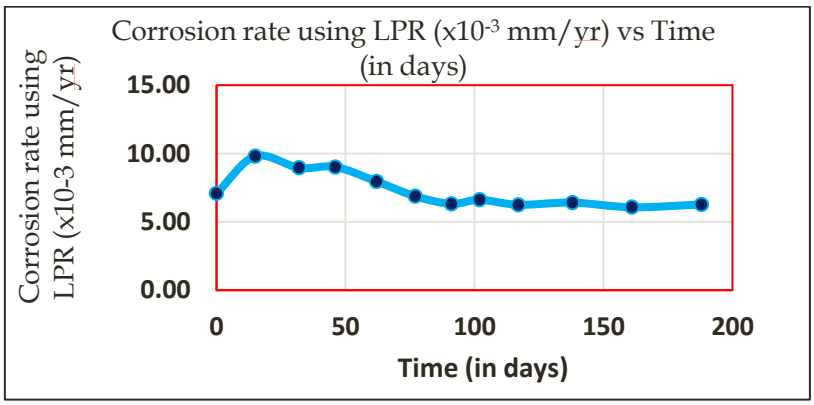


specimens with anodes

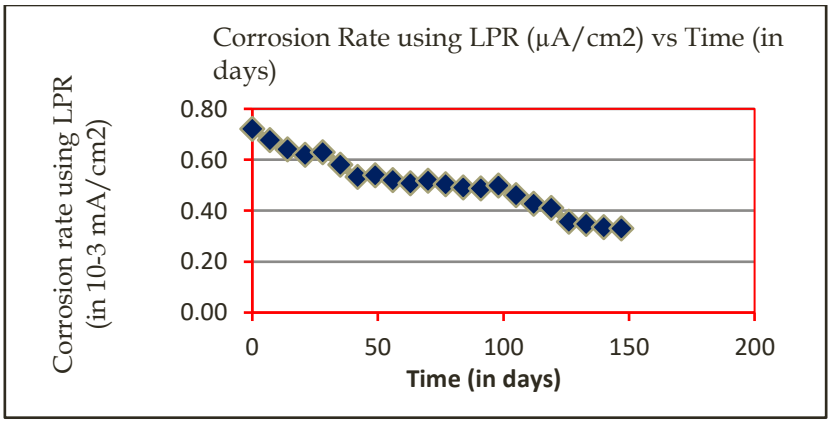
Casting of specimens

Anode A (bottom) & Anode B (top)

Graphical representation of the results of variation in corrosion rate w.r.t time for two typical cases in case of corrosion control and corrosion prevention are shown below:



Corrosion control in carbonation induced corrosion, cementitious system: 100% OPC



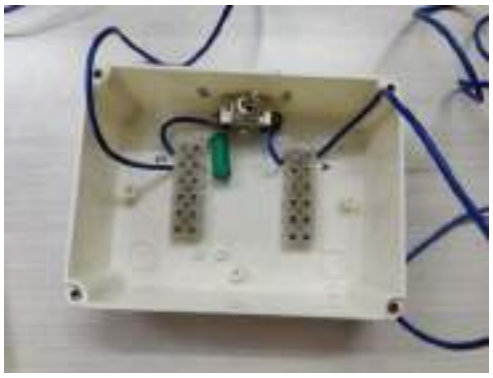
Corrosion prevention, Cementitious system: 100% OPC, w/c=0.45

Field Studies

In the field study part, the design of sacrificial anode-based CP system was done for basement columns of a G+10 storied residential building (about 5 years old) located in Delhi which was affected by corrosion due to admixed chlorides. The design was based on results of on-site condition assessment and previously established results of published research. The spacing and distribution of anodes was worked out.

The anodes were installed along with other repair systems such as concrete penetrating corrosion inhibitor, anti-corrosive coating to reinforcement steel and concrete surface coating to reduce the current demand from anodes. The anodes were instrumented with a monitoring junction box to record the current output of the anodes at various points of time.

The recorded current output at a timeframe of about 2 months from the date of installation was measured and recorded. The results were found to comply with internationally established criteria for cathodic prevention as per ISO 12696.



Based on the Laboratory and field studies, the following conclusions were drawn:

Lab Study

- For corrosion control, installation of anodes in the specimens leads to a reduction in corrosion rate and consequently an increase in service life for both carbonation induced as well chloride induced corrosion.
- The increase in service life seems to be dependent majorly upon the initial corrosion rate (corrosion rate before the installation of the anodes). Higher the initial corrosion rate, lesser is the increase in service life.
- The increase in service life is higher in case of chloride induced corrosion as compared to carbonation induced corrosion
- Results indicate that sacrificial anodes are more effective in the case of cathodic prevention than in the case of cathodic protection.

Field Study

- The design of a CP system based on galvanic anodes requires consideration of the overall current output of anodes over the intended service life for which a minimum current density at the end of service life needs to be judiciously assumed. This depends on a number of factors including the steel density & results of condition assessment.
- The result of field study w.r.t anode current density output of anodes installed in a column in which other repair systems have also been used, is in line with the requirements of ISO 12696 for achieving cathodic prevention.

C. Sponsored Projects Undertaken

NCB carried out a large number of sponsored project works involving structural health and condition assessment of concrete structures, Non-Destructive Testing of concrete structures, quality assurance services of ongoing repair works in the year 2023-2024. Our clientele included reputed Organisations like NTPC, PGCIL, NHPC, NHAI, RBI, BHEL, GAIL, NBCC, AIIMS, CPWD, DDA (New Delhi), IPGCL, MCD, BSES, WBPDCL, THDC, APCPL. 21 sponsored projects were completed during the year 2023-2024. Some of the major projects executed during the year 2023-2024 are listed below:

- Random Quality Inspection during execution of repair work of distressed RCC members of Residential Accommodation for NHAI at Dwarka
- Condition Assessment of quarters of RBI
  - RBI Main Building at Parliament Street, New Delhi
  - RBI Guest House & RD Residence at Ravindra Nagar, New Delhi
  - RBI Colony R. K. Puram, New Delhi
  - RBI Colony Vasant Vihar , New Delhi
  - RBI Colony Sarojini Nagar, New Delhi
- Condition Assessment for recommendations on Maintenance and upkeep of various RCC Structures at NTPC Korba, Chhattisgarh
- Condition Assessment of Old Press Colony Type I & Type II Quarters at Faridabad for CPWD
- Condition Assessment of RCC structures of Turbines at NTPC Faridabad Gas Power Station, Haryana.
- Core Testing of 06 Nos. of 9m PCC Poles & 06 Nos. of 11m PCC Poles for BSES.
- Condition Assessment for recommendation on Maintenance and repair of various RCC Structures at NTPC Kahalgaon.
- Condition Assessment of Kendriya Vidyalaya School building at R K Puram, New Delhi for CPWD.

- Condition Assessment of RCC Chimney at APCPL, Jharli-Jhajjar, Haryana.
- Condition Assessment of TG Decks at NTPC Darlipali, Sundargarh, Odisha.
- Condition Assessment of RCC Deck Slab & Column of TG Foundation at NTPC Farakka
- Condition Assessment of (i) Lady Harding Medical College Hospital Staff Quarters and (ii) Kalawati Saran Children Hospital (Old Block) at Panchakuian Road, New Delhi
- Condition Assessment of three block Buildings at District Hospital Nagaur, Rajasthan.
- Condition Assessment of Academic Block Building (AB-02) at GLA University Mathura, UP.
- Condition Assessment of fire damaged BSL area of CCRF in Convergence Block at AIIMS, New Delhi
- Condition Assessment of Corporate Office Building, Central Ware Housing Corporation (CWC), Hauz Khas, New Delhi.
- Condition Assessment of RCC Structure of MAP Phase-I 304 ORs Quarters and 72 JCOs Quarters at Happy Valley, Shillong, Meghalaya
- Condition assessment of CBI Pool Qtrs 20 nos. at DDA Flats, Kalkaji, New Delhi
- Condition assessment of TYPE-II Residential Quarters (Pocket 1 to IV, 2115 Nos.) in Lodhi Road Complex Area. New Delhi.
- Condition assessment of MCH block building at Banswara City Hospital, Rajasthan.
- Condition Assessment of GPRA Quarters in Andrews Ganj Extn., New Delhi.
- Condition Assessment of RCC Chimneys at Kolaghat Thermal Power Station of West Bengal Power Development Corporation.
- Preliminary inspection of plant & township buildings for condition assessment at NTPC Anta.
- Condition assessment of various RCC structures in plant area at Farakka Super Thermal Power Station NTPC Ltd., West Bengal.

Some of the photographs of the project sites and the site assessment work done by NCB team in various projects are given below:

Project site of Condition Assessment of RCC NDCT Cooling Tower

Core Extraction from the RCC SHELL

Continuity testing being done after installation of Zinc anodes at site

UPV Test on TG Column

Carbonation depth being measured on freshly extracted concrete core

Measurement of existing rebar diameter of an RCC member at a Building site

Electrical Resistivity Measured on TG Column

Half Cell Potential Measured Column

CONSTRUCTION TECHNOLOGY AND MANAGEMENT (CTM)

Third Party Quality Assurance and Audit Services for construction projects

National Council for Cement and Building Materials (NCB) provides Third Party Quality Assurance and Audit consultancy for a wide range of construction projects such as multistoried buildings, convention centres, Exhibition halls, flyovers, dams, barrage, concrete roads, bridges and tunnels, construction utility projects, special construction activities like pre-engineered steel structures, etc., built by the various central / state /PSU/ autonomous organizations across India through the NCB units located at Ballabhgarh, Hyderabad, Ahmedabad and Bhubaneswar. NCB uses state-of-the-art techniques / methods to perform inspections that reduces risk and ensures quality of construction. NCB provides its clients with independent and impartial services that enable them to timely identify, manage and reduce risk in quality of construction. Consultancy is given in form of transparent and unbiased inspection,

testing and verification of remedial measures undertaken during construction so that customers can achieve assurance in their products, processes, systems and services.

The scope of Third Party Quality Assurance / Audit includes inspections, lifting and testing of samples, witness of field and laboratory testing done at site / fabrication yard, review of quality system and documents including Non-Destructive Testing (NDT) wherever applicable. NCB devices proper plan of quality audit of input materials, checks on plants / machinery, workmanship during various stages of construction and finished products. The inspections of works are carried out at different stages to check the quality of construction and its compliance to drawing / design / technical requirements / specification / contract conditions. Regular check on quality of materials and its compliance with the specifications are done through random sampling & testing of materials as per relevant standards / specifications. Inspection of Pre-engineered sections at fabrication yard / factory are done at specified frequency to check quality of production. Inspection of batch mix plant / RMC plant are frequently done to ensure calibrations and effective production process during concrete mix preparation as per approved mix design. Necessary advice in form of quality assurance measures for quality improvement are provided during inspection. NCB provides necessary technical support during the progress / completion of work and gives its recommendations with respect to the discrepancies found at time of inspection including the corrective measures / remedies so that discrepancies can be rectified / re-done. Review / audit for regular quality control is also covered under the scope for which all the test reports, RMC batch mix printouts, Manufacture's Test Certificates (MTC), test register of input materials etc. are made available by the department at site for review. Periodical audit report (generally every week/ fortnightly / monthly) are submitted containing details of work / activities inspected, observations on inspections, construction methodology, material testing, quality assurance measures, review of quality system and NDT. However, major non-conformances observed and also for non-conforming materials, intimation are given during site inspection itself for immediate compliance. The material testing under Third Party checking generally varies from project to project as per agreed terms and conditions. The testing for special items like concrete pipes, DG sets, bearings, pre-stressing wires, pre-engineered sections, etc., are randomly witnessed jointly at manufacturer's production unit.

Prestigious projects of national importance have been awarded to NCB by Indian Trade Promotion Organization, India International Convention Centre, Central Public Works Department (CPWD), State PWDs, All India Institute of Medical Sciences (AIIMS), Delhi & Rishikesh, Development Authority (DDA), Uttrakhand Jal Vidyut Nigam Limited, Municipal Corporation of Delhi (MCD), Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Odisha Industrial Infrastructure Development Corporation (IDCO), State Trade Promotion Organization's in Karnataka & Tamilnadu, Sports Authority of Gujrat (SAG), etc. The centre continues to provide specialized services in the area of quality assurance/control and thereby contributing to the durable, sustainable and quality infrastructure in India.

Some of the photographs of the TPQA projects monitored by NCB

Integrated Transit Corridor in and around Pragati Maidan, Delhi

ROB/RUB at Sultanpuri, Delhi

Chemistry Block at IIT-Roorkee.

Checking of reinforcement at Residential Accommodation at Kasturba Nagar, Delhi

Convention centre and halls of Indian Trade Promotion Organisation, Pragati Maidan, Delhi

Convention centre and exhibition halls of India International Convention Centre, Dwarka, Delhi

Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana

General Pool Residential Accommodation at Thyagraj Nagar, Delhi

Construction of Demonstration Reinforced Geopolymer Concrete (RGC) structure (Single Room Structure) – Quality Assurance and Performance Monitoring

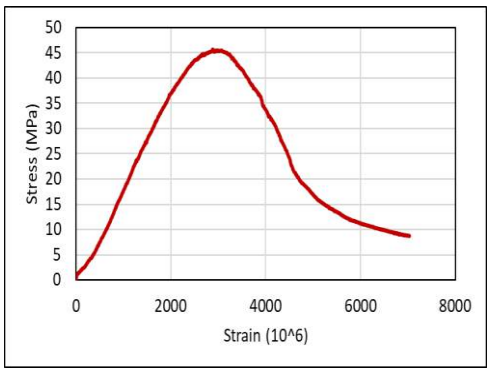
Geopolymer concrete is seen as an alternative to the conventional OPC based concrete. The geopolymer concrete uses industrial mineral waste like fly ash and Ground Granulated Blast Furnace (GGBS) as a binder material in concrete.

Based on the extensive studies carried out earlier at NCB on geopolymer concrete mixes of various strength grades, a sponsored R&D project was taken up wherein NCB developed geopolymer concrete mix equivalent to M35 grade using Ground Granulated Blast Furnace Slag (GGBS) & fly ash as the cementitious binders and Sodium Hydroxide (NaOH) & Sodium Silicate (Na_2SiO_3) as the chemical activators, carried out studies on mechanical and durability properties of hardened concrete specimens and on behaviour of RGC specimens cast using the mix, developed basic design parameters for structural design, carried out quality assurance for casting of a demonstration single storey structure and carried out performance monitoring of the structure through load testing.

Hardened concrete properties such as compressive strength (cube and cylindrical), flexural strength, Modulus of Elasticity (MOE) and drying shrinkage were evaluated. Based on analysis of the results the different mechanical parameters, suggested values for critical mechanical parameters to be used for design of a demonstration RGC structures using the developed mix were arrived at.

Test set up for evaluation of Modulus of Elasticity and Poisson's ratio of concrete specimen

Test set up for evaluation of flexural strength of concrete beam specimen



Typical curve showing Stress-Strain characteristics of M35 grade geopolymer concrete mix developed at NCB

Durability parameters involving Electrical Resistivity measurements using Wenner probe technique, Torrent's Air Permeability test, Mercury Intrusion Porosimetry studies, Sorptivity Test, Chloride Diffusion Test, Accelerated Corrosion Test using Florida Test Method and Corrosion rate measurement on carbonated slab samples using Linear Polarization Resistance (LPR) technique were studied and compared with conventional OPC based concrete of similar strength grade. Based on the test results obtained and study of available research literature, design parameters determined from the testing were used in the structural design of a demonstration structure of 1 storey height using the M35 grade geopolymer mix developed at NCB. Prior to casting of the structure, resistance type embedded strain gauges were

installed and fixed to the beams and slabs at critical locations. Quality inspection of the batching plant setup and concreting activities during the casting of the structure was done by NCB. Surface mounted strain gauges were also fixed to the slabs and beams at critical locations after 28 days' age. Load testing of the structure after 28 days' age was carried out in accordance with the procedure given in IS 456: 2000 in the presence of NCB team.

Test set up for testing of RGC beam in four-point bend test

Arrangement of reinforcement and embedded strain gauges in slabs and beams of single storey RGC structure

Batching plant setup for the production of geopolymer concrete mix

Measurement of slump of geopolymer concrete mix being taken at site

Finished surface of the single storey structure cast with the geopolymer concrete

Arrangement of load on the slab using sand filled bags for load testing

The deflection measurements at critical locations were recorded using mechanical dial gauges. The strain response of the embedded and the surface mounted strain gauges were also recorded using a data logger. The value of maximum deflection recorded during 24 hours under load was less than the value of 40 l^2/D which indicates that the recovery provisions of clause 17.6.3 of IS 456: 2000 are not applicable and the maximum deflection values recorded at critical locations are well within the safe limits. The strain response recorded during the course of load testing indicates that most of the strain induced by the imposed load was recovered at the end of load testing.

Laboratory Facilities

The followings are the laboratory facilities available to CDR centre to support the R&D and Sponsored Projects –

i. Mechanical & Physical Properties Investigation (MPI)

ii. Non-destructive Testing (NDT)

i. Mechanical and Physical Properties Investigation (MPI) Laboratory

Mechanical and Physical Investigation (MPI) laboratory is the part of center for Construction development and research (CDR). It is an NABL accredited testing laboratory in accordance with the ISO/IEC 17025:2017 procedures in the field of mechanical investigation (Test Certificate No.-5296) of construction materials. The Lab has structured quality management system (QMS) and conducts frequent internal and external assessments to ensure consistent reliable laboratory results. Further MPI Lab also involve in homogeneity testing of Standard Reference Material (SRM) such as Bharatiya Nirdeshak Dravyas (BND's) for various cementitious materials.

This lab has wide range of specialized testing facilities for conducting R&D studies. Laboratory has various state of the art facilities for the study of hardened concrete for various mechanical, durability and time-dependent properties.

State of the art facilities

- Chloride Ion Penetrability Testing Equipment
- Corrosion Rate Analyzer
- Universal Testing Machine – 1000kN
- Strain Controlled Compression Testing Machine-3000kN along with Flexural Testing Machine-300kN.
- Crack Monitoring of Reinforced Concrete Beams.
- Determination of Toughness and Energy Absorption of Steel Fibre Reinforced Concrete and Shotcrete Panels.
- Determination of Modulus of elasticity and Poisson ratio of Concrete
- Mercury Intrusion Porosimetry Equipment
- BET Apparatus for Surface Area Determination
- Tri-axial Shear Strength of Concrete-500kN
- Temperature studies in concrete through thermocouples and Resistance Temperature Device and their recording in Data Loggers having multiple channels.
- Water Permeability Testing Equipment
- Study on Carbonation induced concrete by keeping concrete samples in carbonation chambers.
- Study on Long term sustained loading on concrete samples in Creep testing machine

- Study on corrosion studies using Electrochemical Impedance spectroscopy (EIS) equipment
- Under water abrasion testing machine
- Long column testing compression machine

New Facilities Created during the Financial Year

- Carbonation Chambers with Data Logging Facility for monitoring of CO2, temperature and Relative Humidity inside the chambers. Chambers are being designed to work under extreme weather conditions.
- Mercury Intrusion Porosimeter for estimation of porosity of cementitious concrete materials has been added to existing facility.
- Humidity Chamber Procured for conditioning of mortar samples for Lime Reactivity test.
- Control Condition Curing Tanks for curing of concrete samples were added in existing facility.

MPI activities

- Mechanical Testing of Building Materials such as Hydraulic Cement, Aggregates, Fly Ash, Bricks, Steel Bar, Ceramic Tiles, Vitrified Tiles, Cement Concrete Flooring Tiles, Autoclaved Aerated Blocks, Corrosion Inhibitor, Fresh Concrete, epoxy, latex & Hardened Concrete.
- Determination of Alkali Aggregate Reactivity: Alkali Silica Reactivity & Alkali Carbonate Reactivity.
- Admixture Testing.
- Concrete Mix Design.
- Soil Testing includes Grading, Optimum Moisture Content, CBR Test, Liquid Limit & Plastic Limit Test.
- Fineness of cementitious and pozzolanic materials such as microfine OPC, ultrafine GGBFS, silica fume etc. by BET apparatus, etc.
- Steel fiber testing

1. **Mechanical Tests**

    - Modulus of elasticity and Poisson's ratio
    - Toughness and Energy absorption on steel fibre reinforced concrete.
    - Stress-strain characteristics
    - Fracture behaviour of beam
    - Dry and wet abrasion of concrete

- Confined compression of concrete and rock
- Creep and fatigue test on concrete.
- Checking the behaviour of reinforced concrete by testing of beams and columns

2. Durability tests based upon transport mechanisms and other tests

- Migration/ Conduction: RCPT, NT Build 492, Florida method
- Diffusion: chloride diffusion/ ponding, accelerated carbonation (Laboratory as well as field study)
- AdSorption: sorptivity Test
- Penetration: permeability, volume of permeable voids
- Microstructure: mercury intrusion porosimetery
- Chloride induced corrosion: polarizing resistance as per ASTM G3, LPR, EIS
- Ingress of sulphate: sulphate immersion test, mass loss test
- Various other corrosion related test such as long term chloride induced corrosion test for admixture as per ASTM G109/ ASTM C1582.

Apart from the testing of construction materials, laboratory has also provide demonstration and training to various groups from esteemed organization such as Public Works department (PWD), Tamilnadu, Department of Irrigation, NHPC, DMRC, NTPC etc., and recognized cement industry and also to many recognized academic institutions under various training programs.

Corrosion Rate using Electrochemical Impedance Spectroscopy

Initial Surface Absorption Test Facility

Universal testing machine- 1000kN for testing of reinforcement steel

Strain Controlled Flexural Testing Machine for determination of flexural toughness of concrete

Water penetration testing for concrete

Mercury Intrusion Porosity equipment for checking porosity of concrete

Rapid chloride penetration testing (RCPT) of concrete

Under water Abrasion on Hardened Concrete

Hardened Concrete Sample -Accelerated Carbonation

Surface Area determination of cementitous Materials in BET apparatus

Triaxial Testing on concrete samples

Hardened Concrete Sample- CREEP Observation

ii. Non-Destructive Testing (NDT)

Non-Destructive Testing laboratory is equipped with latest state-of-art Non-Destructive testing equipments. The laboratory has NABL accreditation as per ISO 17025-2017 for UPV Testing and Rebound Hammer testing. The laboratory serves as a platform in the Centre for Construction Development and Research for providing services related to non-destructive testing and condition evaluation of concrete structures in various sponsored and R&D projects. The laboratory has skilled technicians and analysts who are trained on regular basis to ensure safety during testing and to deliver accurate processed outputs. All the instruments and devices are regularly calibrated and checked to ensure quality of the test results.

Apart from providing testing and inspection services, the lab has also arranged laboratory demonstrations as part of training programs for officials from various esteemed organisations like NTPC, HPCL, PWD, NHPC, etc.

The laboratory has following equipments and facilities:

- Ultrasonic Pulse Velocity (UPV) Tester for estimating quality of concrete, crack depth, etc.
- Schmidt Rebound Hammers (L-Type, P-Type, N-Type & M-Type) for comparative assessment and obtaining indicative measure of the compressive strength of concrete.
- Half Cell Potential Measurement (Cu-CuSO4 based) for assessing the corrosion status of reinforcement bars embedded in concrete.
- Concrete Cover Meter for locating reinforcement bars and measuring concrete cover depth
- Concrete Core extraction kit with diamond core bits of various diameters (25mm, 60mm, 75mm, 100mm, 120mm, 300mm) for cutting and extracting concrete cores.
- Electrical Resistivity meter based on Wenner 4-probe method.
- Concrete Air permeability tester.

- Crack width measurement by portable crack width measurement microscope
- Pull-Off tester for testing adhesion strength of repair materials to concrete substrates.
- Coating thickness meter.
- Carbonation testing on concrete.
- CO_2 Analyser.
- Unmanned Aerial Vehicle (drone) with optical and IR camera for inspection and condition evaluation of tall structures like chimneys, cooling towers, etc.

UPV Tester

Rebound Hammer

Half Cell Potential Measurement Kit

Concrete Cover Meter

Concrete Core Extraction Kit

Electrical Resisitivity Tester

Air Permeability Test Kit

Pull Off Tester

Dry Film Thickness Meter

Portable Crack Width Observer

Unmanned Aerial Vehicle (Drone)

Centre for Quality Management, Standards and Calibration Services–(CQC)

The activities of the Centre for Quality Management, Standards and Calibration Services are organized under four programmes: Standard Reference Materials, Calibration Services, Interlaboratory Services and Total Quality Management. These activities address all aspects of Quality Management and provide the entire range of Standardization and Calibration services to cement industry, R&D institutions, Concrete and allied building materials laboratories in India and abroad.

Standard Reference Materials (SRM)

NCB's SRM programme is accredited under ISO 17034:2016 as Reference Material Producers. NCB has developed Certified Reference Materials (CRMs) in the areas of cement, building materials and solid fuels (coal and pet coke). NCB's CRMs have been quoted in IS 4031(Part-2), IS 4031(Part-15) and IS 1727.

21 Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs) were developed in collaboration with CSIR-National Physical Laboratory (NPL), NMI of India. It is intended to be used for calibration of equipment, evaluating proficiency of analysts and evaluating/comparing various test methods etc. as well as import substitution which led to saving of foreign exchange.

The following BNDs are commercially available:

Sl. No.	BND No.	Material Description	Parameters
1	5001	OPC - (Lower Range) (Fineness : 250 - 300 m^2/kg)	Blaine's fineness & Specific gravity
2	5021	OPC - (Middle Range) (Fineness : 320 - 360 m^2/kg)	Blaine's fineness & Specific gravity
3	5011	OPC - (higher Range) (Fineness : 400 - 450 m^2/kg)	Blaine's fineness & Specific gravity
4	5002	PPC (Fineness : 200 - 500 m^2/kg)	Blaine's fineness & Specific gravity
5	5003	PSC (Fineness : 200 - 500 m^2/kg)	Blaine's fineness & Specific gravity
6	5006	Composite cement (Fineness : 200 - 500 m^2/kg)	Blaine's fineness & Specific gravity
7	5007	WPC (Fineness : 200 - 500 m^2/kg)	Blaine's fineness & Specific gravity
8	5004	Fly ash (Fineness : 200 - 500 m^2/kg)	Blaine's fineness & Specific gravity
9	5051	OPC	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, Mn_2O_3, TiO_2, SO_3, IR, Na_2O, K_2O & Cl

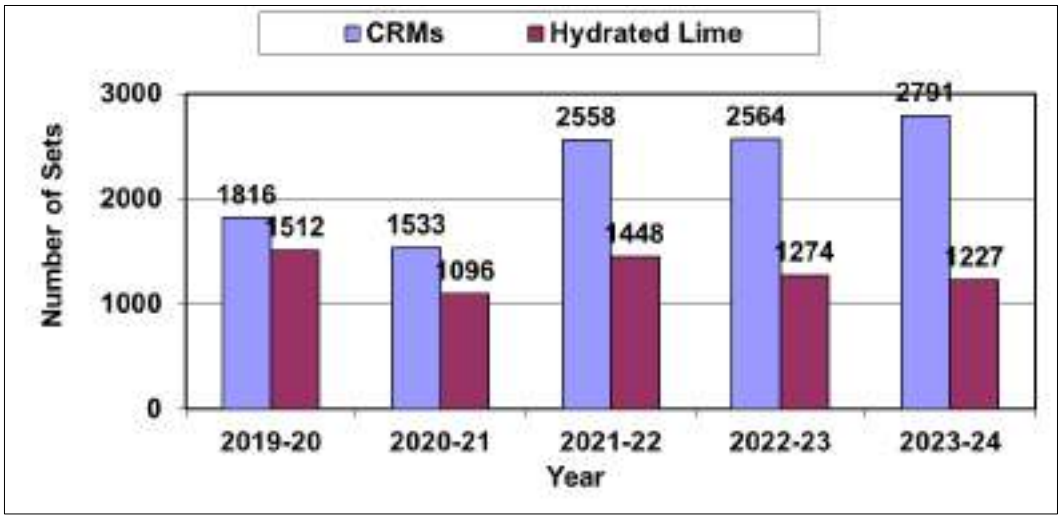
10	5052	PPC	LOI, MgO, SO_3, IR, Na_2O, K_2O & Cl
11	5053	PSC	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, Mn_2O_3, TiO_2, P_2O_5, SO_3, Na_2O, K_2O, Cl, Sulphur & IR
12	5055	Composite cement	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO,SO_3, IR, Na_2O, K_2O & Cl
13	5054	Fly ash	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, SO_3, Cl, Na_2O & K_2O
14	5056	Limestone	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO,Mn_2O_3, TiO_2, P_2O_5, Na_2O, K_2O, SO_3 & Cl
15	5057	Raw Meal	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, SO_3, Na_2O, K_2O, Cl, Mn_2O_3 & TiO_2
16	5058	Clinker	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, SO_3, Na_2O, K_2O, Cl, Mn_2O_3 & TiO_2
17	5091	Coal	Ash content, Volatile matter, Sulphur & Calorific value (values based on dried basis)
18	5059	GGBFS	GOl, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO,SO_3, IR, Na_2O, K_2O, TiO_2, Mn_2O_3 & Sulphide sulphur
19	5061	Pet Coke	Ash Content, Volatile Matter, Sulphur & Calorific value
20	5008	Granulated Blast Furnace Slag	Blaine's fineness & Specific gravity
21	5009	Ordinary Portland Cement	Residue on 45 µm sieve (wet sieving)

The following RMs/CRMs are also commercially available:

Sl. No.	RMs/CRMs No.	Material Description	Parameters
1	CRM 1010	Hydrated Lime (for LR test)	CaO, MgO, SiO_2 & IR
2	CRM 1040	Silica Fume	LOI, SiO_2, Na_2O, & K_2O
3	CRM 1007	Gypsum	Combined water, SiO_2 +Acid insoluble, Fe_2O_3+Al_2O_3, CaO, MgO, SO_3 & Cl (as NaCl)
4	CRM 1013	White Portland Cement	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, SO_3, Na_2O, K_2O & Cl
5	CRM 1011	Clay	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, Na_2O, K_2O, TiO_2, P_2O_5, Mn_2O_3
6	CRM	Calcined Clay Pozzolana	Blaine's fineness & Specific

	1002D		gravity
7	CRM 1045	Bauxite	LOI, SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, Na_2O, K_2O, Cl, TiO_2, Mn_2O_3, P2O5
8	CRM 1044	Iron Ore	SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, Na_2O & K_2O
9	CRM 1037	Fly ash	ROS: 45 µm (wet sieving)
10	CRM 1036	Ordinary Portland Cement	Residue on 90 µm (Dry Sieving)
11	RM 1041	Red Ochre	SiO_2, Fe_2O_3, Al_2O_3 & CaO
12	RM 1039	Laterite	SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, SO_3, Na_2O & K_2O

During the year, total 2,791 units of different CRMs including BNDs and 1,227 sets of standard lime were supplied to 1079 customers of cement plants, testing laboratories, public sector undertakings, R&D institutions including international clients viz Nepal, Bhutan, Bangladesh, Kenya, South Korea etc. The sale records for the past five years are represented in graph below.



Release of BNDs in the Year 2023-24:

Ordinary Portland Cement - Residue on 45 µm sieve (wet sieving) – (BND 5009)

NCB has developed Bharatiya Nirdeshak Dravya (BNDs) for Cement Material i.e OPC 45 Micron standard. NCB's BND was released in the presence of Prof (Dr) Ajay Kumar Sharma, Director, NIT, Delhi, Prof. Venugopal Achanta (Director, CSIR-NPL), Dr L P Singh (DG-NCB) and NCB team at a glittering function on 82nd CSIR Foundation Day in CSIR-NPL on 4th October 2023.

Granulated Blast Furnace Slag - Blaine's fineness & Specific gravity (BND 5008)

Shri Sanjiv, Joint Secretary-DPIIT released Bhartiya Nirdeshak Dravya (BND), the Indian Certified Reference Materials, of Ground Granulated Blast Furnace Slag (GGBFS) developed by NCB and released on the occasion of 61st NCB Day on 22nd December 2023 at NCB Ballabgarh unit.

Pet coke – Chemical Parameters (BND 5061)

Bhartiya Nirdeshak Dravya (BND), the Indian Certified Reference Materials, of Petcoke developed by NCB was released by Prof. Ashutosh Sharma (President Indian National Science Academy -INSA & Ex-Secretary DST, Government of India), Dr. Ranjana Aggarwal (Director CSIR NISCPR), Dr. Viswajanani J Sattigeri (Head, CSIR-TKDL), Prof Venugopal Achanta (Director, CSIR NPL) and NCB team on the occasion of 78th Foundation Day of CSIR-NPL on 4th Jan 2024.

Calibration Services

The calibration laboratories of the center are equipped with the sophisticated equipment and state of the art facilities. The laboratories constantly strive to improve accuracies and uncertainties of measurement of existing calibration facilities and also expand the scope of calibration activities.

The laboratories have acquired sophisticated equipment like Dry Block Calibrator, Temp and Humidity Calibrator, Force Proving Instruments, Universal Length Machines etc. The laboratories are in advance stages of procuring equipment to provide state-of-the –art facilities in the fields of Mass Metrology, High Temperature Metrology, Force Metrology etc.

The scope of calibration laboratories was expanded recently and the new facilities are added as under:

- Calibration of Dial Gauges up to 25mm of 1 micron,
- Calibration of E-2 class Weights (up to 200g),
- Calibration Weighing Balances of L.C -0.001mg, Range-30g and L.C -0.01mg, Range-200g.

RH Calibrator

Mass Comparator-31g

Mass Comparator-220g

Universal Length Machine

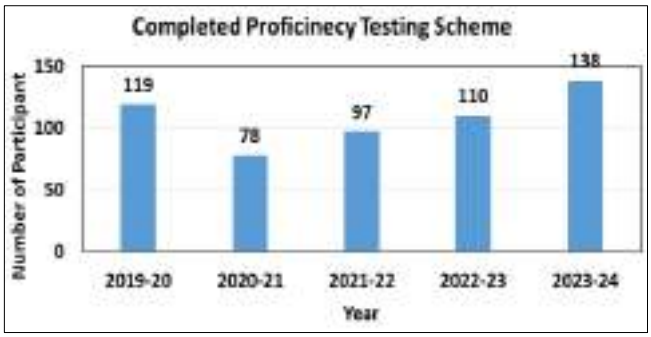
Mass Comparator – 5 kg

The calibration laboratories are accredited as per ISO/IEC 17025:2017 in the fields of force, pressure, temperature & humidity, dimension, mass & volume and RPM. More than 1600 equipment/instrument were calibrated at NCB's testing laboratories and at customer's site. The calibration services are being provided to various Central Govt., State Govt., PSUs, Cement & Construction Industries and have shown remarkable growth.

It is pertinent to mention that more than 95% customers rated our services as excellent in the financial year 2023-24.

Interlaboratory Services (ILS)

Interlaboratory Services (ILS) of NCB are India's 1st accredited services as per ISO/IEC 17043. Since its inception, NCB-ILS services has completed more than 100 programme in the area of Cement and Building Materials. NCB's Interlaboratory Services (ILS) are accredited as per ISO/IEC 17043:2023.



The present scope of accreditation covers: limestone, clinker, cement, fly ash, concrete admixture, water for concrete & coal/coke/pet coke in chemical field and cement, fly ash, aggregate, mortar/concrete, tile (ceramic), burnt clay building brick & steel bar in mechanical field. NCB-ILS has completed 15 PT schemes in the financial year 2023-24. New PT scheme such as NDT for Concrete (ILS/12) and Hydrated Lime (ILS/17) were conducted for the first time in NCB to facilitate the laboratories. The participants were mainly from reputed private laboratories, cement plants, govt. laboratories,

public sector laboratories etc. No. of laboratories participated in the Proficiency testing for the past five years is depicted in the graph as below:

Total Quality Management (TQM)

Total Quality Management programme under CQC provides various consultancy services on Quality Management to cement plants, Academic institutions, Laboratories and R&D organizations etc. The scope of the services under TQM are as under:

- To provide consultancy to laboratories in establishing, Implementing QMS and preparing them to get accreditation as per ISO/IEC 17025:2017
- Training on ISO/IEC 17025: 2017 structure covering the requirements of this international standard.
- To carry out the Gap Analysis of laboratory infrastructure, manpower, equipment and other resources as per ISO/IEC 17025:2017.
- Management, Technical and support processes required to implement ISO/IEC 17025:2017.

During financial year 2023-24, 2 consultancy projects on Laboratory Quality management system as per ISO/IEC 17025:2017 completed while 1 consultancy project on Laboratory Quality Management system is in process.

Completed project during the year:

1. Assistance for getting NABL accreditation as per ISO/IEC 17025:2017 for Quality Control Laboratory of M/s Star Cement Limited, Lumshnong, Meghalaya.
2. Assistance for getting NABL accreditation as per ISO/IEC 17025:2017 for Quality Control Laboratory of M/s Star Cement Limited (Siliguri Grinding Unit), Distt. Jalpaiguri, West Bengal.

Project under progress:

1. Assistance for getting NABL accreditation as per ISO/IEC 17025:2017 for FQA Laboratory of M/s NTPC Limited, Koldam Hydro Power Station, Bilaspur.

Centre for Industrial Information Services–(CIS)

The Centre pursued its activities through six programmes viz. Library, Integrated IT Solutions, Publications & Image Building, Seminars and Conferences, International and National Linkages, and Incubation Centre. CIS collects and disseminates information to cement, building materials and construction industries. Besides other facilities, the Centre includes a modern library and a computer centre.

Library and Information Services

Library added 85 documents to its collection and entries of 50 references to the Bibliographic database taking the total numbers to 47125 documents and 44,700 references respectively. The Bibliographic database is used by scientists for interactive searches.

NCB Ballabgarh Library

Publications & Image Building

Information on technologies and services of NCB is disseminated through NCB Publications regularly. Efforts to widely popularize and promote NCB activities, technology and consultancy services amongst the cement and related building materials industries were continued. The following publications were brought out during the year are as follows:

- NCB Annual Report 2022-23 in English and Hindi versions separately
- News Letter / Special News Letter
- NCB Darpan

National and International Linkages / Collaboration Programmes

NCB has been actively interacting and liaising with a number of international bodies and exchanging knowledge and experience particularly in the area of cement and building materials industries.

MoUs signed by NCB during the year 2023-24 are:

- Shri Vishwakarma Skill University, Dudhola, Palwal
- NTPC Limited, Noida, Uttar Pradesh
- Council of Scientific and Industrial Research (CSIR), New Delhi
- J C Bose University of Science and Technology (YMCA), Faridabad, Haryana

Technical Insight

NCB has been actively interacting and disseminating information with a number of stakeholders and exchanging knowledge and experience particularly in the area of cement and building materials industries. The continued interest of participants in the

areas of alternate fuels and raw materials, climate change, net zero carbon emissions, high performance concrete, nano-technology etc., has led us through to give technical insights for efficient operation of cement plants, making of concrete and other construction activities.

Visitors

Important Visitors (from 1st April 2023 to 31st March 2024)

Date	Name	Organization
10.04.2023	**Shri Babu Lal Meena** Joint Director	Ministry of Commerce and Industry
31.10.2023	**Shri Rajesh Rawat** Under Secretary (Cement Section)-DPIIT	Ministry of Commerce and Industry
22.12.2023	**Shri Sanjiv** Joint Secretary – DPIIT	Ministry of Commerce and Industry
	Shri Neeraj Akhoury President – CMA Managing Director	Shree Cement Ltd.

Participation in Events

The following NCB officials participated in Seminars & Conferences shown against their names during the period:

Sl.No.	Participant(s)	Event
1.	Sh Veddy Venkatesh	"Green Cementech 2023" (Theme: Preparing for a Net Zero Carbon Future) form 18th & 19th May 2023, Organised by Confederation of Indian Industry (CII) at Hyderabad.
2.	Sh P N Ojha Sh Amit Trivedi Dr Sanjay Mundra Sh Nitin Chowdhary Sh Amit Prakash Sh Mantu Gupta Sh Brijesh Singh	"The International Conference on Climate and Disaster Resilient Infrastructure" on 08 September 2023 Organised by ASCE-IS (American Society of Civil Engineers-India Section) at The Ashok Hotel, Chanakyapuri, New Delhi.
3.	Dr Pinky Pandey Ms. Meenu Verma	"15th India Coal Summit" on 22 September 2023 organised by Indian Chamber of Commerce (ICC) at Hotel Le Meridien, New Delhi.
4.	Sh Amit Trivedi	IRF-India Chapter National Conference-cum Exhibition on "Revolutionizing Road Infra with

	Sh Arup Ghatak	Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines, on February 29th – March 1st, 2024 organised by International Road Federation's India Chapter (IRF) at Manekshaw Centre, Parade Road, New Delhi-110 010"

NCB and IIT Hyderabad jointly organized the National Conference on Strategic Solutions & Opportunities for Cement Industry from 24-25 August 2023

NCB and IIT Hyderabad jointly organized a National Conference on Strategic Solutions and Opportunities for Cement Industry on 24 & 25 August 2023 at NCB Hyderabad. More than 130 delegates from prominent cement manufacturing companies and allied industries attended the conference. Technical exhibition was arranged to showcase the advanced and modern technologies and machinery.

Conference was inaugurated by Shri Sunil Sharma, Special Chief Secretary (Energy), Government of Telangana. Shri Krishna Aditya Sriramsetti, Member Secretary, Telangana State Pollution Control Board, attended as the Guest of Honour. On the occasion, Dr L P Singh, Director General-NCB said that the sustainable development requires collective efforts by the industry, research organizations and Government. Dr B Panduranga Rao, Joint Director & Unit In-charge NCB –Hyderabad and Professor K V L Subramaniam, Department of Civil Engineering, IIT Hyderabad welcomed all the delegates.

Plan of actions and strategies were discussed in a panel discussion comprised of experts from multi-disciplinary fields. Expert's panel opined that strong collaboration between industry and research organizations is required to meet the sustainability challenges. There is need for use of green hydrogen in cement manufacturing. Introduction of PAT scheme for CO_2 and green credit system will further boost the cement industry's efforts towards net zero target. Panel urged the government and statutory bodies for the all the possible support to industry in this noble cause.

17th International Congress on the Chemistry of Cement bid wins.

India wins bid to host 17th International Congress on the Chemistry of Cement in 2027. International Congress on the Chemistry of Cement is the largest and most prestigious event of its kind which reviews the progress of research in the area of Cement and Concrete

National Council for Cement and Building Materials (NCCBM) along with IIT Delhi and IIT Madras successfully presented the India's bid before the Steering Committee

members of the ICCC during the 16th ICCC at Bangkok, Thailand. Besides India, other bidders were from Switzerland and UAE. The decision was announced on 20th September 2023 at Bangkok, Thailand during the 16th ICCC. The Indian bid was presented by Dr L P Singh, Director General, NCCBM, Dr S K Chaturvedi, Joint Director, NCCBM and Dr Shashank Bishnoi, Professor (Civil Engg.), IIT Delhi.

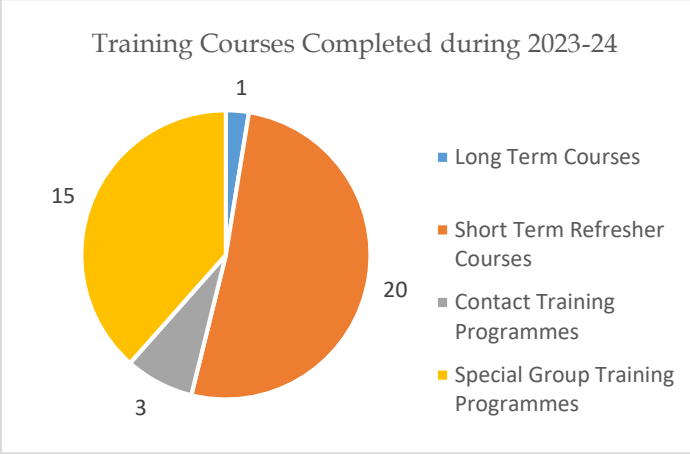
Centre for Continuing Education Services-(CCE)

Centre for Continuing Education Services (CCE), has been organizing various need-based and industry-oriented training programmes at all levels, for the participants from cement, concrete and construction industries since its inception in 1972. Participants comprising of industry professionals and fresh graduates/post-graduates in science and different disciplines of engineering have been benefited. A number of Govt./Semi-govt./Private organizations both from India and abroad have availed the training services of NCB for their engineers and professionals.

During the year 2023-24, 42 training programmes (offline/online) were successfully organized with a total of 636 participants attending the programmes.

The highlights of the training programmes conducted are as under:

Training Programmes completed during 2023-24



Type of Course	No.
Long Term Courses: *PG Diploma in Cement Technology*	1
Short Term Online /offline Courses	20
Contact Training Programmes	3
Special Group Training Programmes	15

Long Term Courses

Post-Graduate Diploma in Cement Technology

In its efforts to develop technological talent for the cement industry, NCB has been regularly conducting Post-Graduate Diploma in Cement Technology since 1983. The course is duly approved by All India Council for Technical Education (AICTE), Ministry of Human Resource Development, Govt. of India.

Eight self-sponsored participants admitted for 2022-23 academic session have successfully completed the course in July 2023. Most of the students were placed in Indian cement industry successfully. In the academic session 2023-24, Fourteen students were admitted in the course.

Short Term Refresher Courses

During the year, 20 (nos.) of Short Term Refresher Training Courses were organized wherein 282 professionals from cement and construction industries participated.

In Cement Technology related area, special emphasis was given to courses such as Diagnostic Studies on Process and Refractory related Problems in Cement Rotary Kiln; Energy Efficiency Initiatives in Cement Industry; Sampling, Testing of Cement as per

BIS Standards; Instrumental Methods of Analysis in Cement Plant; Application of Renewable Energy in Indian Cement Industry; Alternate Fuels and Raw Materials in Portland Cement Manufacture; Calibration and Measurement of Uncertainty of Laboratory Equipment; Laboratory QMS and Internal Audit as per ISO/IEC 17025:2017.

In Concrete and Construction related areas, the training programmes on specific topics were conducted such as; Durability properties of Fresh and Hardened Concrete; Corrosion in Reinforced Concrete Structures and its Remedial Measures; Cracks and Leakages in Concrete Structures: Causes, Prevention and Repair; Concrete Mix Proportions and Acceptance Criteria; Repair and Rehabilitation of Concrete Structures and Non-destructive Testing and Evaluation of Concrete Structures and Repair & Rehabilitation methods of Concrete Structures were organized.

Lecture during Training programme at NCB-H

Lectures during Training programmes at NCB-B

Laboratory Demo Sessions during Training programmes at NCB-B

Contact Training Programmes

On the request of an organization 3 (nos.) of a contact training programme was organized for their official at both NCB's Ballabgarh & Hyderabad unit.

Special Group Training Courses

Fifteen special group training courses on specific topics for the group of engineers/professionals were organized online/offline for the following organizations at NCB-Ballabgarh & Hyderabad units:

Sl No.	Organization	Topics of the Courses Organized
1	M/s Power Grid Corporation Ltd. (PGCIL)	➢ Concrete Technology
2	M/s The Indian Cement Limited (ICL)	➢ Concrete Mix Proportions & Acceptance Criteria
3	M/s Hindustan Petroleum Corporation Ltd. (HPCL)	➢ Quality Control & Quality Assurance in Concrete Structure
4	M/s. Bharathi Cement & M/s. Kalburgi Cement	➢ Cement Manufacturing Technology
5	M/s Aditya Cement Works	➢ Perform Achieve & Trade (PAT) - Rules Awareness and Recent Development
6	M/s Irrigation Management Training Institute (IMTI), Govt. of Tamil Nadu	➢ QC & QA in Concrete Construction for Irrigation Projects 0(4 batches)
7	M/s National Thermal Power Corporation Ltd. (NTPC)	➢ Quality Control & Quality Assurance in Concrete Structure (2 batches)
8	M/s Water Resource Department (WRD), Nagpur, Govt. of Maharashtra	➢ QC & QA in Concrete Construction and Piped Irrigation Network
9	NCB-H	➢ Modern Construction Practices for Durable & Sustainable Infrastructure
10	NCB-B	➢ Calibration and Measurement of Uncertainty of Lab Equipment
11	NCB-H	➢ Optimisation of Grinding Systems to Improve Productivity and Energy Efficiency in Cement Industry

Participants of NTPC Ltd.during Special Group Training Programme at NCB-Ballabgarh Unit

Participants of IMTI, Tamil Nadu.during Special Group Training Programme at NCB-Ballabgarh Unit

Participants of Govt. of Maharashtra during Special Group Training Programme at NCB-Ballabgarh Unit

Participants of IMTI, Tamil Nadu. during Special Group Training Programme at NCB-Ballabgarh Unit

Training programme on Cracks and Leakages in Concrete Structures: Causes, Prevention, Repair & Rehabilitation at NCB-H

LIST OF NCB OFFICIALS WHO HAVE UNDERGONE TRAINING

Sl No	Name of the Official	Title of course	Name and address of Training Organisation	Duration and Period
1 2 3 4 5 6	Sh Pavan Kumar Sh Vikas Singh Sh Pawan Sh Sarfraj Khan Sh Parmod Kumar Kaushik Ms Moon Chourasia	Sampling and Testing of Cement as per BIS Standards	NCB-B	3 day 10-12 May 2023
1 2 3 4	Ms Moon Chourasia Sh Abhishek Sh Bharat Bhushan Sh Giasuddin Ahamed	Optimization of Cement Grinding Systems to Improve Productivity & Energy	NCB-B	2 day 15-16 June 2023

		Conservation		
1 2 3 4 5 6 7 8 9 10 11 12 13 14	Sh P Srikant Sh V Naga Kumar Sh Bharat Ram Sh Rishi Raj Sh Vishnu Dutt Ms Jyotsna Sh Babu Lal Sh Kishan Sh Ravendra Singh Ms Kalpna Sharma Ms Meenu Verma Sh Pawan Kumar Ms Beauty Ms Priyanka Kaushik	Calibration and Measurement of Uncertainty of Lab Equipment	NCB-B	3 day 21-23 June 2023
1 2	Sh Anand Bohra Sh KPK Reddy	Environmental Management System (IS/ISO 14001:2015	NITS, Noida	5 day 10-14 July 2023
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Sh Anil Kumar Popuri Sh Kapil Kukreja Sh Ankur Mittal Sh S K Shaw Sh Anand Bohra Sh KRP Nath Sh KPK Reddy Sh Prateek Sharma Sh V naga Kumar Sh Veddy Venkatesh Sh Saurabh Bhatnagar Sh Vinay Kant Sh Rayees Ahmed Ms Moon Chourasia Sh Bharat Bhushan Sh Soubhagya Ranjan Patnaik	GHG Lead Verifier Training & Certification	NCB-B	4 day 08-11 Aug. 2023

NCB Hyderabad

NCB Hyderabad Unit

NCB Hyderabad is the regional centre established in 1982 in a sprawling campus having world class testing, R&D and training facilities. The activities of NCB Hyderabad are illustrated through the respective centers which provide various testing, R&D facilities, training, energy auditing, Third Party quality assurance and other consultancy services to the cement and construction industries. The unit has adopted quality management systems and certified with ISO 9001:2015.

Centre for Cement Research and Independent Testing (CRT):

Centre for Cement Research and Independent Testing (CRT), Hyderabad unit executes its activities in the areas of Research and development studies, Industry sponsored projects and testing services. Laboratories are NABL accredited (TC-7692), BIS recognised (OSL-6114835), ISO certified, and equipped with state-of-art facilities.

Main areas of activity under CRT are:

- Independent testing laboratories has the facilities for evaluation of chemical, mechanical, mineralogical and microstructure analysis of various raw materials, in-process materials in cement production, fuels, clinker, pozzolanic materials, industrial slags, industrial waste and by-products, hydraulic cements, aggregates, water used in construction, bricks, concrete, admixtures etc. About 1428 samples have been analyzed during 2023-24.
- Development of plant specific standards for calibration of XRF
- Optimization of raw mix to improve clinker productivity
- Utilization of Industrial by-products in cement production
- Establishing Limestone Consumption Factor

Development of Plant Specific Standards for Calibration of XRF:

XRF plays crucial role in quality control in cement plants. Accuracy of the results of XRF for the most part depends on the standards used for the calibration of equipment. NCB developed a programme for preparation of plant specific secondary working standards for calibration of XRF, so as to maximize the accuracy of the results. NCB successfully completed several projects for the various materials being used in cement industry, viz., limestone, additives, raw meal, kiln feed, clinker, cement etc. Collected samples from the plants are analysed in NCB laboratories using different analytical techniques for chemical composition. Assigned true values after the analysis of generated data from different NCB laboratories are used to calibrate the XRF of plant laboratories. Critical samples like check samples, drift correction sample etc. along with developed standard samples are provided to the plants for regular monitoring of the performance of XRF.

Raw Mix Design to Improve Clinker Productivity:

With the introduction of alternate and un-conventional materials into cement industry, optimization of raw mix design has become a challenging task. NCB is

providing services in the area of raw mix design to maximize the use of AFR and to improve clinker productivity with available raw materials.

Establishing Limestone Consumption Factor (LCF):

Limestone consumption factor indicates the amount of limestone consumed by the cement plant for production of 1Tonne of clinker. This study is helpful in monitoring of the limestone reserves and planning of the mining activities.




Centre For Quality Management, Standards & Calibration Services (CQC):

Calibration of around 223 Proving Rings (50kN, 100kN, 250kN, 500kN, 1000kN, 2000kN) from cement and allied industries, testing laboratories & educational institutions was completed, which helps in maintaining the accuracy of compressive strength measurements. New calibration laboratory was set up with the scope established in the areas of thermal, dimension, mass, volume and force (Proving rings). The laboratory is in the process of obtaining NABL accreditation.


Centre for Construction Development and Research (CDR)

Centre for Construction Development and Research (CDR) contributes to application of scientific and technical knowledge in developing durable and sustainable civil infrastructure in the southern region of India. The Centre provides services to the cement, concrete, Building materials and construction industry through the structured programmes namely Concrete Technology (CON), Structural Assessment and Rehabilitation (SAR) and Construction Technology and Management (CTM).

Structural Assessment and Rehabilitation (SAR):

The distress evaluation, condition assessment, repair and rehabilitation of existing structures such as buildings and industrial structures are becoming increasingly important to make them functional and conforming to the safety and serviceability requirements as these structures are aging, affected by environment conditions, fire damaged structures and heritage structures. RCC Structures were investigated by using visual observations, non-destructive evaluation technique (NDE), partially destructive tests and other field tests followed by laboratory tests on extracted core samples and chemical analysis of hardened concrete as per BIS and international standards. The investigation was generally followed by recommendation for repair and rehabilitation with state of art repair materials and implementation techniques for distressed RC structures covering specifications, cost estimates and bill of quantities and quality inspection during the repair of RCC structures is also conducted. Structures have been investigated for various clients viz., NTPC plants, NSPCL plants in Chhattisgarh& West Bengal, CCI Tandur, Powergrid Corporation of India in Andhra Pradesh, Telangana &Karnataka, Singareni Thermal Power Plant in Jaipur, Telangana etc.,

Construction Technology and Management (CTM)

Third Party Quality Assurance/Audit (TPQA) services have been provided to enhance the program's effectiveness and the opportunities for innovation in the construction industry for a wide range of construction projects such as institutional buildings, residential buildings, skill development centres, hostel blocks, etc in southern states viz., Telangana, Andhra Pradesh, Tamil Nadu and Karnataka. With strong organizational and leadership capabilities in management of construction projects, the centre is associated with various Central/ State/ Autonomous Organizations in delivering durable buildings and structures to meet specified quality standards by ensuring quality workmanship, good construction practices, use of quality materials etc. and inspections done in accordance with ISO/IEC 17020:2012 Type 'A' Accreditation standards.

Third Party Quality Assurance/Audit (TPQA) services have been provided for various clients Tamil Nadu Trade Promotion Organization (TNTPO), Indian Institute of Science (IISc) Bangalore, Income Tax Department Bangalore, CPWD (Chennai, Bangalore) Projects etc.,

Concrete Technology (CON)

Testing & evaluation of concrete making materials and conducting various grades of concrete mix proportions, using different types of cements like OPC, PPC, PSC and different kinds of aggregates to enhance durability including analysis and Interpretation of Test results for Civil works for various central/state/PSUs/Private limited organizations was taken up.

Industry Interaction/Site visit photos:



Centre for Mining, Environment, Plant Engineering and Operations (CME):

Sponsored projects carried out:

Project management consultancy for setting up a 600 TPD cement plant in Mafoubou, Tao Tao, Republic of Congo.

The objective of this project is to set up a 600 TPD cement plant in Republic of Congo. NCB is providing the project management consultancy services. NCB-H is associated with NCB-B and NCB-Hyderabad team monitored the civil, electrical and instrumentation aspects of the project. The ongoing project includes evaluation of technical specifications, E&I drawings etc and factory inspections for inspecting quality of equipment's before dispatch to manufacturing location.

Diagnostic study for corrosion of various ducts and chimneys of line-1 and line-2 of M/S KCP Ltd., Mukthyala Cement Plant

Plant approached NCB for conducting a diagnostic study to identify the causes of corrosion occurred at various process ducts and APCE ducts. NCB team visited the plant and Physical inspection was done at various corrosion affected areas for identifying the preliminary causes and carried out various measurements of dust load, gas moisture, gas composition, temperature, pressure and other process parameters in two lines. Various samples of raw materials, fuel and clinker were collected for the laboratory analysis. Based on the plant measurements and lab analysis of the materials it was found that the corrosion is due to acid formation in the ducts due to presence of sulphur in the materials and process temperature differences. Relevant data on process modifications and raw materials were collected and report submitted to the plant on same.

Dust load Measurement at Various Ducts in Pyrosystem, For M/S Rajashree Cement Works:

Monitoring of Dust load at Various Ducts in Pyro system, For M/S Rajashree Cement Works of Ultratech Cements Ltd., Malkhed, Karnataka. The return dust concentration in the preheater down comer and dust load input to the coal mill through hot gas from the preheater outlet were measured at Line-1,2, 3 & 4 to determine grain load increase due to the dust entering the coal mill through hot gas and preheater cyclone dust separation efficiency.

Measurement of Dust Concentration at various points of Two lines of M/s APCW, UTCL, Bhogasamudram, Tadipatri, Andhra Pradesh:

Monitoring of Dust load at Various Ducts in Pyro system, For M/S Andhra Pradesh Cement Works of Ultratech Cements Ltd., Tadipatri, Andhra Pradesh. The return dust concentration in the preheater down comer and dust load input to the coal mill through hot gas from the preheater outlet were measured at Line-1& 2 to determine grain load increase due to the dust entering the coal mill through hot gas and preheater cyclone dust separation efficiency.

Third Party Quality Assurance (Electrical & Mechanical):

The electrical & mechanical quality assurance activities have been taken up in different projects. TPQA electrical team inspected different construction projects like institutional buildings, Convention & Exhibition centers and staff quarters etc in Karnataka and Tamilnadu. The activities carried out at various project sites were verification of procured items, workmanship, use of digital instruments for various measurements, testing of various samples to ensure the quality of items, factory inspection for testing of major items and submitting the detailed inspection report to clients.




Centre for Continuing Education (CCE)

Centre for Continuing Education (CCE) centre organized various training courses to meet the needs of professionals from cement, concrete & construction industry. The centre has well established training complex with excellent infrastructure of class rooms of capacities up to 100 seating capacity with video conferencing facilities. A hostel block (25 Rooms) attached to the training complex is available for providing residential facility to participants. NCB has imparted training to various cement and construction companies across various levels of human resources to enhance the momentum of "National Skill Development Program" CCE Hyderabad organised

short term courses for Cement industry & Construction industry on physical mode at NCB Hyderabad unit.

CCE Hyderabad organised four short term refresher courses for Cement industry and eight short term refresher courses for Construction industry in physical mode. Hands on training was imparted through Contact Training Programme on Chemical Testing of Cement by EDTA method. Around 45 participants benefited through NCB Training from Cement Industry representing Chettinad Cement Corp. Pvt. Ltd, The Ramco Cements Ltd, Ultratech Cement Ltd, Sagar Cements, The India Cements ltd, JSW Cement, PennaCement Industries Ltd, Andhra Cement Ltd, etc.

Around 158 participants benefited through NCB Training from Civil & Construction Industry representing State Bank of India, Vikram Sarabhai Space Centre, Chennai Petroleum Corporation Limited, Rites Ltd, State Bank of India, Reserve Bank of India, Chhattisgarh State Power Generation Company Limited, Nuclear Fuel Complex, NTPC, OHPC, ONGC, AP Transco, Oil India Limited, GMR Airport Developers Limited, VST Industries Ltd, Civil Tech Consultants and Engineers, India Institute of Space Science and Technology etc.

CCE-H conducted Four Special Group Training Programmes on Concrete Mix Proportions and Acceptance Criteria for the officials of M/s. The India Cements ltd, Optimization of grinding systems to improve productivity & energy efficiency in cement industry, Modern Construction Practices for Durable & Sustainable Infrastructure and 3 Weeks Special Group Training Programme on Cement Manufacturing Technology for the officials of M/s. Bharathi Cement & M/s. Kalburgi Cement around 64 participated in the sessions. Hands on training was imparted through two Contact Training Programmes on Physical & Chemical Testing of Cement (OPC, PPC) & Fly ash for M/s. Standard Tec Engineers, HYD and Chemical testing of Cement by EDTA method was conducted. Three members Participated in these training programmes.

Glimpses of Training Programmes:

Training Methodology & Environment

The training techniques include lectures, group discussions, case studies, field visits, audio-visual, presentations, educational films, experience sharing, laboratory practical sessions, demonstration and hands-on training. Two-way interaction between the faculty and participants is encouraged.

Training Infrastructure:

Lab Demonstration / Hands-On Practices:

NCB's laboratories are equipped with most modern and state-of-the-art equipment for providing complete range of evaluation and testing facilities both for cement and concrete industries. The participants are familiarized with the latest equipments and testing techniques during demonstration/ hands-on practice sessions.

Events Organised

NCB and IIT-Hyderabad jointly organized a National Conference on Strategic Solutions and Opportunities for Cement Industry on 24 & 25 August 2023 at NCB Hyderabad. Conference was inaugurated by Shri Sunil Sharma, Special Chief Secretary (Energy), Government of Telangana.

Shri K A Sriramsetti, Member Secy, Telangana State Pollution Control Board attended as the Guest of Honour. On the occasion, Dr L P Singh, Director General-NCB said that the sustainable development requires collective efforts by the industry, research organizations and Government

More than 130 delegates from prominent cement manufacturing companies and allied industries attended the conference. Technical exhibition was arranged to showcase the advanced and modern technologies and machinery.

Future plan of actions and strategies were discussed in a panel discussion comprised of experts from multi-disciplinary fields. Expert's panel opined that strong collaboration between industry and research organizations is required to meet the sustainability challenges.

There is need for use of green hydrogen in cement manufacturing. Introduction of PAT scheme for CO_2 and green credit system will further boost the cement industry's efforts towards net zero target.

Technical exhibition was arranged to showcase the advanced and modern technologies and machinery. Conference was inaugurated by Shri Sunil Sharma, Special Chief Secretary (Energy), Government of Telangana.

Participated in National Technology Day 1stMay 2023 organised by NCB-B through virtual mode

DG Interaction with NCB-H staff on 31 Jan 2024

Engaged in an inspiring startup discussion, exploring innovation ideas and future opportunities on 6th Feb 2024

Visit of Vardhaman College of Engineering students to NCB-H


Republic Day Celebrations on 26th Jan 2024.


Independence Day Celebrations on 15th Aug 2023.


Women day celebrated at NCB-H on 8th March 2024

NCB Ahmedabad

NCB Ahmedabad Unit

NCB Ahmedabad testing laboratory was established in 2001 at Ahmedabad and undertook testing jobs for cement, construction and allied industries within India. NCB Ahmedabad testing laboratory achieved a hallmark when NABL accredited them in the year 2017 and since then, the quality of testing services is maintained through NABL accreditation. The laboratory is BIS recognized, ISO certified facilitating smooth and efficient operations with state-of-art instrumental facilities to carry out the tests. NCB Ahmedabad Unit has essential facilities for testing of cement, concrete, steel and soil in order to provide Quality Assurance and Quality Control (QA-QC) and Third Party Quality Assurance (TPQA) services to the construction industry. Unit providing testing and TPQA services to various Government agencies of Gujarat, Union Territory (UI) of Daman & Diu and Dadra & Nagar Haveli. The following facilities are available with testing lab in Ahmedabad:

- Cement and Cementitious Materials such as OPC, PPC, PSC, Fly ash, Slag, Silica-fume etc. – Complete physical and chemical characterization
- Aggregates – Complete physical analysis
- Soil – Complete physical analysis for classification of soil

NCB Ahmedabad Testing Laboratory undertake complete physical and chemical, analysis of various types of cement, Pozzolana, admixtures, water and physical analysis of aggregate, concrete, bricks, coal, reinforcement etc as per National and International standards.

Services Offered at NCB Ahmedabad

Testing Facilities Available for the Following Materials

- Physical and chemical characterization of Cement and Cementitious Materials such as OPC, PPC, PSC, Fly ash, Slag, Silica-fume etc.
- Aggregates – Complete physical analysis
- Special Concrete, Advance Concrete Composite & Standard Concrete Mix Designs
- Mix design of Ordinary concrete, standard concrete and High Strength Concrete using OPC, PPC, PSC, OPC + fly ash, OPC + Fly ash + silica fume etc.
- Soil – Complete physical analysis for classification of soil
- Reinforcement – Complete physical analysis of steel up to 32 mm dia reinforcement
- Water & Admixture – Complete chemical analysis

Concrete Technology Services Offered

- Evaluation of concrete making materials like Cement and Cementitious Materials such as OPC, PPC, PSC, Fly ash, Slag, Silica-fume etc., aggregates, etc.

- Mix design for ordinary, special and advanced concrete like high strength concrete, self-compacting concrete, pavement quality concrete, dry lean concrete etc.
- Studies on fresh properties and mechanical hardened properties of concrete.
- Service life design & durability studies on concrete including accelerated tests for carbonation induced corrosion, alkali aggregate reactivity, chloride induced corrosion, sulphate attack etc. These studies are taken up in collaboration with NCB Ballabgarh.

Structural Assessment & Rehabilitation Services Offered

- In-situ quality assessment, durability investigation and residual life assessment of concrete structures.
- Distress investigations of buildings, bridges, dams, power plants, chimney, silo etc. deteriorated due to aggressive environment or fire damaged structure.
- Consultancy for repairs/rehabilitation & retrofitting can be done in collaboration with NCB Ballabgarh.
- Load testing and assessment of load carrying capacity of structural members can be done in collaboration with NCB Ballabgarh.

Studies Undertaken for Structural Assessment & Rehabilitation for the year 2023-24

- Non-Destructive Evaluation of 4 Nos Column of Overhead Water Tank at RAF Vastral, Ahmedabad-Reg.

Construction Technology & Management Services Offered

- Technical Audit (TA), Quality Assurance & Quality Control (QA/QC) and Third Party Quality Audit (TPQA) of new constructions- residential, commercial &; institutional buildings; flyovers, concrete roads, bridges etc.
- Third Party Inspection and Monitoring for construction projects such as Buildings, Roads, Underpasses, Over Bridges, Drains, Causeway etc. of OIDC & PWD at Daman Diu & Dadra Nagar Haveli (Union Territory).
- Third Party Audit & Quality Assurance for Retrofitting, Reconstruction of Health care facility buildings and other allied works for Project Implementation Unit & Roads & Buildings Department (Government of Gujarat)
- Technical Audit and Quality Assurance including testing of materials, repairs, retrofitting, reconstruction of building etc. for major reconstruction projects of earthquake affected areas for Gujarat State Disaster Management Authority (GSDMA)
- Third Party Inspection (TPI) for Quality Assurance and Inspection of Materials for Sports Infrastructure Project of Sports Authority of Gujarat in Gujarat region.
- Third party Technical Supervision, Monitoring & Quality Assurance for construction of new yard including building, road, earth works, fire Hydrant

System, Water supply, Strom Water Drain, Electro Mechanical works, Landscaping and ancillary works for The Agricultural Produce Market Committee-Amreli & Rajkot, Gujarat.

- Third Party Inspection (TPI) For Quality Assurance and Inspection for various structures of Narmada main canal, branch canal, distributaries, minor canal etc. at various sites of Sardar Sarovar Narmada Nigam Limited in Gujarat region.

Studies Undertaken for Construction Technology & Management for the year 2023-24

- Third Party Inspection and Monitoring of Construction of fly over Bridges at two major junctions of Ring Road stretches forming at Dokmaradi (Point F) on Silvassa Kilvani Road and at point c crossing Silvassa Sayali Road in UT of D & NH.(PWD Silvassa)
- Third Party Inspection and Monitoring (TPIM) for the work of Construction of High Level Bridge across river Damanganga at Athal on Silvassa Naroli Road (EPC Mode) in the District of UT of Dadra & Nagar Haveli (D&NH), Silvassa

A glimpse of Laboratory Activities at NCB-Ahmedabad



Testing Facility of Compressive Strength of Concrete Cube and Cement Mortar Cube.

Temperature Controlled Condition for Cement Testing Unit

Chemical Testing Laboratory

Testing Facility for Physical Analysis of Coarse & Fine Aggregate

Universal Testing Machine for Reinforcement Testing facility at NCB Ahmedabad Unit

A glimpse of Third-Party Inspection & Quality Assurance project at NCB-Ahmedabad

Third party inspection and monitoring (TPI-M) Construction of fly over bridges at two major junctions of ring road stretches forming at Dokmardi (point f) on Silvassa Kilvani road and at point c crossing Silvassa Sayli road in UT of Dadra & Nagar Haveli

Third Party Inspection and Monitoring (TPIM) for the work of Construction of High-Level Bridge across river Damanganga at Athal on Silvassa Naroli Road (EPC Mode) in the District of UT of Dadra & Nagar Haveli (D&NH), Silvassa

Non-Destructive Test Evaluation Technique for 4 Nos Column of Overhead Water Tank at RAF Vastral, Ahmedabad-Reg- Central Public Works Department- Ahmedabad

NCB Bhubaneswar

NCB Bhubaneswar Unit

NCB Bhubaneswar was established during the year 2016 and the laboratory was set up in a space provided by IDCO, Odisha at Mancheswar Industrial Estate (M.I.E) as per the MoU (during 2016-21) signed between NCB and IDCO, Odisha. NCB has established material testing laboratory in the above shed referred as Independent Testing Laboratory (ITL), NCB Bhubaneswar and the same has been got accredited through NABL for both Mechanical & Chemical parameters in testing of building materials.

NCB Bhubaneswar Unit Expansion

During 2022 NCB has procured of about 1.0-acre land and ready to occupy shed fromIDCO, Odisha for Construction of Research & Laboratory facility (G+2) to setup full-fledged laboratory and office to provide technical services, testing and skill development services to Cement Industries & construction sector in the state of Odisha and neighbouring states. Building Works Committee (BWC) after several interactions has finalized the plans and Construction of Research & Laboratory building is being executed by CPWD as deposit work.

There are, at present, mainly four activities/services carried at NCB Bhubaneswar Unit viz.

1. Independent Testing Laboratory (ITL)- Building Material Testing Services
2. Third Party Quality Assurance (TPQA)- Quality Assurance and Audit Services
3. Structural Assessment and Rehabilitation (SAR)-Condition Assessment of Structures
4. R&D in utilization Industrial waste in constructions

The above activities are illustrated below:

Independent Testing Laboratory (ITL):

ITL is involved in testing of construction materials for industry supported projects. The Chemical Laboratory was established to provide technical support to the cement industry in Odisha and its neighboring states like West Bengal, Jharkhand, Bihar, Chhattisgarh and Northeast Indian states.

Testing facilities available at ITL NCB Bhubaneswar are listed below:

1. **Mechanical Testing Laboratory of Building Materials**

   Laboratory for Mechanical Testing of Hydraulic Cement, Hardened Concrete, Building Bricks, Coarse Aggregate, Fine Aggregate, Soil, Tiles, Granite, Paver

Blocks, Marble, CC Chequred Tiles, AAC Blocks etc. NABL Accreditation (TC-9004) and re accreditation was obtained.

Building Materials Testing services have been extended to various clients including Odisha Industrial Infrastructure Development Corporation (IDCO). H &UD, OBCC, CPWD, NTPC, NBCC, Paradip Port Authority, Bridge & Roof, Rites etc., and for various Cement Factories in Odisha and Neighboring States.

2. Chemical Testing Laboratory of Cement and Cementitious Materials

Chemical testing laboratory for hydraulic cement (OPC, PPC, PSC, composite cement), cement-based materials (Flyash, Slag), construction water, etc. NABL Accreditation (TC-9004) obtained.

Mechanical & Chemical Laboratory:

View of Cement Testing Laboratory

View of Concrete Testing Laboratory

View of Chemical Testing Laboratory

View of Aggregate Testing Laboratory

Building Material's Testing -Clientele

- Cement Plants like Nuvoco, JSW, Sagar Cement, Dalmia, Shree Cements, JK Lakshmi
- OSRTC,Odisha
- H&UD, Odisha
- OBCC, Odisha
- BDA, Odisha

- NTPC Sipat
- NTPC Kaniha
- NBCC, Odisha
- Rites, Odisha
- Bridge & Roof, Odisha
- Paradip Port Authority, Odisha
- Various Municipal Bodies, Odisha

TPQA Projects

- Currently NCB Bhubaneswar is providing TPQA services to NBCC Odisha for various projects in Odisha
- TPQA Projects of M/s Paradip Port Trust Ltd, Odisha
- TPQA Projects of M/s OSRTC, Odisha

R&D Sponsored projects in progress

Under project-based support to Autonomous Institutions

- Stress-Strain Behavior of High-Performance Geo Polymer Self Compacting Concrete Mix and its performance evaluation.
- Start of Project: April 2023, Duration: 2 Years

BWC Meeting for Infrastructure Development of NCB Bhubaneswar

2nd BWC Meeting on 19.04.2023 (VC)

3rd BWC Meeting on 08.05.2023 (VC)

Geo Technical Investigation of Building Site - Research & Laboratory building at NCB Bhubaneswar

R& D Project CON-17 samples under observation at NCB Bhubaneswar

Research & Laboratory building at NCB Bhubaneswar

TPQA Activities photos

TPQA Inspections of 1st Phase AMA BUS STAND Buildings, OSRTC in Odisha

TPQA Inspections of Command and Control Centre, Market complex Buildings, OSRTC in Odisha




Photos of TPQA Site Inspection of various project site at Paradip Port, Odisha



TPQA Site Inspection Project at NBCC Jaipur and KNDA Vyasa Nagar Project Sites



TPQA Site Inspection Project at NBCC IIT Bhubaneswar Project Site




SAR (NDT) Testing of various projects of CPWD, Bhubaneswar

SAR (NDT) Testing of Building at Puri, Odisha

SAR (NDT) Testing of Steel Water Tank at Puri, Odisha

Sample testing witnessing by representatives of various clients at NCB Bhubaneswar

Independence Day

Republic Day

Visit by DPIIT Official Sh. PK Pattnaik

Swatchhata Abhiyan

Swatchhata Abhiyan

Present View of NCB Bhubaneswar Laboratory

Physical Testing-Testing of Soil Samples



Chemical Testing-Cement, Cementitious Materials

Published Research Papers

Published Research Papers

The following papers were contributed by NCB scientists in various Technical Journals/Magazines

Centre for Cement Research and Independent Testing – (CRT)

1. Usage of lime sludge waste from paper industry for production of Portland cement Clinker: Sustainable expansion of Indian cement industry (2023) A.K.Dikshit*, Sandeep Gupta, Sanjeev K. Chaturvedi, Lok Pratap Singh, Case Studies in Chemical and Environmental Engineering Journal (***Elsevier***) Volume 9, June 2024, 100557. **IF 7.93**

2. Incorporation of Nylon-11 into poly (vinylidene fluoride) gel electrolytes membrane for high safety lithium-ion batteries (2024) Asok K. Dikshit, Journal of Sol-Gel Science and Technology (***Springer***), 109, 246-259, https://doi.org/10.1007/s10971-023-06267-8. **IF 2.606**

3. Technology: Transformative Force, Asok Kr. Dikshit, Richa Majumder, Sanjeev Kr. Chaturvedi and Lok Pratap Singh, India Cement Review (SGSC), Annual Issue 2024, P.82-86.

4. Innovative AFR, Asok Kr. Dikshit, Richa Majumder, Sanjeev Kr. Chaturvedi and Lok Pratap Singh, India Cement Review (SGSC), December 2023, Vol.38, No.5, P.61-65.

5. Future Potential Materials (2023) Asok Kr. Dikshit, Richa Majumder, Sanjeev Kr. Chaturvedi and Lok Pratap Singh, India Cement Review (SGSC), November 2023, Vol.38, No.4, P.59-64.

Centre for Mining, Environment, Plant Engineering & Operation – CME

1. Kapil Kukreja, Manoj Kumar Soni, Bibekananda Mohapatra, M V Ramachandra Rao. Decarbonizing of the Indian Cement Industry through Alternative Fuels- Challenge of Transfer Chute Jamming, Asian Journal of Water, Environment and Pollution. Asian Journal of Water, Environment and Pollution, Vol. 20, No. 5 (2023), pp. 71-77. DOI 10.3233/AJW230067

2. Kapil Kukreja, Manoj Kumar Soni, Bibekananda Mohapatra, DK Panda. Impact Assessment of Alternative Fuels on Production Cost, Plant Operation and Environment- Case Study of Indian Cement Industry. Sustainable Energy Technologies and Assessments. https://doi.org/10.1016/j.seta.2023.103300

3. Prateek Sharma, Pratik N Sheth, Subhadip Sen, Aspen plus simulation of an inline calciner for white cement production with a fuel mix of petcoke and producer gas. Energy https://doi.org/10.1016/j.energy.2023.128892

4. Prateek Sharma, Pratik N Sheth, Moon Chourasia and B N Mohapatra, Chemical characterization of refuse derived fuel (RDF) using Py-GC/MS,

Journal of Analytical and Applied Pyrolysis. https://doi.org/10.1016/j.jaap.2024.106456

5. Manish Sharma Timilsina, Subhadip Sen, Bibek Uprety, Vashishtha B Patel, Prateek Sharma, Pratik N Sheth, Prediction of HHV of Fuel by Machine Learning Algorithm: Interpretability Analysis using SHAP. Fuel https://doi.org/10.1016/j.fuel.2023.129573

Centre for Construction Development and Research – CDR

1. Pranay Singh, P N Ojha, Brijesh Singh, Abhishek Singh, Crack Detection and Crack segmentation in concrete beams undergoing mode I fracture using computer vision and Convolutional Neural Network, Canadian Journal of Civil Engineering, April 2023.

2. Amit Trivedi, Manish Mandre, Brijesh Singh, P N Ojha, Role of Material Selection in Mix Optimization of 3d Printable Concrete, Cement and Its Application Journal, May 2023.

3. P.N. Ojha, Brijesh Singh, Amit Trivedi, Pranay Singh, Chirag Pede, Abhishek Singh, Short term mechanical performance and flexural behavior of reinforced slag-flyash based geopolymer concrete beams in comparison to OPC based concrete beams, Research on Engineering Structures & Materials, June 2023.

4. B N Mohapatra, Puneet Kaura, P N Ojha, Brijesh Singh, Sumit Kumar, Versha Liju, Fresh, hardened and durability properties of concrete made with Fly ash and limestone based Portland composite cement, Journal of Asian Concrete Federation, June 2023.

5. Pranay Singh, Brijesh Singh, P N Ojha, Abhishek Singh & Amit Trivedi, Fracture behavior of slag & flyash-based geopolymer concrete in comparison with OPC-based conventional concrete including the effect of steel and hybrid fibers, Revista Ingeniería de Construccion RIC Chillee, August 2023.

6. Brijesh Singh, Pranay Singh, P N Ojha and Abhishek Singh, Experimental study on stress-strain characteristics of very high strength concrete and its effect on stress block parameters for flexural design of building, Research on Engineering Structures & Materials, September 2023.

7. P.N. Ojha, Abhishek Singh, Amit Trivedi, Brijesh Singh, Nitin Chowdhury, Evaluation of coal based bottom ash as an alternative to fine aggregate in concrete: recommendations for specifications of bottom ash and its concrete mix design, Research on Engineering Structures & Materials, December 2023.

8. P.N. Ojha, Puneet Kaura, Brijesh Singh, Studies on mechanical performance of treated and non-treated coarse recycled concrete aggregate and its performance in concrete-an Indian case study, Research on Engineering Structures & Materials, February 2024.

Papers Presented in Seminars and Workshops

The following papers were contributed / presented by NCB experts to / in different National and International Conferences, Seminars and Workshops:

Centre for Mining, Environment, Plant Engineering & Operation – CME

1. Sharma, P., Kukreja, K., Reddy, K.P.K., Mittal, A., Panda, D.K., Mohapatra, B. (2023). Refuse Derived Fuel (RDF) Co-processing in Kiln Main Burner in a Cement Plant: A Case Study. In: Doolla, S., Rather, Z.H., Ramadesigan, V. (eds) Advances in Clean Energy and Sustainability. ICAER 2022. Green Energy and Technology. Springer, Singapore. https://doi.org/10.1007/978-981-99-2279-6_28

2. Saurabh Bhatnagar, Ojas Pravin Rahate, K. P. K. Reddy, D. K. Panda, L. P. Singh, Hydrogen production potential through PEM electrolysis using Organic Rankine Cycle based Waste Heat Recovery System of a Cement Plant, ICAER 2023, 14-15 December 2023, IIT Bombay

3. Kapil Kukreja, Manoj Kumar Soni, D K Panda, Bharat Bhushan, Efficient Waste to Energy in Cement Plants: DEM Simulation Driven Transfer Chute Design, 13th IconSWM-CE & IPLA GF 2023

4. Presentation at 4th Virtual Middle Eastern/African Cement Seminar on TEF and consultancy services for setting up of shredded tyre feeding system in a cement plant

5. Presentation on cement manufacturing process organized by NPTI Badarpur under Advance EE technologies in Cement Sector

6. Presentation on renewable energy for cement industry at 9th Global Summit on Renewable Energy and Resources

7. Presentation on novel waste heat recovery technologies at Jodhpur conference organized by BEE under ASPIRE Programme to reduce carbon emissions in the Indian Cement Sector

8. Presentation on Waste gasification on National Technology Day 2023

9. Presentation on Plastic waste on World Environment Day 2023

Centre for Construction Development and Research – CDR

1. P N Ojha and Brijesh Singh, Mechanical Performance of Ultra-High Performance Concrete for Bridge Applications, IABSE, New Delhi, India, September 2023.

Publication & Membership of Technical Committees

Representation of NCB Officials in Various Technical Committees

NCB is actively involved with a large number of overseas and Indian organizations in formulating and revising standards and policies through membership or otherwise. The Director General and other officials continued to serve on a number of committees constituted by the Government of India, the Bureau of Indian Standards and other organizations as follows:

Dr. L P Singh, Director General

a. Member of Civil Engineering Divisional Council (CEDC) of Bureau of Indian Standards (BIS), Govt. of India

b. Chairman of Cement Sectoral Committee for PAT Scheme of Bureau of Energy Efficiency (BEE), Govt. of India.

c. Chairman of Cement Sectoral Committee for CCTS of Bureau of Energy Efficiency (BEE), Govt. of India.

Dr. S K Chaturvedi, Joint Director

a. Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.

b. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.

c. Member, Cement, Pozzolana and Cement Additives Subcommittee (CED 2:1), Bureau of Indian Standards, New Delhi.

d. Member, Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.

e. Member, Refractories Sectional Committee (MTD 15), Bureau of Indian Standards, New Delhi.

f. Member, Expert Appraisal Committee, MoEF&CC

Dr. D K Panda, Joint Director

a. Member, Stones Sectional Committee (CED 6), Bureau of Indian Standards, New Delhi.

Sh. P N Ojha, Joint Director

a. Member, CIVIL Engg. Divisional Council (CEDC), Bureau of Indian Standards, New Delhi.

b. Member, Panel for Revision of Handbooks (CED 2/P2), Bureau of Indian Standards, New Delhi.

c. Member, Concrete Sub Committee (CED 2:2), Bureau of Indian Standards, New Delhi.

d. Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.

e. Member, Cement Matrix Products Sectional Committee (CED 53), Bureau of Indian Standards, New Delhi.

f. Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1) and Precast Concrete Products Sub Committee (CED 53:2) Bureau of Indian Standards, New Delhi.

g. Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.

h. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.

i. Member, Panel for Aggregates from other than Natural Sources (CED 2/P3), Bureau of Indian Standards and Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.

j. Member, Panel for Revision of IS 457 (CED 2:2/P6), Panel for Revision of Indian Standards on Test Methods for Concrete (CED 2:2/P7) and Cement, Pozzolana and cement additives Subcommittee (CED 2:1), Bureau of Indian Standards, New Delhi.

k. Convenor, Panel for Revision of IS 2386 (CED 2:2/P10), Bureau of Indian Standards, New Delhi.

l. Member, Structural Safety Sectional Committee (CED 37), Bureau of Indian Standards, New Delhi.

m. Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi.

n. Member, National Building Code Sectional Committee (CED 46), Bureau of Indian Standards, New Delhi.

o. Member, Panel for Administration, Development Control Rules and General Buildings (CED 46:P1), Panel for Fire protection (CED 46:P2), Panel for Building Materials (CED 46:P3), Panel for Load, Forces and Effects (CED 46:P4), Panel for Soil and Foundation/Panel for Plain Reinforced & Pre-stressed Concrete (CED 46:P5) and Panel for Plain Reinforced & Pre-stressed Concrete (CED 46:P8), Bureau of Indian Standards, New Delhi.

p. Member, Planning, Housing and Prefabricated Construction Sectional Committee (CED 51), Bureau of Indian Standards, New Delhi.

q. Member, Concrete Reinforcement Sectional Committee (CED 54), Bureau of Indian Standards, New Delhi.

r. Member CED 32, Code for Precast Concrete & 3D Printing, Bureau of Indian Standards, New Delhi.

Sh. Amit Trivedi, Joint Director

a. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1) and Panel for Aggregates from other than Natural Sources (CED 2/P3), Bureau of Indian Standards, New Delhi.

b. Member, Panel for Revision of IS 3370 (Part I & Part II) (CED 2:2/P1), Bureau of Indian Standards, New Delhi.

c. Member, Flooring, Wall Finishing and Roofing Sectional Committee (CED 5), Bureau of Indian Standards, New Delhi.

d. Member, National Building Code Sectional Committee (CED 46), Bureau of Indian Standards, New Delhi.

e. Member, Panel for Administration, Development Control Rules and General Buildings (CED 46:P1), Panel for Soil and Foundation/Panel for Plain Reinforced & Pre-stressed Concrete (CED 46:P5), Panel for Masonry (CED 46:P7), Panel for Prefabrication and Systems Building (CED 46:P10), Bureau of Indian Standards, New Delhi.

f. Member, Planning, Housing and Prefabricated Construction Sectional Committee (CED 51), Bureau of Indian Standards, New Delhi.

g. Member, Cement Matrix Products Sectional Committee (CED 53), Concrete Pipes Sub Committee (CED 53:2) and Precast Concrete Products Sub Committee (CED 53:3), Bureau of Indian Standards, New Delhi.

h. Member, Concrete Reinforcement Sectional Committee (CED 54), Bureau of Indian Standards, New Delhi.

i. Member, Laboratory and RAMCO subcommittee, Bureau of Indian Standards, New Delhi.

j. Member, Laboratory Subcommittee and CASCO, Bureau of Indian Standards, New Delhi

k. Member, Code of Precast Concrete & 3D Printing, CED 32, Bureau of Indian Standards, New Delhi.

l. Member - Sub-committee 3 of CASCO-National Mirror Committee, Bureau of Indian Standards, New Delhi.

m. Member - MSD 20-Reference Materials Sectional Committee, REMCO, Bureau of Indian Standards, New Delhi.

n. Member - Laboratory and RAMCO subcommittee, Bureau of Indian Standards, New Delhi.

Sh. B P Ranga Rao, Joint Director

a. Member, Flooring, Wall Finishing and Roofing Sectional Committee (CED 5), Bureau of Indian Standards, New Delhi.

b. Member, Panel for Prefabrication and Systems Building (CED 46:P10), Bureau of Indian Standards, New Delhi.

c. Member, Water Proofing and Damp Proofing Sectional Committee (CED 41), Bureau of Indian Standards, New Delhi.

d. Member, SSD-06, Construction and related engineering services sectional committee, Bureau of Indian Standards, New Delhi

Sh. G J Naidu, General Manager

a. Member, Panel for Fire protection (CED 46: P2), Bureau of Indian Standards, New Delhi.

b. Member, Sieves, Sieving and other Sizing Methods Sectional Committee (CED 55), Bureau of Indian Standards, New Delhi.

Dr. Sanjay Mundra, General Manager

a. Member, Flooring, Wall Finishing and Roofing Sectional Committee (CED 5), Bureau of Indian Standards, New Delhi.

b. Member, Concrete Pipes Sub Committee (CED 53:2), Bureau of Indian Standards, New Delhi.

Sh. B S Rao, General Manager

a. Member, Panel for Masonry (CED 46: P7), Bureau of Indian Standards, New Delhi.

Sh. Brijesh Singh, Group Manager

a. Member (Young Professional), Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.

b. Member, Cement, Pozzolana and cement additives Subcommittee (CED 2:1), Concrete Sub Committee (CED 2:2), Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5) and Panel for Revision of Indian Standards on Test Methods for Concrete (CED 2:2/P7), Bureau of Indian Standards, New Delhi.

c. Member, Structural Safety Sectional Committee (CED 37), Bureau of Indian Standards, New Delhi.

d. Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi

e. Member, Panel for Fire protection (CED 46:P2), Member, Panel for Load, Forces and Effects (CED 46:P4), Panel for Plain Reinforced & Pre-stressed Concrete (CED 46:P8), Bureau of Indian Standards, New Delhi.

f. Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1), Bureau of Indian Standards, New Delhi.

g. Member, Concrete Reinforcement Sectional Committee (CED 54), Bureau of Indian Standards, New Delhi.

h. Member, working group on code of precast concrete & 3D Printing, CED 32, Bureau of Indian Standards, New Delhi.

Sh Amit Prakash, Group Manager

a. Member, Panel for Masonry (CED 46: P7), Bureau of Indian Standards, New Delhi.

Sh Manish Kumar Mandre, Group Manager

a. Member, Panel for Revision of IS 2386 (CED 2:2/P10), Bureau of Indian Standards, New Delhi.

b. Member, Code of Precast Concrete & 3D Printing, CED 32, Bureau of Indian Standards, New Delhi.

Sh Mantu Gupta, Group Manager

a. Member, Panel for Revision of IS 457 (CED 2:2/P6), Bureau of Indian Standards, New Delhi.

b. Member working group for revision of IS: 6491 Method of Sampling of Flyash

Dr. Kapil Kukreja, Group Manager

a. Member, Working Group on Technical Sector of Standard Promotion and Consumer Affairs Deptt. (SP & CAD), Bureau of Indian Standards (BIS)

b. Member, Construction Plant and Machinery Sectional Committee (MED 18), Bureau of Indian Standards, New Delhi.

c. Member, Bulk Handling Systems and Equipment Sectional Committee (MED 7), Bureau of Indian Standards, New Delhi.

d. Member, Solid Waste Management (CHD 33)

Sh. Ankur Mittal, Group Manager

a. Member, Solid Mineral Fuels Sectional Committee (PCD 07), Bureau of Indian Standards, New Delhi.

b. Member, Coke Sub Committee (PCD 7:2), Bureau of Indian Standards, New Delhi.

c. Member, Coal Sub Committee (PCD 7:3), Bureau of Indian Standards, New Delhi.

d. Member, Coal serving as member Beneficiation & Lignite Sub Committee (PCD 7.6 and PCD 7.9), Bureau of Indian Standards (BIS)

Sh. Suresh Kumar Shaw, Group Manager

a. Member - MSD 20-Reference Materials Sectional Committee, REMCO, Bureau of Indian Standards, New Delhi.

b. Member, Coke Sub Committee (PCD 7:2), Bureau of Indian Standards, New Delhi.

Dr. (Mrs) Pinky Pandey, Group Manager

a. Member, Building Limes Sectional Committee (CED 4), Bureau of Indian Standards, New Delhi.

Sh Puneet Kaura, Manager

a. Member, Concrete Sub Committee (CED 2:2), Bureau of Indian Standards, New Delhi.

b. Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.

c. Member, Panel for Revision of Indian Standards on Test Methods for Concrete (CED 2:2/P7), Bureau of Indian Standards, New Delhi

d. Member Working group (WG-2) of IS:456-2000

Sh Amit Sagar, Manager

a. Member, Flooring, Wall Finishing and Roofing Sectional Committee (CED 5), Bureau of Indian Standards, New Delhi.

Sh Arup Ghatak, Manager

a. Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi

Sh Y N Daniel, Manager

a. Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1), Bureau of Indian Standards, New Delhi.

Sh Rizwan Anwar, Manager

a. Member, Water Proofing and Damp Proofing Sectional Committee (CED 41), Bureau of Indian Standards, New Delhi.

Dr. (Mrs) Varsha T Liju, Manager

a. Member, Cement Matrix Products Sectional Committee (CED 53), Bureau of Indian Standards, New Delhi.

Sh. Anand Bohra, Manager

a. Member, Environmental Protection and Waste Management Sectional Committee (CHD 32), Bureau of Indian Standards, New Delhi.

b. Member, Environment Management Sectional Committee (CHD 34), Bureau of Indian Standards, New Delhi.

c. Member, Air Quality Sectional Committee (CHD 35), Bureau of Indian Standards, New Delhi.

d. Member, Environmental Services Sectional Committee: SSD 07, Bureau of Indian Standards, New Delhi

Sh. Saurabh Bhatnagar, Manager

a. Member, Construction Plant and Machinery Sectional Committee (MED 18), Bureau of Indian Standards, New Delhi.

b. Member, Bulk Handling Systems and Equipment Sectional Committee (MED 7), Bureau of Indian Standards, New Delhi.

Sh. K R P Nath, Manager

a. Member, Air Quality Sectional Committee (CHD 35), Bureau of Indian Standards, New Delhi.

b. Member, Environmental Services Sectional Committee: SSD 07, Bureau of Indian Standards, New Delhi

Sh. K P K Reddy, Manager

a. Member, Environment Protection Sectional Committee (CHD 32), Bureau of Indian Standards (BIS).

Dr. Prateek Sharma, Manager

a. Member, Environmental Management Sectional Committee (CHD 34), Bureau of Indian Standards, New Delhi.

b. Member, Solid Waste Management (CHD 33)

Sh. P Srikanth, Manager

a. Member, Laboratory and RAMCO subcommittee, Bureau of Indian Standards, New Delhi.

Sh. Nikhil Kaushik, Manager

a. Member, Panel for Revision of IS 2386 (CED 2:2/P10), Bureau of Indian Standards, New Delhi.

Sh. Giasuddin Ahamed, Manager

a. Refractories Sectional Committee (MTD 15), Bureau of Indian Standards, New Delhi.

Sh. V Naga Kumar, Manager

a. Member - Sub-committee 3 of CASCO-National Mirror Committee, Bureau of Indian Standards, New Delhi.

Sh. Abhishek Agnihotri, Deputy Manager

a. Member - Sub-committee 3 of CASCO-National Mirror Committee, Bureau of Indian Standards, New Delhi.

Sh. Gaurav Bhatnagar, Assistant

a. Member, Solid Mineral Fuels Sectional Committee (PCD 07), Bureau of Indian Standards, New Delhi.

b. Member, Coke Sub Committee (PCD 7:2), Bureau of Indian Standards, New Delhi.

c. Member, Coal Sub Committee (PCD 7:3), Bureau of Indian Standards, New Delhi.

d. Member, Coal serving as member Beneficiation & Lignite Sub Committee (PCD 7.6 and PCD 7.9), Bureau of Indian Standards (BIS)

Finance and Accounts

FINANCE

CONTRIBUTIONS

Ministry of Commerce & Industry Grant

During the year 2023-24, Grant of Rs. 22.11 Crores received.

FOREIGN EXCHANGE

During the year 2023-24, the Council earned Foreign Exchange amounting to US$ 45455.98 towards Training Fee, Testing Charges, Sponsored R & D, Seminar, Delegate Fee, Technical Exhibition Etc.

AUDITORS

M/s P C Chhajed & Co. Chartered Accountants, New Delhi were the Auditors of the Council for the year 2023-24.

ACCOUNTS

The Accounts for the 2023-24 duly audited by the Auditors of the Council are given at Annexure (Balance Sheet as at 31st March 2023 and Income & Expenditure Accounts for the year ended 31st March 2024).

INDEPENDENT AUDITORS' REPORT

To

The Members of National Council for Cement and Building Materials

Opinion

We have audited the accompanying financial statements of **National Council for Cement and Building Materials** ("the entity"). Which comprise the Balance Sheet as at March 31, 2024 and Income and Expenditure Account for the year then ended, and notes to accounts including a summary of significant accounting policies.

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid financial statements give a true and fair view of the financial position of the entity as at March 31, 2024, and of its financial performance for the year then ended in accordance with the accounting standards issued by the Institute of Chartered Accountants of India (ICAI).

Basis of Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by the Institute of Chartered Accountants of India (ICAI). Our responsibility under those standards are further described in the, "Auditor's Responsibility for the Audit of the Financial Statements" section of our report. We are independent of the entity in accordance with the code of Ethics issued by the ICAI and we have fulfilled our other ethical responsibilities in accordance with the code of ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide the basis for our opinion.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation of these financial statements that give a true and fair view of the state of affairs, results of operations and cash flows of the entity in accordance with the Generally Accepted Accounting Principles in India. This responsibility includes the design implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the entity's ability to continue as going concern, disclosing as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so.

Those Charged with Governance are responsible for overseeing the entity's financial reporting process.

Auditors' Responsibilities for the Audit of Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

We further report that:

a) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of audit.

b) In our opinion proper books of account as required by law have been maintained by the entity as far as appears from our examination of these books.

c) The Balance Sheet and Income and Expenditure Account dealt with by this report are in agreement with the books of account.

For P C Chhajed & Co.
Chartered Accountants
Firm Registration No. 101800W

CA Gaurav Singh
Partner
Membership No. 545179
UDIN: 24545179BKFTFO6516

Place: New Delhi
Date: September 28th, 2024

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

BALANCE SHEET AS AT MARCH 31, 2024

	Schedules		As at March 31, 2024		As at March 31, 2023
SOURCES OF FUNDS					
Capital Fund	A	6,80,76,146		6,80,76,146	
Reserves and Surplus	B	2,16,21,21,570		1,95,90,03,584	
Building Fund		45,00,000		45,00,000	
Gratuity Fund		8,87,18,480		9,12,95,257	
Provision For Leave Encashment		16,97,77,263		16,72,92,869	
Capital Grant from Govt of India	C	29,46,88,379		31,79,35,192	
Current Liabilities & Provisions	D	12,92,06,352	2,91,70,88,190	13,20,24,091	2,74,01,27,139
Total			**2,91,70,88,190**		**2,74,01,27,139**
APPLICATION OF FUNDS					
Fixed Assets					
Gross Block	E	1,04,22,04,697		97,43,34,252	
Less: Accumulated Depreciation		62,80,03,263	41,42,01,433	59,22,38,939	38,20,95,313
Lab Equipment Under Inspection			-		1,08,12,699
Gratuity Fund Investment					
(Fixed Deposit / Savings Bank / Interest Accrued)		15,60,33,981		14,85,26,058	
Leave Fund account		8,60,33,345		8,11,69,951	
Current Assets Loans & Advances					
R&D Contribution Outstanding		7,98,34,813		9,78,57,485	
Sundry Debtors (unsecured and considered good)	F	7,09,93,347		3,92,91,525	
Loans and Advances		19,98,28,725		10,56,61,307	
Cash and Bank Balances	G	1,86,22,23,207	2,45,49,47,418	1,81,81,47,971	2,29,06,54,297
FDR In lien			1,11,11,233		1,40,72,345
Interest Accrued on Bank Deposits			3,68,28,106		4,24,92,485
Total			**2,91,70,88,190**		**2,74,01,27,139**
Significant Accounting Policies	M				
Notes on Accounts	N				

The Schedules referred to above form an integral part of the Balance Sheet.
This is the Balance Sheet referred to in our report of even date.

For and on behalf of
P C Chhajed & Co.
Chartered Accountants
Firm Registration no.: 101800W

Dr Sanjay Mundra
General Manager

Dr L P SINGH
Director General

CA Gaurav Singh
Partner
M.No. 545179
New Delhi
Date:

Shri Neeraj Akhoury
Chairman -NCB

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 2024

			For the Year ended 31 March 2024		For the Year ended 31 March 2023
INCOME					
Research & Development Contribution	**H**		23,94,73,872		28,83,25,037
Other Income	**I**		14,12,19,129		11,74,83,897
Grant-in-Aid (Revenue) from Ministry of Commerce & Industry	**J**		22,11,00,000		21,50,00,000
			60,17,93,000		**62,08,08,935**
EXPENDITURE					
Employee's Cost	**K**		31,12,07,262		30,46,90,284
Travelling & Conveyance (Including Overseas Travelling)			91,85,421		1,33,23,240
Lab. Stores Serv.& Comp. (S.W.)			69,28,239		1,14,82,659
Symposia & Seminars			10,94,743		1,56,87,712
Training Programmes			35,25,476		20,08,108
Repairs and Maintenance			1,33,17,172		1,19,22,889
Other Expenses	**L**		2,58,54,575		2,71,44,220
Depreciation		3,57,64,328		3,05,51,520	
Less: Transfer from Capital Grant from Govt of India		2,32,46,813	1,25,17,515	1,98,58,488	1,06,93,032
			38,36,30,403		**39,69,52,144**
Surplus for the year before tax			21,81,62,598		22,38,56,791
Less: Current Tax & Prior Period Tax			1,50,44,612		-
Surplus for the year after tax transferred to Reserve Fund			**20,31,17,986**		**22,38,56,791**
Significant Accounting Policies	M				
Notes on Accounts	N				

The Schedules referred to above form an integral part of the Income and Expenditure Account.
This is the Income and Expenditure Account referred to in our report of even date.

For and on behalf of
P C Chhajed & Co.
Chartered Accountants
Firm Registration no.: 101800W

Dr Sanjay Mundra
General Manager

Dr L P SINGH
Director General

CA Gaurav Singh
Partner
M.No. 545179
New Delhi
Date:

Shri Neeraj Akhoury
Chairman -NCB

Particulars	As at March 31, 2024 (Amount in Rs.)	As at March 31, 2023 (Amount in Rs.)
SCHEDULE - A		
Capital Fund		
As per the last Balance Sheet	6,80,76,146	6,80,76,146
Includes UNIDO Equipment valued at Rs 20,187,535 (Previous Year Rs 20,187,535) (Refer Note 3 (b) of Schedule M)		
TOTAL	**6,80,76,146**	**6,80,76,146**
SCHEDULE - B		
Reserves and Surplus		
As per the last Balance Sheet	1,95,90,03,584	1,73,51,46,793
Add: Surplus for the year	20,31,17,986	22,38,56,791
TOTAL	**2,16,21,21,570**	**1,95,90,03,584**

Particulars	As at March 31, 2024 (Amount in Rs.)	As at March 31, 2023 (Amount in Rs.)
SCHEDULE - C		
Capital Grant from Govt of India		
As per the last Balance Sheet	31,79,35,192	33,77,93,680
Add: Plan Grant received during the year	-	-
	31,79,35,192	33,77,93,680
Less: Grant transferred to Income & Expenditure Account to the extent depreciation charged during the year on assets purchased out of capital grant	2,32,46,813	1,98,58,488
TOTAL	**29,46,88,379**	**31,79,35,192**
SCHEDULE - D		
Current Liabilities and Provisions		
Retention & Security Money	1,37,34,930	1,36,04,905
Other Liabilities	11,54,71,422	11,84,19,186
TOTAL	**12,92,06,352**	**13,20,24,091**

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS
DEPRECIATION AS AT 31 MARCH 2024

Schedule -E

Amount in RS.)

[illegible]	[illegible]							[illegible]											[illegible]	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16	17	18	19	20
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[illegible]	[illegible]		[illegible]				[illegible]	[illegible]		[illegible]	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]

Particulars	As at March 31, 2024 (Amount in Rs.)	As at March 31, 2023 (Amount in Rs.)
SCHEDULE - F		
Sundry Debtors (Unsecured and Considered Good)		
Others	7,09,93,347	3,92,91,525
TOTAL	**7,09,93,347**	**3,92,91,525**
SCHEDULE - G	-	-
Cash and Bank Balances	-	-
In Fixed Deposits	1,74,60,63,256	1,64,66,56,336
In Saving Accounts	11,59,18,476	17,12,56,872
Cash in hand including postage imprest	2,41,475	2,33,626
UNESCO Coupons (US Dollar 132.10)	-	1,137
TOTAL	**1,86,22,23,207**	**1,81,81,47,971**

Particulars	As at March 31, 2024 (Amount in Rs.)	As at March 31, 2023 (Amount in Rs.)
SCHEDULE - H		
Research and Development		
Sponsored Research and Development		
Contribution	14,50,47,013	16,84,64,446
Standardisation and calibration	5,81,15,391	4,90,50,476
Symposia & Seminars	18,70,850	4,78,95,232
NCB Proficiency Testing Programme	3,44,40,618	2,29,14,884
TOTAL	**23,94,73,872**	**28,83,25,037**
SCHEDULE - I		
Other Income		
Interest	12,59,74,025	9,96,41,447
Sale of Publications	212	-
Training Programmes	1,61,24,782	1,16,66,339
Miscellaneous Receipts	16,99,963	4,74,836
Foreign Exchange Fluctuation	(12,435)	2,05,593
Licence Fee (Housing Colony)	8,42,755	10,38,180
Interest on Income Tax Refund	-	40,06,030
Sale of Condemned Item Income	12,89,107	4,51,473
Reversal of Prior Period Income	(46,99,281)	-
TOTAL	**14,12,19,129**	**11,74,83,897**
SCHEDULE - J		
Grant from Ministry of Commerce & Industry		
Towards Non-Plan Grant from Cement Cess	22,11,00,000	21,50,00,000
Grants from Ministry of Environment	-	-
TOTAL	**22,11,00,000**	**21,50,00,000**

Particulars	As at March 31, 2024 (Amount in Rs.)	As at March 31, 2023 (Amount in Rs.)
SCHEDULE - K		
Employee's Cost		
Establishment Charges	28,35,23,894	27,15,62,814
Contribution to Provident Fund & other Fund	2,06,13,878	2,08,35,623
Gratuity (Refer Note 4 of Schedule - M)	48,32,401	1,00,25,190
Social Security & Welfare	22,37,089	22,66,657
TOTAL	**31,12,07,262**	**30,46,90,284**
SCHEDULE - L		
		s
Other Expenses		
Rent, Rates and Taxes	28,39,544	35,26,100
Electricity and Water Charges	84,37,481	90,58,471
Foreign Exchange Fluctuation	-	-
Postage, Telegrams & Telephones	23,77,486	26,02,589
Publications	51,702	2,20,448
Stationery & Miscellaneous Stores	22,20,224	19,53,477
Books, Periodicals and Membership Fee	9,74,720	15,35,167
Exhibition, Publicity and Advertisements	5,52,316	3,050
Legal Expenses	8,52,925	16,04,100
Patents	4,45,000	4,26,000
Audit Fees - Statutory Auditors	3,10,000	3,10,000
Bank Charges	70,172	87,761
Insurance of Assets	13,88,067	13,45,029
Sundry Expenses	45,41,387	34,65,213
Collaborative Assistance in R&D and	7,93,550	10,06,815
TOTAL	**2,58,54,575**	**2,71,44,220**

SCHEDULE – M

SIGNIFICANT ACCOUNTING POLICIES

1. **The accounts are prepared on a going concern basis as per the historical cost convention.**

2. **Recognition of Income:**

   a. Income from Sponsored Research & Development Contribution is accounted for on the basis of the percentage of work completed during the year.

   b. Other Incomes, other than Technical Services Fees, are accounted for on accrual basis.

3. **Fixed Assets:**

   a. Fixed Assets are recorded at cost and for the better presentation of financial statements. During the Financial year 2020-2021, the Council has decided to change the depreciation rates and has adopted the rate of depreciation of Income Tax Act 1961 for all block of assets prospectively i.e. rates as per Income Tax Act 1961 will be applied on the written down value and the additions made from the financial year 2020-21 onwards. Old rate of depreciation will continue to apply for assets purchased upto financial year 2000-2001. Depreciation is charged on written down value basis.

   Rate of depreciation is as follows:

	Old Rates % p.a.	Rates as per Income Tax Act 1961 % p.a.
* Vehicles	20	15
* Office Furniture and Equipment	10	10
* Laboratory Equipment	10	15
* Laboratory Projects Services	10	15
* Building including Staff Housing	2.5	
i) Residential Property		5
ii) Other than Residential Property		10
* Computers	-	40
* Solar Power Plant	-	40

   Depreciation has been provided on assets for whole year irrespective of the date of addition.

b. Fixed Assets include Laboratory Equipment and Energy Bus received free of cost & custom duty from the United Nations Industrial Development Organisation (UNIDO). The value adopted in the accounts is as per customs CIF assessment upon import or at value advised by UNIDO and the corresponding credit for this amount is included under Capital Fund (Refer Schedule A) Rs. 19,564,057 for Laboratory Equipment and Rs. 623,478 for Energy Bus. The title to these assets has been transferred to Government of India and the further transfer of these fixed assets from the Ministry of Commerce & Industry, Government of India to the Council is pending. However, the Council provides depreciation on these fixed assets in accordance with the rates noted in para 3 (a) above.

c. The organization has acquired the land and building in Bhubaneswar on a leasehold basis for Rs. 1,50,00,000 and Rs. 42,22,098 respectively during FY 2022-23. The leasehold land and building is allotted up to 14th December 2068. This leasehold land and building is being depreciated during the lifetime of the lease.

4. Liability for Gratuity and Leave Encashment is provided for on the basis of actuarial valuation.

5. Accounting for Government Grants:

a. Government Grant of Revenue nature received from the Government have been accounted for as Income for the year under the Income and Expenditure Account.

SCHEDULE – N

NOTES ON ACCOUNTS

1. Purchases made during the year in respect of laboratory stores, raw materials, miscellaneous consumable stores, publications, tools and accessories are charged to the Income and Expenditure Account and closing stock of these items has not been ascertained or accounted for, as per the decision of the Board of Governors.

2. Fixed Asset Register has been updated with the complete details along with value which is to be reconciled with the Accounts. Physical verification of the Fixed Assets has been carried out in each Centre/Group.

3. Contingent liabilities not provided for in respect of:

    a. Claims not acknowledged as debts by the Council, the liability of which is not ascertainable as pending in various Courts.

    b. Claim for interest by the Andhra Pradesh State Government in 1998, for delay in payment for purchase of Land (amount not intimated).

4. Gratuity Fund Investment has a balance of Rs. 15,60,33,981/- (Rs. 14,85,26,058/-). There is a shortfall of Rs. Nil (Rs. Nil) in the "Gratuity Fund Investment Account" as compared to the "Gratuity Fund account" as at 31st March 2024.

5. The Council has got an actuarial valuation of the leave encashment for and upto the year ended 31st March 2024 and the liability computed is Rs. 16,97,77,263/- (Rs. 16,72,92,869/-).

6. An amount of Rs. 6,31,976 has been deposited with Hon'ble Delhi High Court in connection with a case filed by a former employee. Necessary adjustment will be made after the decision of the Hon'ble Court.

7. R&D Contribution has been arrived after adjusting R&D Contribution received in advance of Rs. 98,37,281/- (Rs. 77,80,834/-).

8. During the year 2023-24, the council earned foreign exchange amounting to Rs. 37,34,834/-.

9. Expenditure in foreign currency during the year is Rs. 1,57,972/- (Rs. 7,41,626/-).

10. As on 31.03.2024, there are certain ledgers/accounts which have been pending for reconciliation/settlement with the net debit balance Rs. 10.91 Crore (approx.) since the last many years. These unreconciled ledgers include the ledgers coming under the heads of sundry debtors, creditors, loans and

advances and service tax. The Management has taken a note of it and is working for reconciliation and settlement.

11. There are some unreconciled/unidentified receipts amounting to Rs 5.01 Crores which probably could have been received from sundry debtors whose accounts are pending for reconciliation and settlement. Management is trying to reconcile/identify the parties from whom the payments have been received and also in process of taking constructive steps to mitigate such payments. For the purpose of disclosure, the amount of Rs 5.01 Crore has been deducted from the balance of sundry debtors.

12. In the past years, organization had implemented the project of Government of Karnataka under which a credit balance of Rs. 40.76 Crores and a debit balance of Rs. 40.36 Crores is showing in the books and the respective ledgers are pending for reconciliation. The management has taken a note of this and the accounts will be put up for settlement and necessary accounting entries will be passed in the books.

13. Previous year's figures have been regrouped and rearranged wherever necessary so as to conform to this year's classification.

Institutional Events

Institutional Events

National Technology Day 2023

NCB celebrated National Technology Day on 11th May 2023. Dr S K Chaturvedi, Director General (Actg.) in his National Technology Day address highlighted the Technological Achievements of our country, importance of #MissionLiFE launched by our Hon'ble PM and NCB activities towards achieving the Decarbonisation goal for Indian Cement Industry.

On the occasion, Shri P N Ojha, Joint Director and Head - Centre for Construction Development and Research delivered a presentation on "Approach to Decarbonise Cement, Concrete and Construction Industry" and Shri Prateek Sharma, Manager-CME presented the research outcome of study on "Waste Gasification- Futuristic Technology for enhancing TSR in Indian Cement Industry"

World Environment Day 2023

NCB celebrated World Environment Day on 5th June 2023 with participation of Scientists, Engineers and other staff. This year's theme of world environment day is "Beat Plastic Pollution". Dr S K Chaturvedi, Director General (Actg.) in his environment day address stressed upon the need to do away with single use plastic in our day to day life. He stated that cement plants are best Co-incinerators and highlighted the efforts made by cement industry in Co-processing of plastic waste.

International Yoga Day 2023

The 9th International Yoga Day observed at NCB on 21st June 2023, wherein officers & staff of NCB took part in a yoga session. Dr Sanjay Mundra, General Manager-NCB and Sh Ankur Mittal, Group Manager-NCB initiated the session with encouraging words on maintaining health and fitness through yoga.

To promote a healthy lifestyle within a busy schedule, NCB official Dr Pinky Pandey and Ms Rashmi Gupta demonstrated various yoga postures that can be easily performed in the office and home.

77th Independence Day 2023

77th Independence Day celebrated on 15 August 2023 at NCB Ballabgarh. Dr. L P Singh, DG-NCB hoisted the National Flag, distributed sweets, flags and addressed the NCB staff & their family members.

Swachhata Hi Seva

NCB observed Swachhata Hi Seva campaign from 15th September to 2nd October 2023. Dr. L P Singh, DG-NCB participated in the cleanliness drive and briefed on the activities undertaken during Swachhata Hi Seva.

हिन्दी पखवाड़ा का आयोजन

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद्, बल्लभगढ़ में हिंदी पखवाड़ा 18 सितम्बर 2023 से 04 अक्टूबर 2023 के बीच बड़े हर्षोल्लास के साथ मनाया गया। पखवाड़े का शुभारंभ 18 सितंबर 2023 को माननीय श्री पी एन ओझा, संयुक्त निदेशक के कर कमलों द्वारा किया गया। पखवाड़े का शुभारंभ करते हुये श्री पी एन ओझा जी ने सभी अधिकारियों / कर्मचारियों को कार्यालय में राजभाषा के प्रचार-प्रसार को बढ़ावा देने के लिए अधिक से अधिक कार्य हिन्दी में करने के लिए प्रोत्साहित किया तथा उन्होने कहा कि राजभाषा में कार्य करते समय हमें गौरान्वित महसूस करना चाहिये।

हिन्दी पखवाड़े 2023 के दौरान कार्यालय में निम्नलिखित प्रतियोगितायें आयोजित की गई। जिसमें कार्यालय के अधिकारियों / कर्मचारियों ने उत्साहपूर्वक भाग लिया।

- हिन्दी आदर्श वाक्य (Slogan)प्रतियोगिता
- हिन्दी निबंध प्रतियोगिता
- टिप्पणी लेखन प्रतियोगिता
- कविता पाठ / स्वविचारप्रतियोगिता

हिन्दी पखवाड़ा के दौरान कार्यालय में 26 सितम्बर 2023 को" राजभाषा" "एवं प्रद्यौगिकी विषय पर वार्ताका आयोजन

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् बल्लभगढ़ कार्यालय में हिन्दी के प्रगामी प्रयोग को बढ़ावा देने के लिए दिनांक 26 सितम्बर 2023 को "राजभाषा एवं प्रद्यौगिकी" विषय पर वार्ता का आयोजन किया गया। इस कार्यशाला की अध्यक्षता माननीय डॉ संजीव कुमार चतुर्वेदी, इकाई प्रभारी, एवं संयुक्त निदेशक द्वारा की गई। कार्यशाला के लिए आमंत्रित वक्ताओं, श्री हरिओम शुक्ला, उप-प्रबंधक (राजभाषा) एवं

श्रीमती संजना सिंह, ग्रुप वरिष्ठ प्रबंधक (राजभाषा), नगर राजभाषा कार्यान्वयन समिति (नराकास), फरीदाबाद का स्वागत माननीय इकाई प्रभारी एवं संयुक्त निदेशक, एनसीबी द्वारा किया गया।

दिनांक 04 अक्टूबर 2023 को हिन्दी पखवाड़ा समापन समारोह 'पूरे हर्षोल्लास के साथ आयोजित किया गया। जिसमें संस्थान के कर्मचारियों एवं अधिकारियों के अतिरिक्त डॉ संजीव कुमार चतुर्वेदी, इकाई प्रभारी एवं संयुक्त निदेशक द्वारा भाग लिया गया। हिन्दी पखवाड़ा समापन समारोह के अवसर पर कविता पाठ / स्वविचार प्रतियोगिता आयोजित की गई। जिसमें कार्यालय के कर्मचारियों व अधिकारियों ने उत्साहपूर्वक भाग लिया तथा पखवाड़े के समापन समारोह के दौरान प्रतियोगिताओं में भाग लेने वाले विजेताओं के नामों की घोषणा की गई। जिन्हें कार्यालय के वार्षिक दिवस के अवसर पर पुरस्कृत किया गया।

कार्यालय के वार्षिक दिवस 22 दिसम्बर 2023 के अवसर पर पखवाड़े के दौरान आयोजित प्रतियोगिताओं के विजेताओं को माननीय श्री संजीव जी, संयुक्त सचिव (सीमेंट) उद्योग संवर्धन और आन्तरिक व्यापार विभाग (डीपीआईआईटी), वाणिज्य और उद्योग मंत्रालय, भारत सरकार द्वारा शील्ड एवं प्रमाण पत्र प्रदान किये तथा प्रतिभागियों का उत्साहवर्धन भी किया।

हिन्दी शिक्षण योजना

राजभाषा विभाग, गृह मंत्रालय, भारत सरकार द्वारा हिन्दी शिक्षण योजना के अंतर्गत जनवरी – मई 2023 सत्र के लिए दिनांक 17 मई 2023 एवं 18 मई 2023 को हिन्दी प्रशिक्षण के अंतर्गत पारंगत परीक्षा (101 प्रशिक्षार्थियों) एवं प्रबोध परीक्षा (15 प्रशिक्षार्थियों), राष्ट्रीय सीमेंट एंव भवन सामग्री परिषद्, बल्लभगढ़ परिसर में आयोजित की गई।

राजभाषा विभाग, गृह मंत्रालय, भारत सरकार द्वारा हिन्दी शिक्षण योजना के अंतर्गत जुलाई –नवम्बर 2023 सत्र के लिए दिनांक 25 नवम्बर 2023 एवं 26 नवम्बर 2023 को हिन्दी प्रशिक्षण के अंतर्गत पारंगत परीक्षा (93 प्रशिक्षाथियों) एवं प्रबोध परीक्षा (17 प्रशिक्षाथियों) को राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद्, बल्लभगढ़ में आयोजित की गई। जिसमें एनसीबी कार्यालय के 13 परीक्षार्थियों ने प्रबोध परीक्षा अच्छे अंको से उत्तीर्ण की तथा प्रबोध परीक्षा में उत्तीर्ण कार्मिकों के लिए जनवरी – मई 2024 सत्र के लिए

प्रवीण पाठ्यक्रम की कक्षाएं एनसीबी कार्यालय में संचालित की जा रही है। हिंदी शिक्षण योजना का मुख्य उद्देश्य कार्मिकों को हिन्दी में दक्ष बनाकर अधिकाधिक कार्यालयीन कार्य हिन्दी में करने के लिये प्रेरित करना है।




कार्यालय में नराकास द्वारा निबंध प्रतियोगिता का आयोजन

नगर राजभाषा कार्यान्वयन समिति (नराकास), फरीदाबाद के तत्वाधान में दिनांक 16-20 अक्टूबर 2023 के माह में की जाने वाली हिन्दी प्रतियोगिताओं के अंतर्गत हिन्दी निबंध प्रतियोगिता का आयोजन एनसीबी, बल्लभगढ़ परिसर में दिनांक 17 अक्टूबर 2023 को किया गया जिसमें कार्यालय के साथ साथ अन्य नराकास से संबंधित कार्यालयों के प्रतिभागियों ने भाग लिया।


हिंदी सलाहकार समिति की बैठक

उद्योग संवर्धन और आन्तरिक व्यापार विभाग, वाणिज्य और उद्योग मंत्रालय की हिंदी सलाहकार समिति की बैठक का आयोजन दिनांक 27 अक्टूबर 2023 को श्रीनगर (जम्मू और कश्मीर) में किया गया। जिसमें कार्यालय के महानिदेशक द्वारा भाग लिया गया।


एन.सी.बी. दर्पण के चतुर्थ अंक का विमोचन

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् की वार्षिक हिंदी पुस्तक "एन.सी.बी. दर्पण के चतुर्थ अंक" का विमोचन माननीय श्री संजीव जी, संयुक्त सचिव (सीमेंट) उद्योग संवर्धन और आन्तरिक व्यापार विभाग (डीपीआईआईटी), वाणिज्य और उद्योग मंत्रालय, भारत सरकार के कर कमलों द्वारा 22 दिसम्बर 2023 को एन.सी.बी. बल्लभगढ़ में किया गया।

नराकास, फरीदाबाद, राजभाषा शील्ड प्रतियोगिता में प्रोत्साहन पुरस्कार (वर्ष 2022-23)

नगर राजभाषा कार्यान्वयन समिति (.का), फ़रीदाबाद द्वारा आयोजित शील्ड प्रतियोगिता में विगत वर्षों की भांति वर्ष को राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् 2023 दिसम्बर 27 के लिए भी दिनांक 23-2022, बल्लभगढ़ को प्रोत्साहन पुरस्कार से सम्मानित किया। डॉ कपिल कुकरेजा, समूह प्रबन्धक एवं श्रीमती पूनम कनौजिया, सहायक प्रबंधक ने शील्ड प्रतियोगिता का पुरस्कार ग्रहण किया।

नराकास द्वारा आयोजित काव्य कविता पाठ प्रतियोगिता में डॉ कपिल कुकरेजा /, समूह प्रबन्धक ने प्रोत्साहन पुरस्कार प्राप्त किया।

हिन्दी समिति की बैठक में पारंगत परीक्षा (सत्र जनवरी – मई 2023) में उतीर्ण कार्मिकों को प्रमाण पत्र वितरण।

एन.सी.बी. राजभाषा कार्यान्वयन समिति की बैठक डॉ लोक प्रताप सिंह, महानिदेशक महोदय की अध्यक्षता में दिनांक 22 फरवरी 2024 को एनसीबी, बल्लभगढ़ में आयोजित की गई। समिति की बैठक में कार्यालय में राजभाषा हिन्दी के प्रयोग संबंधी विषयों पर विचार विमर्श के उपरांत महानिदेशक महोदय द्वारा पारंगत परीक्षा (सत्र जनवरी से मई 2023) में उतीर्ण कार्मिकों को प्रमाण पत्र वितरित किए तथा सभी कार्मिकों को कार्यायलीन कार्य राजभाषा हिन्दी में करने के लिए प्रोत्साहित किया।




कार्यालय में "राजभाषा अधिनियम एवं टिप्पण प्रारूप" विषय पर दिनांक 06 मार्च 2024 को हिन्दी कार्यशाला का आयोजन




राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् बल्लभगढ़ में दिनांक 06 मार्च 2024 को हिन्दी के प्रयोग को बढ़ावा देने तथा राजभाषा संबंधी नियमों, अधिनियमों एवं राजभाषा नीति के अनुपालन हेतु हिन्दी कार्यशाला का आयोजन किया गया। इस कार्यशाला की अध्यक्षता आदरणीय डॉ लोक प्रताप सिंह,

महानिदेशक महोदय, एन.सी.बी. द्वारा की गई। कार्यशाला में मुख्य वक्ता के रूप में डॉ देवेंद्र तिवारी, प्रबंधक (राजभाषा) नराकास, एनएचपीसी, फ़रीदाबाद को व्याख्यान देने हेतु आमंत्रित किया गया था। कार्यशाला में डॉ संजीव चतुर्वेदी, संयुक्त निदेशक एवं इकाई-प्रभारी, श्री अमित त्रिवेदी, संयुक्त निदेशक, डॉ जी जे नायडू, महाप्रबंधक उपस्थित रहें तथा कार्यशाला में कार्मिकों ने बढ़-चढ़कर भाग लिया।

Special Swachhta Campaign 3.0

NCB observed Swachhta Special Campaign 3.0 from 2nd October to 31st October 2023 at all NCB offices. Under Special Campaign 3.0, 590 old files were reviewed and weeded out at NCB.



National Unity Day

To commemorate the birth anniversary of Shri Sardar Vallabh bhai Patel, Rashtriya Ekta Diwas (National Unity Day) will be celebrated at NCB on 31st October 2023. On the occasion of Rashtriya Ekta Diwas, NCB officials took National Unity Day Pledge and paid tribute to Sardar Vallabhbhai Patel.



Celebration of Constitution Day

NCB celebrated Constitution Day (Samvidhan Diwas) on 26th November 2023 to commemorate the adoption of the Constitution of India on the same day in 1949 in the Constituent Assembly of India. The preamble of the Constitution was read out by officials of NCB at all units.

61st NCB Day

NCB celebrated its 61st NCB Day (foundation day) on 22nd December 2023 at NCB Ballabgarh campus. Shri Sanjiv, Joint Secretary, DPIIT, Ministry of Commerce & Industry, Govt. of India was the Chief Guest and Shri Neeraj Akhoury, President-CMA and Managing Director-Shree Cement Ltd. was the Guest of Honour on the occasion.

Shri Sanjiv, Joint Secretary, DPIIT congratulated NCB family for completing 61 years and appreciated the pioneering research work carried out by NCB for cement, concrete and building material industry. He stressed upon the need to set up

incubation centre for StartUps at NCB for development and growth of Indian cement and construction sector. He was appreciative of NCB for providing technical support to DPIIT in various activities related to cement industry.

Shri Neeraj Akhoury, MD-Shree Cement Ltd. lauded the nation building role NCB plays including R&D projects on promoting circular economy and waste management in the cement industry. He called upon NCB Scientists and Engineers to carry out research on enhancement of supplementary cementitious materials in cement, ways to achieve Net Zero Target in cement sector and low-cost housing.

Dr L P Singh, Director General-NCB recalled the genesis of NCB, contribution of NCB scientist/engineers in codal formulation at BIS and highlighted the achievements of NCB in cement and concrete research. He informed that NCB along with IIT Delhi and IIT Madras, has successfully won the bid to host the 17th edition of prestigious International Congress on the Chemistry of Cement (ICCC) in India in the year 2027 for the second time after 1992. A 3D printed monogram of ICCC 2027 prepared at NCB's CDR centre was inaugurated on the occasion.

Shri Sanjiv, Joint Secretary-DPIIT released Bhartiya Nirdeshak Dravya (BND), the Indian Certified Reference Materials, of Ground Granulated Blast Furnace Slag (GGBFS) developed by NCB in collaboration with CSIR-NPL. The BNDs give a boost to "Make in India" program and fulfil the mission of Atmanirbhar Bharat and harmonize the quality infrastructure of India. 19 BNDs of NCB have already been dedicated to the Nation.

On the occasion, Shri Sanjiv, Joint Secretary-DPIIT visited the well-equipped laboratories of NCB and Technology resource Centre. He appreciated the research work undertaken by NCB on Zeolite developed by using raw materials of cement industry, Geopolymer tiles and tiles/blocks prepared using marble dust.

Shri Sanjiv, Joint Secretary-DPIIT released the publications of NCB viz. NCB News Letter and NCB Darpan. He felicitated the Swachhata Mitras (Housekeeping & Horticulture staff) of NCB for their contribution in Swachhata Hi Sewa, Special Campaign 3.0 and Swachhata Pakhwada 2023 observed at NCB during 15th September to 15th November 2023. The winners of activities organised during Hindi Pakhwada were also awarded.

75th Republic Day 2024

NCB celebrated 75th Republic Day. Dr L P Singh, Director General, NCB hoisted the National Flag, distributed sweets and addressed the NCB staff & their family members present on the occasion.

International Women's Day 2024

NCB celebrated International Women's Day on 8th March 2024. Dr. L P Singh, DG - NCB highlighted the social, political and economic achievements of women & their contribution in various fields. Ms. Vibha Khullar, Assistant Commissioner, Central GST Faridabad, Department of Revenue, Ministry of Finance, Govt. of India was the Guest of Honour on the occasion.

Interaction with Stakeholders

Interaction with Stakeholders

Interaction with officials of JC Bose University of Science and Technology

Dr. S K Chaturvedi, DG-NCB (Actg.) participated as the chief guest in the program organized on 11 May 2023 on the occasion of National Technology Day 2023 at J.C. Bose University of Science and Technology. On this occasion, Dr. Chaturvedi highlighted the importance of National Technology Day and the role of technology in shaping the future of the country.

NCB participated at Energy Transition Working Group-III, G20 at Mumbai

Dr S K Chaturvedi, DG-NCB (Actg.) participated in panel discussion at the Energy Transition Working group III - G20 International Seminar on Sharing Global Policies and Best Practices to Decarbonise Hard to Abate Sectors like Cement and Steel, organised by Ministry of Power in Mumbai on 16th May 2023.

Dr Chaturvedi highlighted the proactive efforts made by Indian Cement Industry towards decarbonisation like Clinker substitution, usage of alternative fuels, implementation of energy efficient measures under PAT scheme and installation of waste heat recovery systems resulted in reduction of Carbon Intensity from 1.12 tonnes of CO_2 per tonne of Cement in 1996 to 0.67 tonnes of CO2 per tonne of Cement in 2017. For achieving the target given by Hon'ble Prime Minister to become Net Zero by 2070, climate financing and demonstration of newer technologies of Carbon Capture & Utilization are required for Indian cement plants.

Meeting with stakeholders of Gypsum

Meeting with stakeholders to review the progress on 'Achieving Circular Economy in Gypsum' was held on 29 May 2023 under the chairmanship of Shri Sanjiv, Joint Secretary, DPIIT at Vanjiya Bhawan, New Delhi. Dr S K Chaturvedi, DG-NCB presented the current status of actions taken.

Meeting with CSIR National Physical Laboratory of India

Dr S K Chaturvedi, DG-NCB (Actg.) delivered Colloquium on 'Role of Cement and Construction Industry in Circular Economy' on 09.06.2023 at CSIR National Physical Laboratory of India.

Release of BND's

Bhartiya Nirdeshak Dravya (BND), the Indian Certified Reference Materials, of Petcoke developed by NCB in collaboration with CSIR-National Physical Laboratory was released by Prof. Ashutosh Sharma (President Indian National Science Academy -INSA & Ex-Secretary DST, Government of India), Dr. Ranjana Aggarwal (Director CSIR NISCPR), Dr. Viswajanani J Sattigeri (Head, CSIR-TKDL), Prof Venugopal Achanta (Director, CSIR NPL) and NCB team led by Shri Amit Trivedi, Joint Director & Head - CQC, Shri Suresh Shaw, Shri V Naga Kumar and Shri Abhishek Agnihotri on the occasion of 78th Foundation Day of CSIR-NPL on 4th January 2024.

The BNDs give a boost to "Make in India" program and fulfill the mission of "Atmanirbhar Bharat" and import substitution. 21 BNDs of NCB have been dedicated to the Nation till now.

Visit of officials from BARC & UCIL

A delegation of scientists from BARC & UCIL led by Dr D K Aswal, Director, BARC visited NCB Ballabgarh on 12th February 2024 for discussion on utilization of mill tailings. Dr Aswal gave a technical talk on "Radiation, Nuclear Energy and Environment" to NCB Scientists and Engineers.

Interaction with officials of Republic of Congo

An Indian delegation comprising the representatives from the Ministry of External Affairs, GoI and Exim Bank headed by H.E. Mr. Madan Lal Raigar (Ambassador of India to the RoC) and Congolese delegation comprising the representatives from Ministry of Industry & Ministry of Finance headed by H.E. Mr. Raymond Serge BALE ((Ambassador of RoC to the Republic of India) visited the project site on 20th & 21st February 2024 & reviewed the progress of ongoing construction of 600 tpd Greenfield cement plant in Louvakou district in the Republic of Congo.

The project is being executed by M/s Promac Engineering Industries Ltd. (PEIL) with NCB as its Project Management Consultant (PMC), in two packages covering

Geological Prospecting Work, Mine Planning, Mine Development, and Mining Equipment Supply in Package-I and Engineering, Construction and Supply of Machineries to set up the cement plant in Package-II. Package-I was successfully completed in November 2023 and Package-II is expected to be completed in 2025.

Both the Ambassadors expressed immense satisfaction with the on-ground progress of the project and appreciated the work carried out by all the stakeholders, despite facing multiple challenges. They also highlighted the importance of this project, providing employment and improving the social lives of the local population, thereby playing an important role in cementing the relationship between both countries.

Appendices

Appendix - I

Rolling Plan of Missions within the Framework of Centres

D. CENTRE – CEMENT RESEARCH AND INDEPENDENT TESTING (CRT)

Mission 1: Utilization of Marginal Grade Raw Materials in the Manufacture of Cement and Building

Mission 2: Development of Newer Cements, Composites and Alternate Binding and Building Materials

Mission 3: Development of Newer Processes of Manufacturing Cement and other Binding and Buildings Materials

Mission 4: Raw Mix Design Optimization

Mission 5: Utilization of Industrial and other Wastes for Cement and Building Materials

Mission 6: Development of Newer Refractories

Mission 7: Improved Refractory Engineering Practices

Mission 8: Study of Fundamental Concepts in Material Science and Fundamental Studies Relating to Areas of Fuel Combustion, Pyro-processing, Size Reduction, etc.

Mission 9: Independent Testing

E. CENTRE – MINING, ENVIRONMENT, PLANT ENGINEERING AND OPERATION (CME)

Mission 1: Compilation and Updating of National Inventory of Cement Grade Limestone Deposits

Mission 2: Identification, Exploration, Evaluation and Assessment of Limestone Deposits and other Cement Raw Materials

Mission 3: Upgradation and Quality Establishment of Limestone (at Quarries) and Mineral Conservation

Mission 4: Application of Remote Sensing Techniques

Mission 5: Advanced Survey Techniques including Geographical Information System (GIS) and Global Positioning System (GPS)

Mission 6: Application of Geophysical Techniques for Mineral Exploration, Ground Water Investigation, etc.

Mission 7: Mine Planning and Scheduling

Mission 8: Improved Machinery Application and Improved Technological Upgradation for Mining Practices

Mission 9: Sustainable Development through Environmental Improvement including Survey of Land and Water Resources.

Mission 10: Pollution Control Technologies for Particulate Gaseous Emissions and Liquid Effluents

Mission 11: Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for Industrial Projects and Mines

Mission 12: Environmental Management System (EMS) and ISO - 14001 Certification for Process Industries

Mission 13: Utilization of Hazardous Wastes as Supplementary Fuel

Mission 14: Monitoring of Environmental Parameters for Water, Ambient Air Quality, Noise and Vibration Studies

Mission 15: Rehabilitation and Reclamation of Mined out Areas

Mission 16: Improving Capacity Utilization and Increasing the Rate of Production in Kilns and Mills towards Improving Total Factor Productivity in Cement Industry through Process Optimization, Diagnostic Studies and Trouble Shooting and Improvement in Operation

Mission 17: Benchmarks, Best Practices, Operational Norms and Technical Audit including Plant Monitoring

Mission 18: Productivity Enhancement Programme (PEP)

Mission 19: Technological Upgradation

Mission 20: Improving Utilization of Coals

Mission 21: Utilization of Alternate Fuels such as Lignite, Natural Gas, Combustible Wastes etc.

Mission 22: Improvements in Fuel Combustion Efficiency

Mission 23: Optimization of Energy (Both Thermal and Electrical) Consumption

Mission 24: Energy Auditing, Management and Monitoring

Mission 25: Waste Heat Utilization including Cogeneration

Mission 26: Creating Awareness and Motivation for Energy Conservation

Mission 27: Total Productive Maintenance (TPM)

Mission 28: Preventive/Predictive Maintenance Programme, Condition Monitoring Techniques and Tribology including Computerised Maintenance

Mission 29: Inventory Control and Spare Parts Management

Mission 30: Risk Analysis and Improving Safety in Cement Plants

Mission 31: Turnkey Consultancy for Setting up Modern Medium and Large Cement Plants from Concept to Commissioning including Fund Sourcing

Mission 32: Establishing Modern Energy Efficient CRI-MVSK and Rotary Kiln based Mini Cement Plants from Concept to Commissioning

Mission 33: Improvements in System Design and Engineering of Plant and Machinery (including CRI designed indigenous Precalcinator System,

Burners for High Ash Coals, Refractory Lining System and Coal Quality Modulation System)

Mission 34: Modernization and Technological Upgradation in Cement Plants

Mission 35: Upgradation and Modification of VSK based Cement and Lime Plants

Mission 36: Developing Systems Designs for Bulk Movement of Cement by Rail, Road and Waterways

Mission 37: Marketing Strategies and Logistics

Mission 38: Improvements in Packaging of Cement

F. CENTRE – CONSTRUCTION DEVELOPMENT AND RESEARCH (CDR)

Mission 1: Analysis and Design of Structures for Safety and Economy and Development of Related Software Packages

Mission 2: Rationalizing Designs of Structures and Foundations in Cement Plants and Other Constructions

Mission 3: Performance Evaluation of Structures including Machine Foundations through Site Inspection and Testing

Mission 4: Formulation and Evaluation of Protective System for Enhancing the Service Life of Concrete Structures

Mission 5: Evaluation of Concrete Construction through Non-Destructive Investigations

Mission 6: Improving Durability of Concrete Construction through Distress Investigations and Rehabilitation Procedures

Mission 7: Improved Quality Control Procedures for Enhancing Durability

Mission 8: Rational Utilization of Cement and other Ingredients in Concrete, including Admixtures

Mission 9: Promotion of Ready Mix Concrete Technology in India

Mission 10: Development of Concrete for Special and Newer usages such as Underwater Concreting, Special Concrete Exposed to Extreme Temperature etc

Mission 11: Development and Evaluation of Prefab Systems Appropriate for Housing Programmes

Mission 12: Application of Alternative Building Materials and Development of Construction Techniques for Low Cost Housing

Mission 13: Improvements in Construction Technology of Cement Concrete Pavements and Canal Linings

Mission 14: Development of Precast Architectural Concrete Elements and Concrete Finishes

Mission 15: Preventive Maintenance Programme for Enhancing Service Life of Buildings

Mission 16: Extended Application of Concrete for Non-Structural Usage

Mission 17: Improvement in Construction Management Techniques

G. CENTRE – INDUSTRIAL INFORMATION SERVICES (CIS)

Mission 1: Collection, Documentation and Retrieval of Information for Development of Cement and Building Materials Industries

Mission 2: Establishing National Data Bank for the Cement and Building Materials Industries

Mission 3: Providing Library Services

Mission 4: Establishing Display Centre and Sample Museum and Participation in Exhibition and Trade Fairs

Mission 5: Publication of R & D Projects, Technology Digests, R & D Journals, Trend Reports, Promotional Literature etc

Mission 6: Organising Workshops and Seminars at National and International Levels on Topical Subjects in the Areas of Cement and Building Materials

Mission 7: Promoting International Linkages for Development of Technologies in the Field of Cement and Building Materials

H. CENTRE – CONTINUING EDUCATION SERVICES (CCE)

Mission 1: Improving the Talent of Personnel at Entry Level to Cement Industry

Mission 2: Improving Technical and Managerial Skills/Knowledge of NCB Officials through Inhouse/ External Programmes

Mission 3: Manpower Planning and Human Resource Development Strategies for Cement and Building Material Industries

Mission 4: Upgrading Technological Talent of Personnel in the Cement and Building Materials Industries

Mission 5: Improving Operational Skills of Personnel in the Cement Industry through Simulator Based Courses

Mission 6: Training of Personnel in Computer Programming, Application and Information Technology at Different Levels of Participation

Mission 7: Training of Personnel in Software Development, System Analysis and Information Technology Applicable to Cement Manufacturing Process Industry, Structural Design and Investigations

I. CENTRE – QUALITY MANAGEMENT, STANDARDS AN CALIBRATION SERVICES (CQC)

Mission 1: Providing Traceable Calibration Services to the Industry for Ensuring Manufacture of Quality Product

Mission 2: National and International Standardization

Mission 3: Quality Management, Quality Assessment and Quality Improvement in Cement and Building Materials Industries

Mission 4: Development of Improved Methodologies for Testing and Quality Control including Rapid Methods of Testing and Quality of Cement and Other Building Materials in the Field

Mission 5: Inter-Laboratory Proficiency Testing

Mission 6: Quality Related Services

Mission 7: Development of New Standard Reference Materials

Mission 8: Providing Standard Reference Materials (SRMs), Developed by NCB, to the Industry for Ensuring Accuracy of Testing for Quality Control

These Programmes and Missions are proposed to be achieved through the pursuit of specific projects with specified targets of time, cost and assured end products

Appendix II

Completed R&D Project Programme 2023–2024

Sl. No.	Project No.	Project title	Duration
1	WAU-20	Utilization of lime sludge generated from paper industry in the manufacture of Cement	Aug 2021 - Jul 2023
2	FBR-16	Formulation of chemical admixture using by product lignosulfonate from paper industry for improved performance in mortar and concrete	Aug 2021 - Jul 2023
3	PRP-07	Enhancement of plastic waste utilization as Alternative Fuel in Indian Cement Industry and its impact assessment	Aug 2021 - Jul 2023
4	CON-17	Study of Carbonation and Carbonation induced reinforcement corrosion in new cementitious system	Apr 2020 - Sep 2023
5	SAR-01	Cathodic Protection (CP) of RCC structures to enhance service life of new and existing structures using three system (Sacrificial anode, ICCP and hybrid system)	Oct 2020 - Sep 2023
6	WAU-21	Investigations on development of Portland Dolomitic Cements (PDCs) using high MgO limestone and dolomitic grade limestone from different geographical regions	Apr 2022 - Sep 2023
7	AFT-01	Improvement in Clinker quality and Increase % TSR by the Application of Artificial Intelligence	Apr 2022- Mar 2024
8	WAU-22	Investigation on mineral carbonization mechanism of various industrial waste and by products	Apr 2022 - Mar 2024

Appendix –III

Sponsored Projects Completed During the Year 2023-24

National Council for Cement and Building Materials has completed 130 sponsored projects in the year 2023-24. Centre for Cement Research and Independent Testing (CRT) has completed 49 nos. of projects, Centre for Mining, Environment, Plant Engineering & Operation (CME) has completed 36 nos. of sponsored projects and Centre for Construction Development and Research (CDR) have completed 45 nos. of sponsored projects.

Centre for Cement Research and Independent Testing – (CRT)

Name of Project	Sponsors
Establishing limestone consumption factor	M/s Mangalam Cement, Rajasthan
Burnability of Raw Mix samples and testing of limestone sample	M/s RCCPL, Satna M.P.
MoU for consultancy services	M/s Nuvoco Vistas Corporation Ltd., Construction Development and Innovation Centre (CDIC), Unit No 13, Marol Cooperation Industrial Estate, Marol, Andheri (East), Mumbai-400059
Establishing limestone consumption factor	M/s Birla Corporation Limited, PO-Birla Vikas, Satna-485005, M.P.
Development of Standards for Calibration of XRF Analyzer	M/s UltraTech Cement Ltd, (Awarpur cement works), Awarpur, Maharashtra.
Investigation on utilization of two no of processed chrome sludge (A) Organically treated sample and B) Inorganically treated sample incinerated) in the manufacture of clinker and building bricks	
Characterization and Evaluation of Limestone samples	M/s J K Lakshmi Cement Limited, R&D Centre, Jhajjar, Haryana.
Calibration of X-Ray Fluorescence Analyzer (XRF) with standards, Onsite	M/s Ultratech Cement Limited, (Unit: Andhra Pradesh Cement Works), Tadipatri, Bhogasamudram, Anatapur Distt, A.P - 515415
Characterization and Evaluation of Limestone samples	M/s J K Lakshmi Cement Limited, R&D Centre, Jhajjar, Haryana
Development of standards for calibration of XRF	M/s UTCL, Bhogasamudram, Karnool Dist, Tadipatri, Karnataka

Development of methodology for analysis of clinker and slag by optical microscope	
Development of standards for calibration of XRF	M/s RCCPL Chanderia
Evaluate the potential for using Indian C & D waste fines as supplementary cementitious material (SCMs)	
Establishing Limestone Consumption Factor	M/s Sagar Cement, Jeerabad Unit, Dhar, M.P.
Establishing Limestone Consumption Factor	M/s Dalmia Cement (Bharat) Ltd., Kadapa A.P.
Burnability of Raw Mix samples	M/s Ultratech Cement Ltd., Manikgarh Cement Works, Gadchandur, Korpana, Chadrapur, M.H.
Burnability of Raw Mix samples	M/s Ultratech Cement Ltd., Manikgarh Cement Works (Unit-II), Gadchandur, Korpana, Chadrapur, M.H.
Establishing Limestone Consumption Factor	M/s UTCL Aditya Cement Works Chittorgarh
Burnability of Raw Mix samples testing of coal and limestone samples	ACC Ltd., Gagal
Establishing Limestone Consumption Factor	M/s UTCL Siddhi Cement Works M.P.
Establishing Limestone Consumption Factor	M/s KJS M.P.
Establishing Limestone Consumption Factor	M/s Diamond Cement, Heidelberg Cements
Establishing Limestone Consumption Factor M/s UTCL, Bella Cement Works, Rewa, Satna	Establishing Limestone Consumption Factor M/s RCCPL, Satna
Burnability of Raw Mix samples	M/s Ultratech Cement Ltd., Manikgarh Cement Works, Gadchandur, Korpana, Chadrapur, M.H.
Burnability of Raw Mix samples	M/s Ultratech Cement Ltd., Manikgarh Cement Works (Unit-II), Gadchandur, Korpana, Chadrapur, M.H.
Burnability of Raw Mix samples testing of coal and limestone samples	, M/s Prism Johnson, Satna. M.P

Burnability of Raw Mix samples testing of coal and limestone samples	M/s Prism Johnson, Unit-II, Satna. M.P
Establishing Limestone Consumption Factor	M/s M/s Vikram Cement, M.P.
Establishing Limestone Consumption Factor	M/s Prism Johnson, Satna, M.P.
Establishing Limestone Consumption Factor	M/s ACC Ltd., Kymore cement works, M.P.
Burnability of Raw Mix samples testing of coal and limestone samples	M/s UTCL, Manikgarh Cement LTD,Gadchadur, M.H.
Burnability of Raw Mix samples testing of coal and limestone samples	M/s UTCL, Manikgarh Cement LTD, Unit-II, Gadchadur, M.H.
Burnability of Raw Mix samples and testing of limestone sample for	M/s UTCL, Birla White, Rajshree Nagar, Jodhpur
Chemico Mineralogical Characterization and burnability investigation	M/s Nuvoco Vista, Rajasthan
Establishing Limestone Consumption Factor	M/s Shiva Cement (JSW Unit) Orissa
Establishing limestone consumption factor	M/s Jaykay Cement Central Ltd., Tehl Amanganj, Panna M.P.
Burnability of Raw Mix samples and testing of limestone sample	M/s RCCPL, Satna M.P.
Development of standards for calibration of XRF	for M/s UTCL, Maihar Cement Works, Satna M.P.
Burnability of Raw Mix samples testing of coal and limestone samples	M/s UTCL, Manikgarh Cement LTD, Unit – II, Gadchadur, M.H.
Burnability of Raw Mix samples testing of coal and limestone samples	M/s UTCL, Manikgarh Cement LTD, Gadchadur, M.H.
Establishing limestone consumption factor	M/s Orient Cement, Chittapur, Gulbarga, KA
Technical suitability of utilization of copper slag in manufacturing of cement	M/s Adani Enterprises Ltd., Udaipur, Chattisgarh
Evaluation of GGBFS and slag samples for glass content (60 samples)	
Establishing Limestone Consumption Factor	M/s Birla Cement Ltd, Birla Nagar, Satna, M.P.
Burnability evaluation of kilnfeed samples	for M/s UTCL, Manikgargh Cements Unit-I, M.H.

Burnability evaluation of kilnfeed samples	M/s UTCL, Manikgargh Cements Unit-I, M.H.
Establishing Limestone Consumption Factor	M/s KJS Cement, Maihar, M.P
Development of standards for calibration of XRF	M/s UltraTech Cement Limited, (Unit: Andhra Pradesh Cement Works), Tadipatri Mandal, Bhogasamudram, Anantapur

Centre for Mining, Environment, Plant Engineering and Operation (CME)

Sponsored Project Title
QUALITY ASSURANCE GROUP (Electrical & Mechanical)
Provision of Air Conditioning Facility, Lighting points, Power Points, Air Conditioner, Wall mounted fans ceiling lights at ICU in Ground Floor Delivery Suite at 1st Floor and Panchkarma Centre at 2nd Floor Online UPS in Electrical Cable for ICU Dialysis unit and lifts; Exhaust Fan for Medical Store in Basement, Ground Floor 1st Floor and 2nd Floor portable OT Examination Light at 100 Bedded Tilak Nagar Colony Hospital under West zone.
Redevelopment of general pool Residential Colony at Thyagnagar, new Delhi
Redevelopment of General pool residential colony at Mohammadpur, New Delhi, Construction of 400no. Type 2 and 345 no. type-3 GPRA on EPC Basis
Provision of lighting arrangement with galvanized poles in parks of Nangal Dewat village, C-6 Vasant Kunj, C-9 Vasant Kunj, C5 Vasant Kunj in ward no. 50S and approach road of Bamnauli Village and Dhoolsiras village under NGZ.
Construction and providing multilevel electro mechanical car parking system in new upcoming office buildings complex of MoD at KG Marg (near Asia house) and Africa Avenue (near Sarojini Nagar depot), New Delhi
Third party quality Assurance/audit of "Survey, Design, Testing & Commissioning Zone and 5year O&M including insurance of rooftop solar panel system of 5Kw capacity each at 177 nos. school of SDMC under Samagra Siksha Abhiyan
Enhancement in Capacity of Electrical Horizontal Centrifugal pumps at Malikpur Pumping Station under Najafgarh Zone, MCD
Operation and Maintenance of Waste water treatment plant at Shahdara Jheel near zonal office in ward no.-39E under Shahdara (North) zone.
Construction of Bharat Darshan Park at Panjabi Bagh Ward no. 02-S in West Zone under Waste to Art. Subhead: Provision of Lead Acid Batteries, Bollard Lights, C PVC Pipe, Electrical Cable and Electrical Power Distribution Control Panel
Annual Operation of Fire Alarm Protection and Fire Hydrant System installed in Hindu Rao Hospital

SITC of pumping stations for supply of treated effluent water from Keshopur STP to various parks of Vikaspuri under west zone, SDMC
Comprehensive AMC (Annual Maintenance Contract) for Repair and Maintenance of Tubewells installed at various Mpl. Parks under Keshav Puram Zone.
Comprehensive AMC (Annual Maintenance Contract) for Repair and Maintenance of Tubewells installed at various Mpl. Parks under Rohini Zone
Construction of integrated complex of 273 multi-storeyed EWS housing with facility building behind DDA Project Office at Manglapuri, Dwarka
Construction of International Boys Hostel of 500 Capacity & Food Court including water supply, sanitary installation, internal electrical installation, Fire Fighting System, Fire Alarm system, Sub-Station, Lifts, D.G. Sets, CCTV, R.O. Plants, Access control system and solar PV system at IARI Pusa, New Delhi.
C/o New Office Building for the Agriculture Scientists Recruitment Board at Pusa, New Delhi.
Construction of Permanent Administrative Block Building at Rohini Depot-I. Sub Head Electrification and firefighting works of New Admin Building at DTC Rohini Depot-I.
Comprehensive operation and maintenance contract of 4 Nos. truck mounted suction cum jetting machines 8 KL capacity in the jurisdiction of North DMC for further 3 months.
Provision of EI, Fans and Compound lightning and kitchen ventilation system in proposed big size modular centralized kitchen at M.C. Pry. School B-Block Kalkaji pocket- 40 CR park CNZ, M.C. Pry. School B-3A Block Janakpuri west zone, MC primary school Bagdola village Najafgarh zone and M.C primary school (Boys) Lado Sarai south Zone under SDMC
TPI- Electrical Installation for Rural Electrification Corporation World, Headquaters Building, Sector29, IFFCO CHOWK METRO STATION,GURGEON,122022
Supply, Installation, Testing and Commissioning alongwith 05-year Comprehensive Maintenance of Oxygen Gas pipe system with Manifold, in Ward Block for 100 beds (Ground to 3rd floor) Balak Ram Hospital in Timarpur, Civil Line Zone.
Hostel block in medical college at Hindu Rao hospital in c280/CLZ.
Provision of street light Poles with LED fitting at Santushti Apartment D-6 Vasant Kunj, ward No 69S under South Zone.
Improvement and development of Lighting arrangement with octagonal poles (with fittings) in parks and streets of Pocket-A Sukhdev Vihar in ward No.-89S under central zone.
Providing and Fixing of street lights on existing poles with allied accessories at dark spots surveyed and listed by Safetipin at various location in ward no .2N, 3N, 4N, 5N, 29N, 30N, 31N, 35N, 36N & 39N under Narela Zone.

Construction of 100 Bedded Hospital at Tilak Nagar, New Delhi under west zone. Sub Head: - Provision of Lighting arrangement at Third floor, Fourth floor, Fifth Terrace floor and LT Main Panel in Tilak Nagar Colony Hospital Under West Zone/SDMC.

Centre for Construction Development and Research (CDR)

Title	Name of Sponsor
Concrete Technology (CON)	
Alkali-Aggregate Reactivity Testing of Coarse Aggregate and Fine Aggregate for Dugar HE Project (500MW)	NHPC Limited, Dugar HE Project (500MW), Luj, Killar, (Pangi), Chamba, (H.P.)
Testing of Coarse Aggregate and Fine Aggregate for Kirthai-II HE Project in Kishtwar (J&K)	Chenab Valley Power Project (P) Ltd. Kirthai-II HE Project, Chenab Nagar-II, Kishtwar, J&K
Evaluation of Granulated Blast Furnace Slag Sand as per IS: 383: 2016 and Study its Suitability to be used as Fine Aggregate for M/s JSW Cement Limited	JSW Cement Limited, JSW Center, Bandra Kurla Complex, Bandra (East) Mumbai, Maharashtra
Evaluation and Testing of Concrete making materials and Mix Design of M50 (SCC) Grades of Concrete (2 Nos) with Ultratech OPC 53 Grade & Flyash and Wonder OPC 53 Grade & Flyash for Construction of Common Central Secretariat Integrated Buildings 1-2 & 3 at Plot No. 137, New Delhi	Central Vista Project Division-7, CPWD, Vidyut Bhawan, New Delhi
Evaluation of Materials and Concrete Mix Design for Concrete of Grades M25, M30, M35 & PQC (M35 for Road Work) for CHP Civil Works Package 3X800 MW PVUN (Stage-I), Patratu, Ramgarh	PVUN Patratu, Distt- Ramgarh, Jharkhand
Evaluation of Materials and Concrete Mix Design for Concrete of Grades of M30A20 (each source) and M20A20 (each source) for the work of Dewatering and associated strengthening works of plunge pool at Koldam HPS	NTPC Limited, Kol Dam Hydro Power Station, Post. Jamthal, Jal Jyoti Vihar, Tehsil Sadar, Distt. Bilaspur, HP

Conduct Thermal Studies of Concrete Punatsangechhu-I HE Projects, (6X200 MW), Bhutan	M/s Wapcos Limited, Gurugram
Evaluation of Materials and Concrete Mix Design for Concrete of Grades M30 Ramco OPC 43 Grade and M30 (with Ultratech OPC 43 Grade) for RCC Chimney Shell of FGD Works	NTPC Farakka, NTPC Limited, Farakka Super Thermal Power Station, P.O. Nabarun, Distt. Murshidabad
Performance evaluation of Integral Crystalline Admixture (Fosroc Conplast Crystalline) in M30 grade concrete at two dosages for the work of "Redevelopment of General Pool Residential Colony at Kasturba Nagar, New Delhi (Phase-1) – Construction of 1206 nos. Type-II, 1200 nos. Type-III Including Two Level Basement, Podium Parking and Facilities including all development Works and Services on EPC basis including maintenance for 1825 days after completion of work."	ITD Cementation India Limited, Site Office, Sewa Nagar, Kotla Mubarakpur, Railway Station, New Delhi
Evaluation of Materials (Cement Sample and Water Sample) and Concrete Mix Design for Concrete of Grade M25 using Dalmia PPC for the Work of "Integrated Township and Administrative Building Package for PB, CB, KD & BD Coal Mining Projects"	NTPC Site Office, Sikri Barkagaon, Pakri Barwadih Coal Mining Project, NTPC Limited, Hazaribagh, Jharkhand
Evaluation of Material and Concrete Mix Design of M25, M35 and M45 Grade of Concrete	Central Public Works Department, Buglow No. 8, Near B K Chowk, Faridabad
Performance Evaluation of Crystalline Waterproofing Admixture i.e. Dr. Fixit PolyPlus CP Admix in Concrete	Pidilite Industries Limited, Ramkrishna Mandir Road, P.O. Box No. 17411, Andheri (E), Mumbai, Maharashtra
Structural Assessment and Rehabilitation (SAR)	
Condition assessment of Ward building (G+5 storied) of RML Hospital, New Delhi	RML Hospital, CPWD, Near GATE No.9, Talkatora Road, Rohini, New Delhi

Condition assessment of CBI Pool Qtrs 20 nos. at DDA Flats, Kalkaji, New Delhi	V-Division, CPWD, East Block-3, Level-5, R.K. Puram, New Delhi
Condition Assessment of RCC members of stilt floor and peripheral RCC members of Building Envelope of Residential Towers of Vaish Group Housing Society (GHS) Apartments at Sector-45, Faridabad	The Vaish Co-Operative Group Housing Society Ltd, GHS 5, Sector-45, Faridabad
Condition Assessment of Type II Residential Quarters (Pocket 1 to IV, 2115 nos.) in Lodhi Road Complex Area, New Delhi	Executive Engineer 'T' Division, CPWD, East Block-2, Level-3, R.K. Puram, New Delhi
Random Quality Inspection during Rehabilitation & Retrofitting of 1st floor Fairlie Ware house, SMPK, Kolkata.	Civil Engineering Department, Syama Prasad Mukherjee Port Trust, 15, Strand Road, Kolkata
Condition Assessment Studies of TG Foundation Unit#1, 2 & 3 at NTPC Ltd/ Farakka.	Farakka Super Thermal Power Station NTPC Limited, Farakka, P.O. Nabarun, Distt- Murshidabad
Core Testing of 6 Nos. of 9 Mtr. PCC Poles & 6 Nos. of 11 Mtr. PSC Poles for BSES	BSES Rajdhani Power Limited, 1st Floor, C-Block, BSES Bhawan, Nehru Place, Delhi
Core Testing of 38 Nos. of 9 Mtr. PCC Poles & 38 Nos. of 11 Mtr. PCC Poles for BSES	BSES Rajdhani Power Limited, 1st Floor, C-Block, BSES Bhawan, Nehru Place, Delhi
Carry out Condition Assessment Study of RCC Terrace Slab of Bank of Baroda Building at Hyderabad	Baroda Bhavan, Urdu University road, Telecom Nagar, Gachibowli, Hyderabad
Carry out Condition Assessment using Non-Destructive Evaluation Techniques including preparation of material specification for repair & rehabilitation of RCC Overhead Tank at NRSC, Hyderabad	Dy. Head (Civil Division-I), Construction and Maintenance Group National Remote Sensing Center, ISRO, Dept. of Space, Govt. of India, Balanagar, Hyderabad
Condition assessment of MCH block building at Banswara City Hospital, Rajasthan	HSCC (INDIA) Limited, Vidhya Nagaur, Pali, Rajasthan

Condition Assessment of one Building (AB-02) at GLA University Mathura, UP	Civil Engineering Department, GLA University, NH-2, Mathura, UP
Condition Assessment of GPRA Quarters (16 blocks/256nos.) in Andrews Ganj Extn., New Delhi	'P' Division, CPWD, Andrews Ganj, New Delhi
Condition assessment of TG Deck slab & Columns of Unit 4,5 &6 (500MW each) at Farakka Super Thermal Power Station NTPC Ltd. West Bengal	Farakka Super Thermal Power Station, NTPC Limited, Farakka, Distt-Murshidabad, West Bengal
Condition Assessment of fire damaged BSL area of CCRF in Convergence Block at AIIMS, New Delhi	Admn. Block, All India Institute of Medical Sciences, Ansari Nagar, New Delhi
Carrying out Condition Assessment of Corporate Office Building, Central Ware Housing Corporation (CWC), Hauz Khas, New Delhi	Central Ware Housing Corporation, 4/1, Siri Institutional Area, August Kranti Marg, Hauz Khas, New Delhi
Condition Assessment Studies of TG Hall Structure Stage# 1, 2, 3 at NTPC Ltd/. Farakka. (P.O. No.4000193363-026-1024/780 dated 2-11-17)	Farakka Super Thermal Power Station, NTPC Limited, Farakka, P.O. Nabarun, Dist- Murshidabad, West Bengal
Non Destructive Test Evaluation Technique for 4 Nos Column of Overhead Water Tank at RAF Vastral, Ahmedabad-Reg.	Executive Engineer (Ahmedabad), Central Public Works Department - Government of India
Condition Assessment of three block Buildings at District Hospital Nagaur, Rajasthan	HSCC (INDIA) Limited, Near Bangaur College, B. Vidhya Nagaur, Pali, Rajasthan
Preliminary Site inspection of Plant & Township buildings for Condition Assessment of Buildings at NTPC Anta, Rajasthan	NTPC Ltd, Anta Gas Power Station Plant, Township and CSR, Field Engg. Services & FQA (Solar & Misc.) Anta, Distt. Baran, Rajasthan
Third Party Quality Assurance during Repair and strengthening of TG Roof and 4 nos. CW Pump Foundations Power Plant-III at NSPCL, Bhilai, Chhattisgarh.	Sr. Manager (Civil), PP-III, NTPC SAIL Power Company (P) Ltd. (NSPCL), Bhilai

Carry out Random Quality Inspection during Repair of Distressed MGR Bridges (6 no's) at NTPC Korba	Sr. Manager MGR, NTPC Limited, Korba Thermal Power Station, PO: Jamnipali, Chhattisgarh
Detailed investigation of quarters at Sriperumbudur Substation.	Power Grid Corporation of India Ltd, Southern 400 KV Substation, Pennalur Sriperumbudur
Condition Assessment Study of Existing RCC Structure of Pre-heater Building at CCI Tandur Cement Factory	Cement Corporation of India Ltd., Tandur Cement Factory, Tandur, Karankote, Telangana
Preliminary Site Inspection for Condition Assessment of Civil Structures at NSPCL CPP-II, Rourkela.	Rourkela PP-II, Administrative Building, CPP-II, Sail-RSP Complex Rourkela
Condition Assessment of School building at NTPC Talchar Plant, Orissa	NTPC Talchar, Talchar Thermal Power Station (TTPS), P.O. Deepshikha (Kaniha), Distt. Angul, Orissa
Condition Assessment of the building M.S. Flats, Pandara Park, New Delhi.	N-Division, CPWD, I.P. Bhawan, New Delhi
Condition Assessment of RCC Structures of MAP Phase-I 304 ORs Quarters and 72 JCOs Quarters at Happy Valley, Shillong, Meghalaya	RITES Limited, 4th Floor, NEDFI House, Dispur, Guwahati, Assam
Construction Technology and Management (CTM)	
Third Party Quality Assurance/Audit for work of "Construction of 48 Nos Type-II Quarters and 28 Nos T-III Quarters at Block No. 2 & 3 in Schedule 'A' and at Block No. 12 in Schedule 'B' including Basement for Parking under Redevelopment Scheme of the President Estate, New Delhi	Central Public Works Department, President Estate Project Division, Rashtrapati Bhawan, New Delhi
Third Party Quality Assurance / Audit for work of "Construction of RCC drainage system of Wazirabad main road part-1 RHS in Wazirabad Village (PH-1) in C-12N/CLZ(2) C/o RCC drainage system of Wazirabad main	Executive Engineer (Project) CLZ, North Delhi Municipal Corporation, Shakti Nagar, Delhi

road part-2 RHS in Wazirabad Village(total 08 sites).	
TPQA for work of "Construction in M C Pry. School at Vishnu Garden in ward no. 007 in WZ (Part B: Dismantling of existing old structure, part C: P/o EI fans and compound lighting, Part D: Firefighting work and Part E: Grid tied rooftop solar power plant.)"	Executive Engineer (Pr-II), WZ, South Delhi Municipal Corporation, Under Dabri Flyover, New Delhi
Third Party Quality Assurance/Audit for work of "beautification and face lifting of water body/park adjoining Rajkiya Pratibha School and near DDA pocket-2 Dwarka New Delhi by providing brick work steel work MS Grill interlocking CC Paver Block Kerb Stone red sand stone work painting etc. in boundary wall footpath entrance gate pedestrian gate in ward no. C-38-S(Dwarka-B)/NGZ"	Executive Engineer (M-I), NGZ, South Delhi Municipal Corporation, Najafgarh, New Delhi
Third Party Quality Assurance for Various works of Construction of Type-V, 24 Nos Quarters at IARI Pusa, New Delhi	Construction Division-IV, Central Public Works Department, IARI, Pusa, New Delhi

Appendix – IV

Research and Development Programme 2023–2024: In Progress

S. No.	Code	Project Title	Date of commencement	Target Date of Completion
PROJECTS UNDER DCCI				
1.	WAU-19	Investigations on Utilization of Phospho- gypsum in Cement Manufacturing	Aug 2021	Jul 2024
2.	COB-14	Development of methodology for estimation of kaolinite content in Indian quality clay	Apr 2023	Mar 2025
PROJECTS UNDER: PROJECT BASED SUPPORT FOR AUTONOMOUS INSTITUTES				
1.	SOD-13	Effect of Fire on the Residual Mechanical Properties of reinforcing bars and Structural Performance of Reinforced Concrete Beams in flexure & Shear.	Apr 2022	Mar 2025
2.	SAR-02	Evaluation of Concrete Surface Coatings for their effectiveness in service life enhancement of RCC elements under: Carbonation induced corrosion & Chloride Induced Corrosion.	Apr 2022	Mar 2025
3.	CON-19	Utilization of CO2 in fresh concrete and study on fresh and hardened properties of CO2 induced concrete.	Apr 2022	Mar 2025
4.	NCB-BH/CON1	Stress–Strain Behavior of High Performance Geo Polymer Self Compacting Concrete Mix and its Performance evaluation	Apr 2023	Mar 2025

NCB Patents Granted/ Filed During 2011-2023

Patents Granted:

Sl. No.	Patent No	Title	Names of Inventors
1.	344069	Mineralizing effect of "barium sludge- an industrial byproduct" in the manufacture of ordinary Portland cement	Sh. A Pahuja Dr. M M Ali Dr. V P Chatterjee Sh. S K Chaturvedi Sh. S K Agarwal
2.	314591	Rationalizing formulations and curing conditions for improving properties of hardened Geopolymeric Cement	Sh. Ashwani Pahuja Dr. M M Ali Dr. R S Gupta Dr. S Vanguri Dr. V Liju
3.	337143	Process for the Preparation of sulphoaluminate - belite cement utilizing high magnesia / dolomitic limestone	Sh. Ashwani Pahuja Dr. M M Ali Sh. P S Sharma Dr. V P Chatterjee
4.	340210	Nanosilica blended ordinary Portland cement compositions with improved performance characteristics and a process thereof	Sh. Ashwani Pahuja Dr. M M Ali Dr. S Harsh Sh. Suresh Vanguri Dr. Varsha Liju
5.	344307	Fast process for determining expected 28-days compressive strength of concrete made with Portland Pozzolana Cement (PPC)	Sh. V V Arora Sh. Suresh Kumar Sh. Manish Kumar Mandre
6.	294833	A process for producing of Ordinary Portland Cement	Sh M Vasudeva Dr M M Ali Dr D Yadav Dr J M Shatma NALCO Officials
7.	295058	A process for preparation of synthetic slag from low grade limestone and dolomite	Sh. A Pahuja Dr. M M Ali Sh. P S Sharma Sh. S K Chaturvedi Sh. S K Agarwal Dr. V P Chatterjee Dr. D. Yadav Sh. Tashi Tshering Sh. Udai Kaflay

Sl. No.	Patent No	Title	Names of Inventors
8.	347356	Marble dust as mineral additive in the manufacture of ordinary Portland cement	Sh. A Pahuja Dr. M M Ali Sh. P S Sarma Sh. S K Agarwal Sh. Ashish Goyal
9.	355368	Method for rapid estimation of Na2O and K2O in different types of cement and raw materials	Sh. Ashwani Pahuja Dr M M Ali Sh. S K Chaturvedi Sh. S. C. Sharma

Patents Filed:

SI/No.	Application No.	Title	Name of Inventors
1.	1195/DEL/2015	Investigations on the use of limestone mine reject on the properties of OPC clinker and resultant cement	Sh Ashwani Pahuja Dr M M Ali Dr V P Chatterjee Sh S K Chaturvedi Sh S K Agarwal
2.	201711000524 Dt:05-01-2017	A Process for Preparing Tiles	Sh Ashwani Pahuja Dr. S K Chaturvedi Dr S Harsh Dr. R S Gupta Sh. S Vanguri Dr. V Liju Dr. M N K Prasad Bolisetty
3.	201811047884 Dt:18-12-2018	Geoploymer concrete paving block and a process for preparation thereof	Sh. V.V. Arora Sh. Amit Trivedi Sh. Lalit Kumar
4.	201911049295	Composition of PPC and PSC using High Magnesia (MgO) clinker	Dr B N Mohapatra Dr S K Chaturvedi Sh G J Naidu Sh Giasuddin Ahamed
5.	202211044873	Sustainable Concrete composition and method for preparation there of	Ms Sonal Saluja Dr Arun Gaur Dr Sanjay Mundra
6.	202311023188 Dt:29-03-2023	A flexible Material Transfer Apparatus for Handling Solid Alternative Fuels & their mix	Dr Kapil Kukreja Dr Manoj Kumar Soni Dr B N Mohapatra
7.	202311059563 Dt:05-09-2023	Vertical Alternative Fuel Dryer (VAFD) for Minimizing	Dr. L P Singh Dr. D K Panda

SI/No.	Application No.	Title	Name of Inventors
		Moisture Content of Solid Alternative Fuels (AFs).	Dr Kapil Kukreja Dr Prateek Sharma Sh Ankur Mittal Sh Bharat Bhushan

National Council for Cement and Building Materials

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