ANNUAL REPORT 2018-19

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

Annual Report 2018 - 19

1 April 2018 to 31 March 2019

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-121 004, Haryana

CONTENTS

	Message from the Chairman*
	From the desk of Director General*
	Vision and Mission
	NCB Hierarchy
	Introducing NCB
	NCB's Commitment to International Quality Standards
	Dr. Bibekananda Mohapatra, took over as Director General of NCB
	Board of Governors 2018-2019
	Corporate Advisory Committees
1	**NCB's Programmes and their Fulfillment**
6	**Centre for Cement Research & Independent Testing- CRT**
13	**Centre for Mining, Environment, Plant Engineering & Operation- CME**
20	**Centre for Construction Development and Research- CDR**
35	**Centre for Quality Management, Standards and Calibration Services - CQC**
41	**Centre for Industrial Information Services- CIS**
48	**Centre for Continuing Education Services- CCE**
56	**NCB Hyderabad Unit**
63	**NCB Ahmedabad Unit**
66	**NCB Bhubaneswar-Project Office**
68	Papers Presented in Workshop, Seminars and Conferences
69	Papers Published
70	**Representation of NCB Officials in Various Technical Committees**
80	**Appendix – I: Rolling Plan of Missions within the Framework of Centres**
85	**Appendix – II: Programmed Projects Completed During the Year 2018-19**
86	**Appendix – III: Sponsored Projects Completed During the Year 2018-19**
98	**Appendix – IV: Research and Development Programme 2019-20**
100	**Appendix – V: NCB Patents Granted/ Filed during 2010-2019**
103	**Finance and Accounts**
103	Finance
103	Accounts
	Important Events

Compendium on "The Cement Industry –India 2018"

Launch of Indian Certified Reference Materials (BNDs) Developed by NCB in the area of Building Materials

Visit of Sh. Anil Aggarwal, Joint Secretary-DPIIT to NCB-Ballabgarh

Review of R&D Projects at DPIIT, Udyog Bhawan, New Delhi

National Technology Day

हिन्दी पखवाड़ा

राजभाषा नीति और कार्यान्वयन पर कार्यशाला

माननीय संसदीय राजभाषा समिति की बैठक

राजभाषा अधिनियम पर कार्यशाला

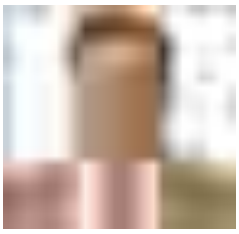
Forum for Science and Technology (FST)/Scientific & Technological Interactive Meet (STIM)

NCB Day Celebrations

Republic Day Celebrations at NCB

Highlights of NCB Activities

Message from the Chairman



NCB - The apex body for research, development, technology development & transfer, continuing education in the areas of Cement and Building Materials, under its mission based approach has always strived for developing technical know-how through its programmed projects and rendering technical services with efficiency to the cement and construction industries. It is a matter of contentment to be associated with NCB since long. As I have observed, NCB always keeps pace with latest developments in the interest of the industry and nation such as conservation of mineral wealth, conservation of energy, environmental aspects, productivity, quality control and quality assurance and growth as a whole.

With the industry and stake holders in mind, NCB has taken up programmed projects on Application of CFD in Indian Cement Industry, Cost Effective Technology for Low Traffic Volume Concrete Roads, Impact of Ammonia on Environment due to use of Ammonia for secondary abatement of NOx Control in Cement Industries in India, Improving the Reactivity of Fly Ash and their Effect on Cement and Concrete Performance etc.. NCB has completed 4 programmed projects during 2018-19.

NCB renders its services to the cement and building material industries by executing projects on sponsor basis, testing materials in its NABL accredited and BIS recognized laboratories, providing calibration services, training and solving problems wherever required. With its strength, NCB has completed 381 sponsored projects during this period.

Investigation on Development of Synthetic Slag using Low grade Limestone, limestone consumption factor studies, Development of Active Belite Cement using Low Grade Limestone, studies on Investigation on Improving the Performance of Composite Cement by Separate Grinding of Constituents, Improvement of fly ash quality through chemical/mineral doping in coal during its generation, Comparative Evaluation of Limestone Calcined Clay and Marble Waste Calcined Clay Cement Blends, Utilization of Wollastonite Mineral in Cement Manufacture are the prime areas where NCB has made significant contribution to the benefit of the industry.

NCB conducted studies on geological mapping and topographical survey for several limestone deposits in India and abroad using advanced computerized techniques. Projects on Computer-aided Deposit Evaluation and Optimization of Limestone resources, number of projects on Environment Management and Monitoring of Environmental Parameters, Process Optimization, Energy Audit, Preparation of TEFR for cement plants in India and abroad, Utilization of Waste Derived Fuel, Loss Estimation and Project Revival, Project Monitoring and Consultancy etc. have been completed during the period.

NCB has been carrying out pioneering work for the concrete and construction industries. Development of Ultra High Performance Concrete (UHPC) including use of Nano Technology, Evaluation of concrete making materials and mix design, alkali aggregate reaction (AAR) studies, Investigation on application of Carbon Nanotubes for improving performance of cement concrete and concrete based precast building products, Study on Use of ferrochrome slag as a fine aggregate (water cooled) and coarse aggregate (air cooled) in concrete, Durability Study on PSC made using composite slag (mix of BF slag and LD slag), Design of Low-Traffic Volume Concrete roads using C&D waste are the important areas where NCB has contributed to the industries. NCB has also developed number of special concretes for different uses. Also, NCB has completed number of projects on structural assessment of buildings, bridges, dams, flyovers etc. Third Party Quality Assurance/Audit (TPQA) programme has assisted various organizations to ensure delivering quality constructed facilities.

NCB has been organizing International Seminars on Cement and Building Materials since 1987, and the 16th NCB International Seminar will be held during 03-06 December 2019 in New Delhi for which NCB is putting its efforts to bring all to a single platform for mutual benefit and for benefit of the nation as a whole.

In the area of Human Resource Development, NCB conducted 69 Training Programmes during the year benefitting 1309 participants. In the area of Quality Management, NCB conducted 10 Inter Laboratory Proficiency Testing Schemes and continued the supply of reference materials in its new avatar 'Bhartiya Nirdeshak Dravyas' (BNDs). NABL accredited Calibration services were also provided,

The scientists and engineers including other technical and non-technical staff with their continuous efforts have achieved these. The achievements and progress made by NCB to a great extent are due to the active support and cooperation from the Government, industry and other organizations. I wish to extend my sincere thanks to my colleagues on the Board of Governors and its Committees for their valuable advice and guidance in decision making on various issues from time to time. I also extend my sincere thanks to the Department for Promotion of Industry and Internal Trade, Government of India for providing their support and direction.

Mahendra Singhi
Chairman

08 November 2019

From the desk of Director General

With immense pleasure, I'm presenting to the cement and concrete fraternity, government, academia, scientific institutions, civil society and all our stakeholders, the Annual Report for the year 2018-19. This year's Annual Report is all about capturing the dynamic quality that permeates every laboratory, training hall and building in NCB units present in all four corners of the country.

With the year gone by, as we at NCB have been able to broaden our client base and attract attention of a large number of clients, fresh and old alike, looking for technological and industrial support services in various areas of our activities. With pro-active customer centric approach and constantly updating infrastructure facilities, we have satisfactorily completed 381 sponsored projects for the industry and 4 programmed projects besides pursuing 16 R&D Projects during the year. The projects covered all important research areas like raw mix design, utilization of industrial wastes, process optimization studies, energy conservation, environment improvement, diagnostic studies on distressed structures, quality audit and human resource development and so on.

In the area of cement research, two noteworthy game changer breakthroughs were made during the year namely, Belite sulphoaluminate clinker produced using low grade limestone and other industrial wastes at a temperature of 1250°c and high MgO clinker for blended cements. These breakthroughs will pave the way for sustainable and environment friendly clinker/cement production in years to come subject to codal formulations. Results show that composite cement samples prepared by separate grinding with blending gave enhanced performance characteristics, particularly better strength properties. Another study revealed that the sintering aids convert the crystalline content of silicate materials into amorphous content and enhances the same in coal. By using chemical activators, it is found that fly ash content in PPC can be increased up to 45%. NCB has developed synthetic slag using Low Grade Limestone and other waste additives having similar properties of GBFS as obtained from steel plant. The performance of PSC blends prepared using synthetic slag sample were found to have performance characteristics comparable to the PSC samples prepared using granulated blast furnace slag provided by the plant and conformed to the compressive strength requirements of Indian Standard Specification, IS:455-1989 for PSC from granulated blast furnace slag. Another investigation, explored use of Wollastonite mineral and its unique characteristic of being a lime bearing non-carbonate material in the much needed CO2 reduction during cement manufacture. The Independent Testing Laboratories at NCB tested more than 11,060 samples during the period. Raw mix design and optimization services were provided to two cement plants while 14 plants availed the services of establishing the limestone consumption factor.

Computer-Aided Deposit Evaluation, Beneficiation on Laboratory Scale for Low/ Marginal Grade Limestone, environment management, monitoring of environmental parameters, Optimization of raw mill and cement mill, energy audits and safety audits of cement plants, TFR on used tyres as alternate fuels in cement manufacture, study for minimizing excessive kiln build-ups, Project Monitoring and Control (*PMC*) Consultancy Services, estimation of losses and project revival and TEFR for setting up of cement plants were some of the industry sponsored studies carried out by NCB. Some of these projects were carried out for our clients abroad. We are honored as well as happy to receive repeat orders from them for our consultancy services, which asserts their belief in us.

In the areas of Construction Development and Research, special concretes like Self-Compacting Concrete, Abrasion Resistant Concrete with and without Steel Fiber have been developed for different customers. Preparation of specifications and guidelines for use of coal based bottom ash as replacement of fine aggregate in concrete, development of Ultra High Performance Concrete (*UHPC*) – including use of Nano Technology, Alkali Aggregate Reaction (*AAR*) studies on aggregates, evaluation and characterization of concrete making materials and concrete mix designs, use of Carbon Nanotubes for improving performance of cement concrete and concrete based precast building products, use of ferrochrome slag as a fine aggregate (*water cooled*) and coarse aggregate (*air cooled*) in concrete, durability of PSC made using composite slag (*mix of BF slag and LD slag*), evaluation of corrosion inhibitors were studies carried out successfully. NCB conducted diagnostic and prognosis evaluation of distress and condition assessment on variety of structures such as turbo generator foundation, dam structure, cooling towers, bridges and

residential, commercial and industrial buildings in different states in India. Third Party Quality Assurance/Audit (*TPQA*) programme offered by NCB has assisted various organizations and contributed to nation building by ensuring quality of materials and workmanship to meet their quality commitments in constructed facilities including ongoing projects of international importance like the Convention Centers at ITPO and Dwarka in New Delhi. TPQA was carried out for roads and bridges construction, residential blocks, community facilities and institutional buildings, canal lining work, concrete drain projects, boundary wall construction etc. for construction industry.

In quality management area, under Inter laboratory services, ten PT schemes have been completed on materials like: steel bar, concrete cube, coal, coarse aggregate, fine aggregate, water for concrete, OPC etc. These schemes were implemented in accordance with ISO 17043:2010 by the laboratories engaged in testing of cement and building materials. Assistance in ISO 17025 (*NABL*) Accreditation was given to two cement plants. NCB has developed ten Bhartiya Nirdeshak Dravyas (*BNDs*), the Indian Certified Reference Materials (*CRMs*). NCB has so far developed 79 types of CRMs. A total of 9,196 vials of different CRMs and 1,483 sets of standard lime were supplied to 730 customers from cement plants, testing laboratories and R&D institutions. The calibration laboratories continued to implement Quality Management System as per ISO 17025:2005 requirements. 1700 equipment/apparatus including proving rings, compression testing machines, vibrating machines, dial gauges, Blaine cells, pressure gauges, sieves, thermometers, environmental chambers, ovens, furnaces, balances, rebound hammers etc. were calibrated.

In the area of human resource development, we conducted short and long term training programmes on subjects related to cement manufacture, testing and calibration, quality management and advances in concrete for professionals from various reputed organizations in India and abroad. During 2018-19, 69 training programmes were successfully organized with a total of 1,309 participants attending the programmes. So far 2,602 training programmes have been organized from which a total number of 43,548 participants comprising of industry professionals and fresh graduates/post-graduates in science and different disciplines of engineering have benefited.

It is a matter of great satisfaction to say that NCB's current Research and Innovative projects are well aligned to national as well as global priorities besides addressing current Research & Innovation requirements of cement, building materials and construction industries. We at NCB have chalked out an ambitious plan to conduct frontline research activities till 2021 and beyond in areas such as Low carbon and multicomponent blended cements, Alternative binders and cementitious materials, Alternate fuels and raw materials, Productivity and environment improvement, Stable and durable construction systems, High performance concrete systems and Carbon Capture & Utilization to meet the target of emitting 0.350 t of CO_2/t of cement well before 2050. This exciting, game-changing research taking place in our labs and in the field will surely provide the cement and construction industry with a technologically sound platform to further reduce CO_2 emissions, energy consumption leading to resource and environment conservation, higher thermal substitution rates, longer service lives of concrete structures and cost optimization, taking due care of national and international commitments.

I wish to thank my colleagues for their dedicated support, whole hearted cooperation and commitment to uphold the high standards of professionalism. I am grateful to the Board of Governors and its Committees, Department for Promotion of Industry & Internal Trade, Ministry of Commerce and Industry, Government of India for their support, guidance and encouragement. I also thank industry in general for reposing faith in NCB's services and their continued patronage without which no achievements would have been possible.

I hope that every page of this report introduces you to the true inner workings of NCB, the engines that keep us running strong. At many places in the report you will see faces, smiles, curious and determined eyes, passionate hearts and boundary-pushing minds. In short, our people.

Dr. B N Mohapatra
Director General

08 November 2019

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

INTRODUCING NCB

National Council for Cement and Building Materials (NCB), 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.

Today, NCB is the premier body under the administrative control of Ministry of Commerce and Industry, Govt. of India, for technology development, transfer, continuing education and industrial services for cement and construction industries. NCB serves as the nodal agency for providing the Government 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 center and main laboratories located at Ballabgarh (near New Delhi); another well-established regional center at Hyderabad, unit at Ahmedabad (Gujarat) and at 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 accredited testing and calibration services, ISO 17043 accredited proficiency testing (PT) services and ISO 17020 accredited inspection services. It also develops and supplies certified reference materials (CRMs) to cement and construction sector. For human resource development, NCB provides training services in cement, concrete and building materials field through short term and long term courses. PG diploma course in cement technology is accredited by AICTE. In the area of industrial information services, NCB organizes international seminars on cement, concrete and building materials. It has organized 15 editions of this seminar, so far. All these activities are channelized through six corporate centres:

Centre for Cement Research & Independent Testing (CRT) - Centre is responsible for research activity in the area of cement and other binder, waste utilization, refractory and ceramics, fundamental and basic research. Centre also look 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 management, process utilization and productivity, energy management, plant maintenance and project engineering and system designing.

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) - CIS 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 variety of need base, industry oriented training programmes in the area of cement, concrete and constructions.

NCB has 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

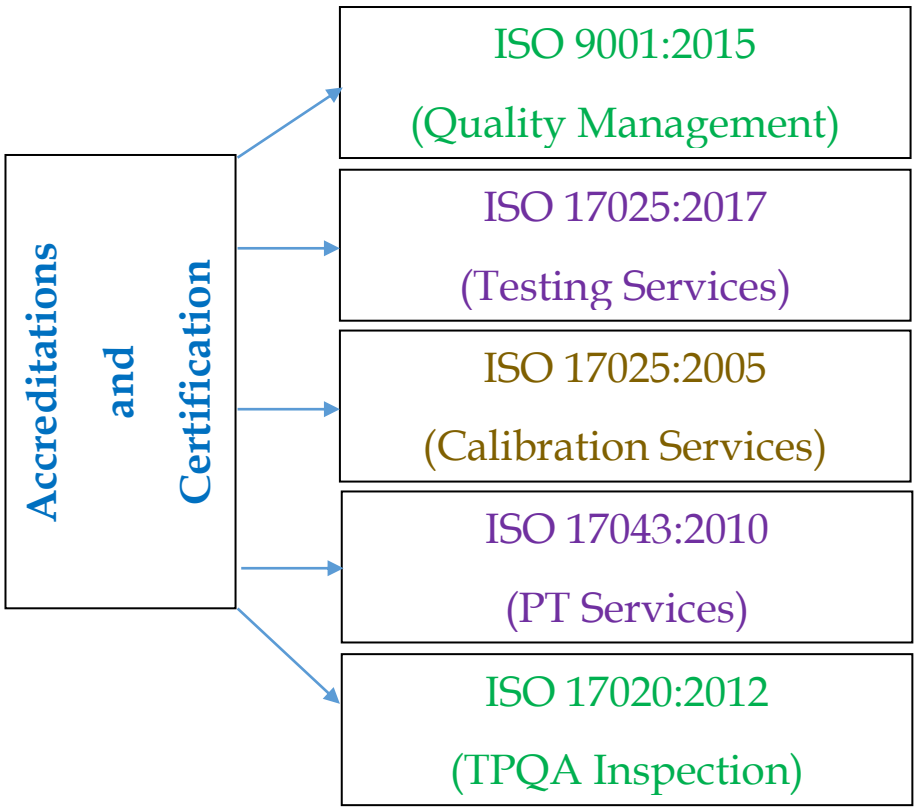
Human Resource and Administrative Services (HRS) - HRS-GEN provides the transportation infrastructure and HRS-PER human resources activity such as recruitment, promotion, appraisal etc.

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 Third Party Inspection 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 POLICY

We commit ourselves to:

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

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.

ISO 17025:2005- Calibration Services

ISO/IEC 17025:2005 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 and accurate calibration results to the total satisfaction of customers in accordance with the stated methods and customers requirements, and set quality objectives.

QUALITY OBJECTIVES

1. ***Providing reliable calibration services, accurately and timely, to the satisfaction and requirements of customers;***
2. ***Continual improvement and upgradation of services and facilities in accordance with changing customer requirements;***
3. ***Improving customer satisfaction feedback;***
4. ***Increasing resource generation.***

ISO 17043:2010 - Proficiency Testing Services

ISO/IEC 17043:2010 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 17043:2010 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.***

ISO 17020:2012-Third Party Quality Assessment

ISO/IEC 17020:2012 is international standard published by International Organization for Standardization and International Electro Technical Commission. This standard specifies requirements for the competence of bodies performing inspection and for the impartiality and consistency of their inspection activities. NCB implemented ISO 17020:2012 for Third Party Quality Assurance Inspection Services since 2017. NCB provides 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.

QUALITY POLICY

National Council for Cement and Building Materials is committed to provide reliable and impartial inspection services in a confidential manner and without any discrimination to the total satisfaction of customers in accordance with the stated methods and customer requirements.

Dr Bibekananda Mohapatra, took over as Director General of National Council for Cement & Building Materials

Dr Bibekananda Mohapatra, took charge as Director General of National Council for Cement & Building Materials on 03rd December 2018, by the approval of the Cabinet Committee under PMO. He brings with him over 32 years of cross-functional experience in areas of Research and Development and has ability to guide the organization towards carrying out research activities aimed for achieving cement sustainability, reduction of CO emissions & low energy cement, which are of prime relevance to the industry today.

Dr Mohapatra earned his Ph.D degree in Cement Mineral Chemistry. He commenced his career as Lecturer in Chemistry and then Scientist in Dalmia Institute of Scientific and Industrial Research, Rajgangpur, Odisha. He worked as HOD (Quality Assurance) in Orissa Cement Limited for about 10 years and later joined Vikram Cement Works (A Unit of UltraTech Cement Ltd), Khor, Dist. Neemuch (MP) as Assistant Vice President. Dr Mohapatra worked as Vice President (New Product Development and Product Quality Management) in the

Corporate Sector of Ambuja Cements Limited, Mumbai prior to joining NCB. He has expertise in characterization of materials covering physical, physio-thermal, thermal (like DTA/DTG) and X-ray diffractometry. He has done extensive research works on effect of inherent Fluorine in cement manufacturing process and cement quality.

His contribution in use of alternate fuel by utilizing hazardous wastes and all agricultural refuses brought a new dimension to the cement manufacturing of the country. He was also associated with development and commercial production of cement such as Composite Cement, Sulphate Resisting Portland Cement, Oil Well Cement, etc. He has attended many National and International Conferences and published about 68 research papers in reputed journals of both National and International fame. He has also authored a book on "Application of X-Ray Diffractometry in Cement Quality Control System" which was released during 14th NCB International Seminar held at Delhi in December 2015. He is a member in various Committees of Bureau of Indian Standards (BIS), State Pollution Control Board (SPCB), Central Pollution Control Board (CPCB), Ministry of Environment & Forests (MoEF) and Central Ground Water Authority (CGWA), Govt. of India.

BOARD OF GOVERNORS (BOG)
2018 & 19

Management of NCB is entrusted to a Board of Governors, which consists of representatives of cement manufacturers, government of India and consumers of cement.

Composition of BOG

Chairman
Shri Mahendra Singhi
President CMA

Members

Shri Anil Agrawal
Joint Secretary (Cement), DPIIT

Shri K K Maheshwari
Managing Director, UltraTech Cement Ltd

Shri B V N Prasad
Director (HR), Cement Corp. of India Ltd. (CCI)

Shri Rajendra Chamaria
Vice Chairman & MD, Cement Manufacturing Co Ltd

Shri Sumeer Malgoora
Managing Partner, Shivalik Cement Industries

Shri Shashank Priya**
Additional Secretary & Financial Adviser, DPIIT

Shri Abhay Bakre,
Director General, Bureau of Energy Efficiency

Shri Ajay Kapur
Managing Director & CEO, Ambuja Cements Ltd

Shri Mahendra Singhi
(Group CEO-Dalmia Cement (B) Ltd)

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

Shri Prashant Bangur
Director, Shree Cement Ltd.

Dr Subhash Chandra Pandey*
Special Secretary & Financial Adviser, DPIIT

Shri S P Singh Parihar
Chairman, Central Pollution Control Board

Shri Getamber Anand
Chairman, CREDAI

Dr B N Mohapatra,
Director General – NCB ¶

Shri Ashutosh Saxena,
Director General (Actg.) – NCB #

** Till June 2019*
*** Since July 2019*
 # Till 02 December 2018
¶ Since 03 December 2018

116th BOG meeting in Progress

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 of eminent and learned technocrats representing Indian cement and concrete industry, technology suppliers, officials from MoCI, Govt of India, Elite academia and Bureau of Indian Standards *(BIS)*, Director General-NCB etc. The RAC members meet twice in a year.

In the financial year 2018-19, the 70th RAC meeting was first held on 27th April, 2018 in which ongoing 24 R&D projects and 07 nos. new project proposals were discussed. Valuable suggestions and feedback were received from the esteemed members.

Composition of RAC

Chairman

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

Members

Shri Ashwani Pahuja
Executive Director
Dalmia Bharat Enterprises Ltd.

Dr K Mohan
Ex Director General-NCB

Shri Ashok Kumar
Energy Economist
Bureau of Energy Efficiency (BEE)

Shri C K Jain
Head Manufacturing Operations – Cement Division
Vasavadatta Cement
Kesoram Industries Ltd.

Prof. A K Tiwari
Vice President – Concrete Research
UltraTech Cement Ltd

Dr. S A I Mujtaba
Suptdg. Geologist
Geological Survey of India

Shri J S Kalra
Senior Joint President
Birla Corp. Ltd.
(Satna Cement Works)

Dr D Venkateswaran
Sr. Vice President (R&D)
The India Cements Ltd.

Dr G V K Prasad
Senior President (CPU-I, II & CCP)
The KCP Ltd.

Dr Manoranjan Hota
Director (IA)
Ministry of Environment, Forests & Climate Change

Dr. Nahar Singh
Principal Scientist
National Physical Laboratory

The Industrial Advisor
Ministry of Commerce & Industry
Government of India

The Director
Central Soil & Materials Research Station (CSMRS)

The Chief Mineral Economist
Indian Bureau of Mines

Shri J K Prasad
Consultant – Building Materials
Building Materials and Technology Promotion Council (BMTPC)

Dr K Ramanjaneyulu
Chief Scientist, Structural Engineering Research Centre (SERC)

The Chairman and Managing Director
National Research Development Corporation

Shri Rakesh Bhargava
Chief Climate and Sustainability Officer
Shree Cement Ltd.

The Deputy Director General
Geological Survey of India

Dr S K Handoo
Advisor (Technical),
Cement Manufacturers' Association

Shri Sanjay Pant
Director (Civil Engg) & Head
Bureau of Indian Standards

Dr Bibekananda Mohapatra
VP (New Product Development and Product Quality Management), Ambuja Cements Ltd.

The Member Secretary
Central Pollution Control Board

Shri S K Tiwari
Technical Director
Heidelberg Cement India Limited

Shri Kamal Kumar
Chief General Manager
Holtec Counsulting Pvt. Ltd.
HOLTEC Centre

Dr. Lakshmy Parameswaran
Chief Scientist
Bridges and Structures Division
Central Road Research Institute

Shri Ashwani Gupta
Scientist 'G', Department of Scientific and Industrial Research (DSIR)

Shri S A Khadilkar
Director-Quality & Product Development
ACC Limited

Prof. B Bhattacharjee
Dept. of Civil Engineering
Indian Institute of Technology, Delhi

Shri Sushil Kumar Rathore
Unit Head
J K Cement Works

Shri S K Saxena
Vice President (Jhajjar Unit and QA)
JK Lakshmi Cement Ltd.

Shri Gopi Ranganathan
Sr. GM (TPE)
Zuari Cement Ltd.

Shri V K Pandey
GM (Project & Technical)
Cement Corp. of India Ltd.

Shri Narendra Singh
Head – Plant, Saurashtra Cement Ltd.

Shri R K Khandekar
Addl. General Manager
Ash Utilization Group, NTPC Limited

Shri Sivakumar Subramaniyam
Country Head Supply Chain Management & SVP – Industrial, Lafarge India Pvt. Ltd.

71st Research Advisory Committee (*RAC*) meeting under chairmanship of Shri Ashwani Pahuja (*Executive Director- Dalmia Bharat Cement Ltd.*) was organized at NCB Ballabgarh office in 06th March 2019. In 71st meeting progress was discussed for 17 ongoing R&D projects and 06 nos. new project proposals to be taken up from FY 19-20. Many valuable suggestions were received from members including Shri Zakaria Khan Yusufzai (*SDO, DPIIT, MoCI, Govt of India*), Shri Ashwani Pahuja, Shri Sanjay Pant (*BIS*), Dr B N Mohapatra (*Director General-NCB*), Shri Avdhesh Singh (*UltraTech Cement*), Shri B C Pandey (*Ambuja Cements*), Shri A S C Bose (*India Cements*), Dr. S K Handoo (*CMA*), Director-CBRI, CMD-NRDC, Director-CMRS, Prof. G C Mishra (*Director- A K S University*) etc.

Composition of RAC

Chairman

Shri Ashwani Pahuja
Executive Director, Dalmia Cement (B) Ltd.

Members

Shri V H Choudary
Plant Head, My Home Industries Ltd

Shri S K Tiwari
Technical Director, Heidelberg Cement India Ltd.

Dr Awadhesh Singh
UltraTech Cement Ltd
VP and Head, (Product Assurance and Services)

Shri Ravindra Khamparia
Asstt. Vice President
Nuvoco Vistas Corp. Ltd,
(Formerly Lafarge India Ltd)

Dr V Ramachandra
Head (Tech Services),
UltraTech Cement Ltd., (Cement Marketing)

Shri A Subose Chandra Bose
Joint President (Manufacturing)
The India Cements Limited

Dr G V K Prasad
Senior President (CPU-I, II & CCP)
The KCP Ltd.

Shri Rakesh Bhargava
Chief Climate and Sustainability Officer
Shree Cement Ltd.

Shri Sushil Kumar Rathore
Unit Head
J K Cement Works

Shri Narendrasinh N Gohil
Dy General Manager (Q&A)
Shree Digvijay Cement Co Ltd

Shri S K Saxena
Vice President (Jhajjar Unit and QA)
JK Lakshmi Cement Ltd.

Shri M Srinivasan
President-Manufacturing
The Ramco Cements Limited

Shri B C Pandey
Manufacturing Cluster Head (N)
Ambuja Cements Ltd

Shri S D Arya
Vice President (Production & QA)
Mangalam Cement Ltd

The Senior Development Officer
(Cement), DPIIT

Shri Sunil Khandare
Director, Bureau of Energy Efficiency (BEE)

Dr. Nahar Singh
Principal Scientist
National Physical Laboratory

The Director
Central Soil & Materials Research
Station (CSMRS)

Dr. K. Ramanjaneyulu
Chief Scientist
Structural Engineering Research Centre (SERC)

The Chairman and Managing Director
National Research Development Corp.

Dr. Lakshmy Parameswaran
Chief Scientist, Bridges and Structures Division
Central Road Research Institute

The Director
Central Building Research Institute

Prof. B. Bhattacharjee
Dept. of Civil Engineering
Indian Institute of Technology, Delhi

Prof. G C Mishra
Director (Cement Technology)
AKS University

Shri R K Khandekar
Addl. General Manager
Ash Utilization Group
NTPC Limited

The Deputy Director General
Geological Survey of India

Shri Pankaj Kejriwal
Executive Director, CMA

Dr Manish V Karandikar
Vice President- Raw Mix & Product
Optimisation

The Member Secretary
Central Pollution Control Board (CPCB)

Ms Aparna Dutt Sharma
Secretary General, CMA

Director (IA)
Ministry of MoEF & CC

The Controller General
Indian Bureau of Mines

The Executive Director
Building Materials and Technology
Promotion Council (BMTPC)

The Director General
National Productivity Council

Shri Sanjay Pant
Director (Civil Engg) & Head
Bureau of Indian Standards

Dr K Mohan
Ex Director General-NCB

71st RAC Meeting in progress

Infrastructural Development Committee (*IDC*)

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.

Composition of IDC

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

Members

The Senior Development Officer (Cement)
Dept. for Promotion of Industry and Internal Trade (DPIIT)
Ministry of Commerce & Industry

Shri S K Deshpande
Scientist 'G & Advisor
Dept. of Scientific & Indl. Research
Ministry of Science & Technology
Technology Bhawan

Dr. Rakesh Kumar
Head of Deptt. (Rigid Pavements)
Central Road Research Institute

Shri Shashi Ranjan
General Manager-PE-Civil
NTPC Ltd.
Engineering Office Complex

Dr. Sujit Ghosh
Executive Director (New Building Solutions)
Dalmia Cement (Bharat) Ltd.

Administration and Finance Committee (*AFC*)

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 shall be reported to the Board at its immediate next meeting through the relevant status report.

Composition of AFC

Chairman

Shri Rajendra Chamaria
Vice Chairman & Managing Director,
Cement Manufacturing Co Ltd

Members

Shri C K Bagga

Former Vice President-Accounts & Finance at JK Lakshmi Cement Ltd.,

Shri Dharmender Tuteja

Executive Director-Finance & Accounts and Commercial at Dalmia (B) Limited

The Senior Development Officer (Cement)

Dept. for Promotion of Industry and Internal Trade (DPIIT)

The Director, Integrated Finance Wing

Dept. for Promotion of Industry and Internal Trade (DPIIT)

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, held 05 meetings and deliberated upon important issues including approving proposals for 381 sponsored projects.

Composition of EC

Chairman
Dr B N Mohapatra, DG-NCB

Secretary
Dr S K Chaturvedi, HOC-CRT & HOS-FAS

Members

Shri V V Arora	:	HOC-CDR
Shri Ashutosh Saxena	:	HOC-CME & HOS-HRS
Mrs. K V Kalyani	:	Unit Head, NCB-Hyderabad
Shri P N Ojha	:	HOC-CQC
Shri A K Dubey	:	HOS-ETS
Shri A V S Manian	:	HOC-CIS
Dr D K Panda	:	HOC-CCE
Shri Amit Trivedi	:	HOS-MMS
Dr Devendra Yadav	:	GM-TPM

NCB'S PROGRAMMES AND THEIR FULFILMENT

The Corporate Programmes

Over the years, NCB has emerged as preferred research & consultancy partner for the cement and construction industry. With its modern laboratories, experienced team of scientists and engineers and pro-active leadership, NCB has been providing innovative technological solution to overcome the hurdles faced by industry. Services were provided in the areas of development of newer products, optimal utilization of resources be it limestone or industrial waste, process optimization, energy studies, plant maintenance, structural assessment and rehabilitation, quality assurance in construction, concrete technology, materials evaluation, application of nanotechnology and total quality management.

Investigations show Composite Cement samples prepared by separate grinding with blending found to give better strength properties. Limestone consumption factor was established for fourteen cement plants. Studies conducted to develop Active Belite Cement using Low Grade Limestone. In another study, it was revealed that the sintering aids converts the crystalline content of silicate materials into amorphous content and enhances the amorphous content in the coal. Investigations show compressive strength development of marble dust calcined clay cement blends showed marginally improved strength as compared to their limestone based counterparts. In another study cement was prepared using clinker prepared with and without Wollastonite were found to be comparable. NCB has developed synthetic slag using Low Grade Limestone and other waste additives having similar properties of GBFS as obtained from steel plant. The performance of PSC blends prepared using synthetic slag sample were found to have performance characteristics comparable to the PSC samples prepared using granulated blast furnace slag provided by the plant and conformed to the compressive strength requirements of Indian Standard Specification, IS:455-1989 for PSC from granulated blast furnace slag.

Assessment study for SO2 and NOx generation and mitigation measures from pyro-processing system were carried out at three cement plants. Environment Monitoring Studies were carried out for a construction site apart from various thermal power plants. Technical Study of feasibility of used tyres as alternate fuels in preheater and clinkerisation was carried out for a cement plant abroad. Co-processing of alternate fuels & resources of cement industry and a baseline report on C&D waste is also prepared & submitted. Feasibility study was taken up for Pre-processing & co-processing of Alternate Fuels for an Indian cement plant. With its varied experts, the NCB has carried out Optimization of Raw mill and cement Mill studies for many cement plants. Diagnostic study for improving productivity & process optimization for a Cement plant was conducted to identify the reasons for low productivity. Diagnostic study for minimizing excessive kiln build-ups was carried out. Coating and ring formation study was carried out for a cement plant. Feasibility study for co-processing of alternate fuels was carried out in which a suitable handling and firing system for both solid and liquid alternate fuels was proposed for a plant. CFD software installed and introductory training completed. Plant Energy Audit study was done for a cement plant in Bhutan. Strengthening capabilities workshop organized through BEE for AEA focusing on cement sector for Bureau of energy efficiency. Mandatory Energy audit conducted at 14 cement plants in India during this period. NCB prepared a Detailed TEFR for setting up a 1 mtpa cement plant in Meghalaya. Loss estimation and project revival study was done for new 1200 tpd clinkerisation line project in Assam. Project Monitoring and Control (PMC) Consultancy Services for setting up a 600 tpd Cement Plant in Republic of Congo continued.

In the area of Structural Assessment and Rehabilitation, services of condition/health assessment for old & new structures like Turbo Generator, Cooling Towers, Chimneys, Coal Handling Structures, Machine Foundations, Dam Structures, Bridges, Water Reservoir Basins, Commercial, Industrial & Residential RCC buildings in different states of India are conducted as sponsored R&D assignments.

Distress investigation, durability assessment & service life prediction for the existing RC structures are being carried out under Structural Assessment and Rehabilitation Program. In the area 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. More than 80 numbers of aggregates were evaluated for Accelerated Mortar Bar test, Mortar Bar test, Potential alkali reactivity of carbonate rocks etc. NCB is making great strides in Development of Ultra High Performance Concrete (UHPC) – including use of Nano Technology for UHPC. Studies have been taken up for preparation of specifications and guidelines for use of coal based bottom ash as replacement of fine aggregate in concrete. After completing the feasibility work, NCB has taken up investigation on application of Carbon Nanotubes for improving performance of cement concrete and concrete based precast building products. Similarly, a Study on Use of ferrochrome slag as a fine aggregate (water cooled) and coarse aggregate (air cooled) in concrete was carried out as a sponsored assignment. An experimental Durability Study on PSC made using composite slag (mix of BF slag and LD slag) is also being carried out. Other Studies like Concrete Mix Design for Special Applications like - Self-compacting concrete, Abrasion Resistant Concrete with and without Steel Fiber, Evaluation of Corrosion Inhibitors are also being taken up to supplement the research work. Geopolymer concrete using high volume of GGBFS in combination with fly ash is used to develop Solid and hollow building blocks. Experimental stretches with panel size of (1.33m X 1.25m) have been cast using supplementary cementitious materials (GGBS and fly ash along with cement) and C&D aggregates (recycled concrete aggregates) at replacement of 75% and 100% to that of natural coarse and fine aggregates. Another study, investigates the application of SCMs (single and multi) in high proportion as a part replacement of Ordinary Portland Cement and its impact on service life. Fine and coarse aggregate samples from various organizations were evaluated for Petrographic and Mineralogical Analysis and Alkali Aggregate Reaction (AAR) studies. The Third Party Quality Assurance/Audit of

construction projects were taken up this year for a large number of satisfied customers.

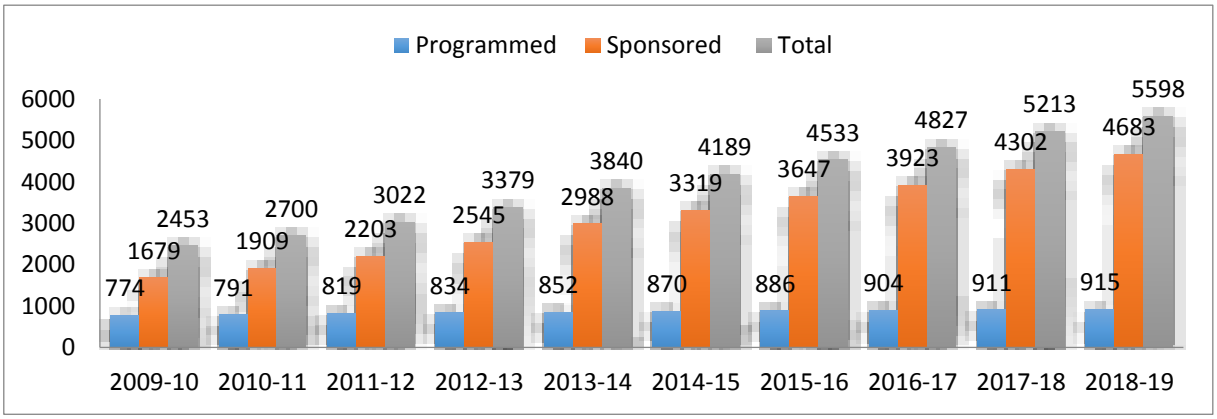
In the area of Total Quality Management services, one project was taken up for training laboratory personnel of public sector units in ISO 17025 accreditation requirements. In 2018-19, Interlaboratory Services completed 10 PT schemes. These schemes were implemented in accordance with ISO 17043:2010. 10 Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs) were developed by NCB. The availability of SI traceable BNDs will give a boost to "Make in India" programme and harmonize the quality infrastructure of the country. Reference materials have been developed and provided to the end users. NCB has a wide range of CRMs for chemical and mechanical parameters of cement, fly ash and other materials. So far, 79 types of CRMs have been developed. Calibration services are continued.

NCB's Rolling Plan of Missions is given in Appendix-I. During the year, projects with time target, cost and assured end product were pursued under six Corporate Centres which are responsible for delivering the needed technological support services to the user industries. Close liaison was maintained with Cement Manufacturers Association (CMA), Ministry of Environment and Forests (MoEF), Central Pollution Control Board (CPCB), Indian Bureau of Mines (IBM), Bureau of Energy Efficiency (BEE), Bureau of Indian Standards (BIS) and concerned departments of the state governments on aspects related to the development of cement and construction industries including availability of raw materials, quality assurance, modernization, energy management, environment, consumer protection, human resources development etc.

Framework of Institutional Efforts

The activities of the Council were carried out under the six Corporate Centres at NCB's Units, situated in Ahmedabad, Ballabgarh and Hyderabad. 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, 4 Programmed and 381 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 2018-19, as given in Appendix IV. The broad activities carried out by the six Corporate Centres during 2018-19 are highlighted in the following sections.



Projects Completed by NCB (Cumulative)

NCB BALLABGARH

CENTRE FOR CEMENT RESEARCH AND INDEPENDENT TESTING - CRT

The Centre executes its activities through five programmes viz. Cements and Other Binders, Wastes Utilization, Refractories and Ceramics, Fundamental and Basic Research and Independent Testing. 40 Sponsored Projects were completed and 6 Programmed Projects were pursued during the year.

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 218 cement plants. During the year, LCF studies were completed for 14 cement plants from Rajasthan, Maharashtra, Andhra Pradesh, Tamil Nadu, Gujarat and Madhya Pradesh.

Investigation on Improving the Performance of Composite Cement by Separate Grinding of Constituents

Composite cements can be produced by either intergrinding of clinker, fly ash, Granulated Blast Furnace Slag (GBFS) and gypsum or by blending of the separately grinded clinker, fly ash, GBFS and gypsum. There are a number of factors governing the selection of appropriate grinding technique for manufacture of composite cements. The types of SCM used, energy consumption, replacement levels, the required fineness, strength and durability properties - all play a vital role in deciding the suitable grinding technique in cement manufacture. Since the standard for composite cement manufacture is recently published, its production in India is only marginal and it is manufactured through the route of intergrinding. The present work compares the performance of composite cement prepared through both the route of intergrinding as well as separate grinding and blending.

In the present work composite cements were prepared with varying concentration of constituents through both intergrinding as well as separate grinding and blending. Clinker, fly ash and gypsum samples were collected from a cement plant situated in northern part of the country. GBFS was collected from a steel plant. 20 numbers of composite cement blends were prepared by

intergrinding as well as separate grinding and blending of constituents at two finenesses of 350 ± 10m^2/kg and 400±10m^2/kg. The prepared composite cement samples were studied for its chemical constituents and physical performance by relevant Indian standard methods of chemical and physical testing.

The performance evaluation of composite cement samples indicated that the composite cement samples prepared by separate grinding with blending gave enhanced performance characteristics particularly better strength properties. The project work is in progress utilizing the raw materials from three other zones across the country.

Improvement of fly ash quality, through chemical/mineral doping in coal during its generation in thermal power plant, and study its effects in cement and concrete

Fly ash is a typical industrial waste and around 218 MT per year produced from thermal power plants in India. Around 65% of generated fly ash is utilized in different sectors including cement. Day to day the production of fly ash is increasing and disposal of coal fly ash (CFA) is a matter of serious environmental concern. The utilization of fly ash in cement system depends on its amorphous /glass content. Fly ash is generated by combustion of coal and contains various amounts of inorganic mineral oxides such as silicate minerals, which influence the reactivity of fly ash. The present study investigates the effect of sintering aids doping in the coal before combustion. The coal mixtures were prepared by the addition of different minerals and ash prepared in laboratory furnace at around 950°C. Experimental results were compared with and without mineral dopants. Chemical, mineralogy and microstructure characterizations of resultant ash samples (with and without sintering aids) were carried out. Mineralogy and microstructure and amorphous content/glass content were analyzed by XRD, SEM and Optical microscopy. The results revealed that the sintering aids converts the crystalline content of silicate materials into amorphous content and enhances the amorphous content in the coal.

Waste Utilization

Comparative Evaluation of Limestone Calcined Clay and Marble Waste Calcined Clay Cement Blends

The use of Supplementary Cementitious Materials (SCMs); fly ash and granulated BF slag, by lowering clinker content in cement is a viable strategy to bring down CO_2 emission during cement manufacture.

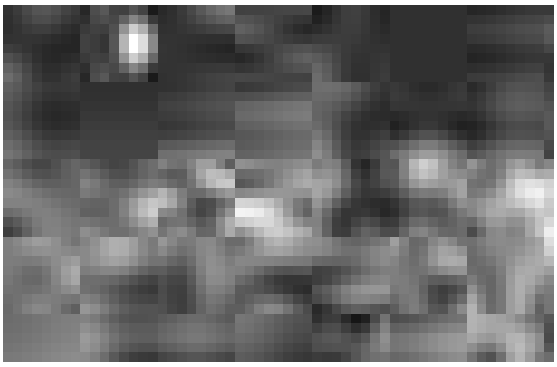


Fig. 1: Microstructure analysis of doped ash samples by SEM

Fig. 2: Quartz mineral content was reduced and going towards glassy form in doped ash compared to control ash

Due to the large availability of clay and limestone all over the world, a new ternary cementitious cement system containing calcined clay and limestone could increase clinker substitution to about 50 percent without significantly influencing cement performance due to the synergy between aluminates from calcined clay and carbonates from limestone. Marble waste, a by-product of marble processing industry, is a resource which is quite similar to limestone and therefore, it can contribute to higher added value for cement industry. In present investigation, cement blends based on different limestone-calcined clay (LC) and marble dust calcined clay (MC) were prepared maintaining clinker substitution of 0.40, 0.45, 0.50, 0.55 and 0.60 by interblending technique. The results of compressive strength development of marble dust calcined clay cement blends showed marginally improved strength as compared to their limestone based counterparts (Fig 1), particularly clinker factor at 0.45 afterwards.

Fig. 3: Compressive strength of limestone calcined clay and marble dust calcined clay cement blends, prepared maintaining different clinker to cement ratios

Fundamental and Basic Research

Improving the Reactivity of Fly Ash and their Effect on Cement and Concrete Performance

Three fly ash samples and two OPC were taken up for the studies. Enhancement of Fly ash reactivity studied by chemical activation, mechanical activation and their combination using two types of chemical activators, grinding for different fineness and their combination respectively. Chemical activators were added for different dosages with fixed fineness and mechanical activation of fly ash and was studied by grinding the fly ash samples to three fineness levels - 400, 600, above 600. Activated fly ash samples from the above all the methods were evaluated for fineness, L.R., C.R. etc. Studies were conducted to optimize the concentration of grinding aids. PPC samples were prepared by blending activated fly ash with OPC. Increasing the fineness of fly ash resulted in increase in specific gravity, and water requirement for LR determination. Increasing the fineness of fly ash by mechanical activation resulted in enhanced physical and chemical properties of fly ash. With increase in fineness of fly ash up to 400-600 m^2/kg, fly ash content in PPC can be increased up to 45% with performance of cement meeting the standard requirements (IS 1489 Pt-1-2015) comfortably. Chemical activation didn't yield desired results. However, the benefit is observed in reduction of grinding time. CA1 was found more effective than CA2 for activation of fly ash. By using CA1 as chemical activator, fly ash content ($600m^2/kg$) in PPC can be increased up to 45%. Besides quality of fly ash, clinker quality has significant effect on absorption of fly ash in manufacture of PPC.

Fig. 4: Mineral phase analysis of fly ash sample ground for different fineness (a) As received, (b) 350 m^2/Kg fineness fly ash sample and (c) 400 m^2/kg fineness fly ash sample

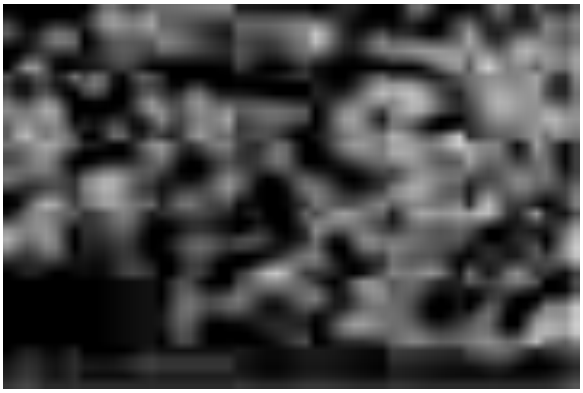
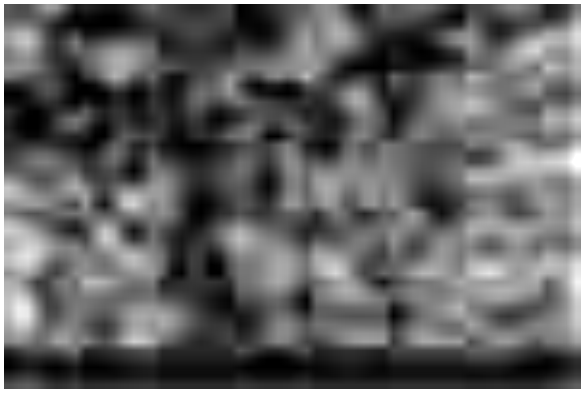


Fig. 5: (a) Morphological characteristics of Fly ash sample as received



(b) Morphological characteristics of mechanically activated Fly ash sample

Investigations on Utilization of Wollastonite Mineral in Cement Manufacture

Global warming caused due to CO_2 emissions is increasing at an alarming rate. Cement production is known to contribute ~7% of global CO_2 emissions. Efforts are being made to minimize the emission of CO_2 /t of clinker from the present rate of 0.86 tonne/tonne clinker to 0.35 tonne/tonne by 2050. Many steps are being taken to achieve the above mentioned target. Around 60% of the total CO_2 emitted during cement manufacture is due to calcination process. Thus it is evident that use of a non-carbonate lime bearing raw material for cement manufacture can drastically reduce the CO_2 emission. The present work is carried on the utilization of a Wollastonite mineral which is a non-carbonate lime bearing material by replacing equal quantity of conventional carbonate raw material i.e. limestone in cement manufacture. Wollastonite is a naturally occurring calcium silicate mineral with the molecular formula $CaSiO_3$. It is a white color, needle shaped crystal. The Wollastonite mineral is found associated with other accessory minerals like quartz, calcite, diopside (calcium magnesium silicate), garnet (calcium iron silicate, calcium aluminum silicate) etc.

At present, the Wollastonite minerals were used for manufacture of OPC along with the other conventional raw materials like high grade limestone, feedable grade limestone, low grade limestone and red ochre. Mix designs were prepared using 1 to 5% Wollastonite by replacing high grade limestone content in the raw mix. A control sample was also designed by utilizing high grade limestone and without using Wollastonite mineral. The mineralogical evaluation of the clinker was performed with XRD and optical microscopy. The results of the mineralogical analysis showed that the clinker phases with Wollastonite at 1400°C were comparable to the control clinker at 1450°C. Accordingly, cement

was prepared using clinker prepared with and without Wollastonite at 1400°C and their performance was evaluated as per the relevant IS standard. The result obtained indicated that the performance was comparable.

Thus Wollastonite mineral is a potential material for cement manufacture and its unique characteristic of being a lime bearing non-carbonate material proves its usefulness in the much needed CO_2 reduction during cement manufacture.

Fig. 6: Optical micrograph of Wollastonite sample

Investigation on Development of Synthetic Slag using Low Grade Limestone

Studies were taken up for development of Synthetic Slag using Low Grade Limestone having similar properties of Granulated Blast Furnace Slag (GBFS). The major raw material for cement clinker production is cement grade limestone which is getting depleted day by day and the same has reached to an alarming level where the availability of cement grade limestone in India has reduced to 8949 million tonnes. This has necessitated the need for looking beyond and develop new alternate cementitious materials utilizing low grade / dolomitic limestone, imbibe more and more industrial wastes. NCB has developed synthetic slag using Low Grade Limestone and other waste additives having similar properties of GBFS as obtained from steel plant. Various mixes were designed and pyro-processed. Synthetic slag samples have been prepared in NCB laboratory using a muffle furnace followed by water quenching. These laboratory made synthetic slag samples were also investigated by Optical Microscopy (OM) (fig -7) and found to have maximum 92% glass content which is greater than 85% as specified in IS:12089-1987. Portland slag cement (PSC) samples were prepared

with 40% and 60% synthetic slag replacing equal quantity of clinker. The performance of PSC blends prepared using synthetic slag sample were found to have performance characteristics comparable to the PSC samples prepared using granulated blast furnace slag provided by the plant and conformed to the compressive strength requirements of Indian Standard Specification, IS:455-1989 for PSC from granulated blast furnace slag.

Fig. 7: OM analysis of water quenched laboratory preparation of synthetic slag sample, Glass Content-92%

Fig. 8: Synthetic slag being produced in NCB Laboratory

Independent Testing

Independent Testing Laboratories of NCB undertake 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 etc as per National and International standards.

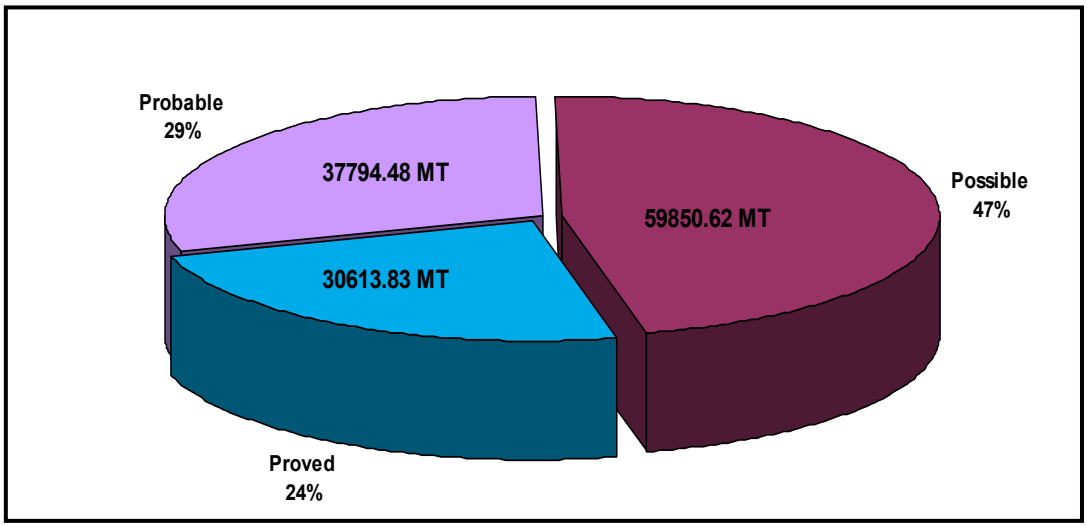
The INT laboratories established in 1977 on a Test House pattern, undertake testing jobs for cement, construction and allied industries. NCB testing laboratories achieved a landmark when NABL accredited them in the year 1997 as per ISO 17025 quality system. The laboratories are equipped with state-of-art instruments to carry out the tests as per National and International standards. During the year, assignments were carried out for samples from neighboring countries also. The number of samples tested during the period was more than 11,060.

CENTRE FOR MINING, ENVIRONMENT, PLANT ENGINEERING & OPERATION – CME

Centre for Mining, Environment, Plant Engineering and Operation carried out its activities through six Programmes viz Geology, Mining & Raw Materials; Environmental Management; Process Optimisation and Productivity; Energy Management; Plant Maintenance and Project Engineering & System Design and completed 44 sponsored projects during the year.

Geology, Mining and Raw Materials

NCB under its continuous activity "Updating of National Inventory of Cement Grade Limestone Deposits in India" is updating it through regular interaction with various central and state DGM's for collection of exploration data on latest status of limestone resources. The total limestone resources of all categories is estimated at 128,258.93 million tonnes as on 31st March 2019 out of which the proved, probable and possible categories are of 30,613.83 million tonnes, 37,794.48 million tonnes and 59,850.62 million tonnes respectively.



National Inventory of Cement Grade Limestone Resources

"Preliminary Investigation for Beneficiation on Laboratory Scale for Low/ Marginal Grade Limestone" for Singsar Limestone mines, Tehsil Kodinar, Dist. Gir Somnath, Gujarat. for M/s Ambuja Cements Limited (unit-Ambujanagar). The objective of the study is to upgrade the existing limestone quality by separating the contaminants from the limestone by dry beneficiation process. A total weight of 613.85 kg of limestone bulk samples is received at NCB laboratories. The bulk sample represents the four different locations within the mines. Limestone is buff in colour, fine to medium

grained fossiliferous limestone. The microfossil broken shells are interwoven and bound by carbonate rich matrix. The samples received are mixture of clay and limestone fragments of various sizes. Physical and Mechanical properties such as density, porosity and average true specific gravity of the limestone is determined. The mineralogical studies through X-ray diffraction, optical microscopy and dry beneficiation studies of coarse size fraction through sieve analysis of representative sample of limestone feed is carried out. The bulk samples received at NCB are already -80 mm size. Further sieving is carried for sieve sizes of 40, 25, 20, 12.5, 10, 8, 6.3, 3.35, and 1 mm, and chemical analysis is carried for three samples covering different areas TH-75 from Thordi and SNG-125, and SNG-292 from the Signsar area. In case of TH-75 there is an improvement in the quality of the limestone in terms of CaO, SiO_2 percentages up to the size fractions of +3.35mm. Quality below 3.35mm size fraction is deteriorating due to the contamination of weathered limestone, and marl/clay. In case of SNG-125 which is marginal grade limestone, there is significant improvement in the quality of the limestone in terms of enrichment in CaO quality and reduction in the SiO_2% up to the size fractions of +25mm. The quality below -25mm show slight improvement up to +10mm size, and down below the improvement is not seen. This can be attributed to the contamination of weathered limestone, and clay. Since the weight retained and the recovery percentage is very less below 12.5mm, it may not have much impact on cumulative quality up to certain (+) size sieve fraction. In case of SNG 292 there is no significant improvement in the quality of the limestone in terms of CaO, and SiO_2 percentages in the entire sieve fraction. The overall quality of limestone is directly useable.

Computer-aided Deposit Evaluation and optimization of limestone resources for Yerraguntla Mines (ML area of 656.68 hectares), Mandal Yerraguntla, Dist. Kadapa, Andhra Pradesh for M/s Zuari Cement Ltd (Heidelberg Cement Group) was carried out.

Environmental Management

Studies on "Impact of Ammonia on Environment due to use of Ammonia for secondary abatement of NOx control in Cement Industries in India" have been taken up. Impact assessment of baseline scenario with uncontrolled NOx of 2000 mg/Nm^3 and alternate scenario with controlled NOx emissions of 800 mg/Nm^3 using SNCR was carried out. The impacts due to ammonia production and ammonia transportation also included in the analysis.

Studies on "Assessment study for SO_2 and NOx generation and mitigation measures from pyro-processing system" were carried out at three cement plants in Meghalaya and Assam. The SO_2 measurements were carried out at various locations of pyro-system and samples of limestone were collected for analysis of pyritic sulphur content.

Process measurements of existing Air Pollution Control Equipment for kiln and VRM was carried out for Cement Corporation of India, Rajban, H.P., wherein dust load on the current APCE and process flows in the pyro-processing circuit was measured. Based on the measurements, design parameters for new RABH was given.

Environment Monitoring Studies

- Environment Monitoring Studies were carried out for a construction site in Delhi during three seasons under which ambient air, construction water, soil quality and ambient noise were monitored

- Environment Monitoring Studies were carried out at Thermal Power Plant of Haryana Power Generation Corporation Ltd located in Panipat, Haryana

- Environment Monitoring Studies were carried out at two Thermal Power Plants of Uttar Pradesh Rajya Vidyut Utpadan Nigam Ltd. (UPRVUNL) located in Aligarh and Parichha (Jhansi).

Process and Productivity

Technical Study of feasibility of used tyres as alternate fuels in preheater and Clinkerisation was carried out for M/s Oman Cement Company and a suitable system for utilization of used tyres is proposed in this project.

Co-processing of alternate fuels & resources of cement industry phase-2 for SINTEF, Oslo, Norway in which Draft on baseline report on C&D waste is prepared and submitted. Baseline report on inorganic waste is in progress.

Optimization of Raw mill and cement Mill was carried out at M/s Ultratech Cement Ltd, Sewagram. Plant Technical Audit to assess the plant Performance Indicators (PI) i.e. Specific power consumption (kWh/ tonne of product) and Specific thermal energy consumption (kcal/ kg of clinker) and suggest recommendations to improve them was carried out at M/s Purbanchal Cement ltd, Meghalaya. Safety Audit for Coal Mill was carried out at CMS Cement Industries, Malaysia. Cement mill optimization study was undertaken at M/s Malabar Cements Ltd, Kerala. Feasibility study for Pre-processing & co-processing of Alternate Fuels at M/s RCCPL Pvt Ltd, Maihar.

A suitable system for handling various solids wastes is proposed in this project. Diagnostic study for improving productivity & process optimization for M/s Hill Cement limited, Meghalaya was conducted to identify the reasons for low productivity and gave suitable recommendations for improving the same. A Heat and gas balance study for M/s Hemadri cements was carried out and recommendations for reducing specific heat consumption were given.

Diagnostic study for minimizing excessive kiln build-ups was carried out for M/s Star Cement Ltd, Meghalaya and recommendations were given for reducing kiln build-ups and ring formation inside the kiln. Diagnostic study for minimizing excessive kiln build-ups in cement rotary kiln and improving the clinker quality for M/s Saurashtra Cement Ltd., Gujarat.

Under the study "Application of CFD in Indian Cement Industry", Data Compiled on CFD technologies related to Energy, Performance improvement of major process equipment, improving combustion efficiency and Environmental improvement etc and International practices on CFD technologies were studied, CFD software installed and introductory training completed.

Energy Management

NCB carried out plant energy audit study at M/s Dungsam Cement, Bhutan. A workshop was organized for Strengthening capabilities through BEE for AEA focusing on cement sector for Bureau of energy efficiency.

Mandatory Energy audit conducted at:

- M/s Shree Digvijay Cement Co Ltd., Jamnagar, Gujarat
- M/s JK Lakshmi Cement Ltd., Sirohi, Rajasthan
- M/s Mangalam Cement, Morak, Rajasthan
- M/s Dalmia Cement, Ariyalur
- M/s ACC Ltd., Chanda, Madhya Pradesh
- M/s ACC Ltd., Gagal-1, Himachal Pradesh
- M/s ACC Ltd., Gagal-2, Himachal Pradesh
- M/s Penna Cement, Boyareddipaali
- M/s Penna Cement, Thalricheruvu

- M/s Penna Cement, Ganeshapahad
- M/s The KCP Cement Ltd, Macherla
- M/s Bhavya Cement Ltd., Andhra Pradesh
- M/s J K White cement, Gotan, Rajasthan
- M/s JK Lakshmi Cement. (GU), Jhajjar, Haryana

Project Engineering and System Design

Detailed TEFR for setting up a 1.0 mtpa cement plant at Mynkree, East Jaintia Hills, Meghalaya

NCB prepared a Detailed TEFR for setting up a 1 mtpa cement plant. The report covered all the important aspects like study of available limestone deposits, market scenario, basic resources & infrastructure, technical concept, project implementation schedule, capital cost estimation and viability of the project.

Loss estimation and project revival study for new 1200 tpd clinkerisation line project at CCI Bokajan, Assam.

On the basis of the review of site work and equipment delivered at site, NCB estimated the losses projected/incurred till March'2018 due to non-commissioning of project in March'2012 due to various factors which includes loss of cement sale, payment made on account of purchasing of idle machineries, civil works, manpower deployment, subsidies accommodation etc.

Detailed Technical Feasibility Report for setting up a ball mill circuit along with existing VRM at Guwahati, Assam

It is envisaged that in this circuit, VRM will be used as pre-grinder. Instead of producing the final finished product, VRM will be used to grind coarser semi-finished product and final grinding will be carried out in a ball mill (closed circuit). In this way, the final output of the grinding circuit shall increase.

Project Monitoring and Control (*PMC*) Consultancy Services for setting up a 600 tpd Cement Plant in RoC for Government of RoC

"NCB is working as a project consultant to RoC for preparation of EPC tender, offers evaluation, participation in bid opening, monitoring and controlling the project implementation activities and providing the support for project supervision, RoC has also awarded the work for DPR Preparation for the same project as additional assignment".

Measurements of SO_2 emissions at stack of a cement plant

Sampling at a limestone mine of a cement plant

NCB Team Visited Tao Tao, Republic of Congo

NCB Team Visited at M/s RCCPL Pvt. Ltd.

NCB Team Visited M/s Dungsam Cement, Bhutan for plant energy audit

NCB Team Visited at M/s J K Lakshmi Cement Ltd. Jhajjar for Energy Audit

NCB team
Site Visit of Republic of Congo

NCB team at CMS, Malaysia imparting training for Safety of coal mill circuit to CMS officials

NCB team at JK White Cement Ltd. carrying out Utilities audit study
(*part of Mandatory Energy Audit*)

NCB team with CCI Executives at CCI Bokajan for losses estimation and project revival study

CENTRE FOR CONSTRUCTION DEVELOPMENT AND RESEARCH - CDR

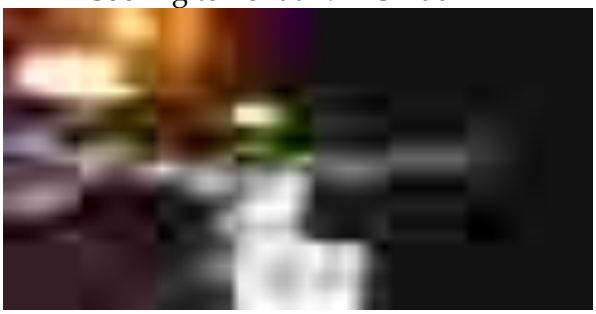
Centre for Construction Development and Research (CDR) is contributing in developing durable and sustainable civil infrastructure for the nation. The Centre provides services to the cement, concrete and construction industries through four programmes namely Structural Optimization and Design, Concrete Technology, Structural Assessment and Rehabilitation, and Construction Technology and Management. The Centre conducted 284 sponsored projects during the year.

Structural Assessment and Rehabilitation

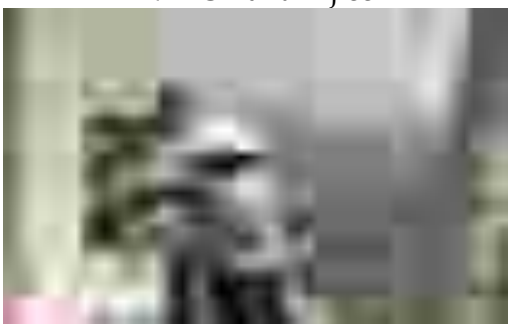
Distress investigation, durability assessment & service life prediction for the existing RC structures are being carried out under Structural Assessment and Rehabilitation Program. The gap in quality planned and quality achieved continues to become wider. The distress in any form i.e. cracks, flaws, imperfection & spalling of concrete not only disturbs the aesthetic appearance but also reduces safety of the structures under use. Keeping in view the rapid growth of infrastructure & other upcoming industrial & institutional projects in India, the use of NDE techniques is emerging rapidly for finding the gap between planned & achieved quality. Centre has facility of versatile testing equipment in NDT laboratory which include profometer, rebound hammer, ultrasonic pulse velocity tester, core drilling extraction, carbonation test, half-cell potential mapping, resistivity meter apart from chemical sample analysis laboratory for concrete powder sample analysis. The CDR is performing various condition assessment & structural stability studies for structures including TG Deck & supporting structures, coal handling structures, cooling towers, bridges, tower foundations, chimneys, dams, institutional and residential RCC structures through-out in India. Various R&D sponsor projects were completed for reputed clients like NTPC, MES PGCIL, CPWD, GAIL, DDA, NHPC etc. The investigation through NDT is a scientific approach in finding the actual cause & extent of damage & further formulation of the repair & rehabilitation methodology for existing structures. The investigation is followed by repair implementation program for distressed structures along with cost & quantity estimates. Team of scientists & experts at CDR have versatile abilities to address adequate solution to distressed RCC structure for its wide spread clients on pan India basis. The main emphasis is to create the viable solution for ascertaining durable RC structures.

Profoscope testing at Natural Draft Cooling tower at NTPC Dadri

Core extraction at PA Fan Foundation at NTPC Kanti Bijlee



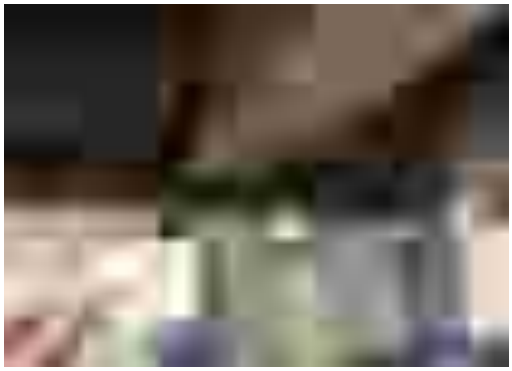
Core Extraction at Track Hopper at NTPC Dadri



Rebound Hammer Testing on Chimney at NTPC Vindhyachal

Half-cell Measurement test on Bulk Storage Tan at NTPC Jhanor

UPV testing on FD Fan foundation at NTPC Mouda



UPV testing on MGR Bridges at NTPC Rihand

Half-cell Measurement test on Bridge Pier at NTPC Rihand

Material evaluation and concrete mix designs

Evaluation and characterization of concrete making materials like cement, coarse aggregates, fine aggregates, chemical admixtures, flyash and micro silica as per relevant IS codes on the basis of their mechanical and physical properties has been carried out. Various trials are conducted for achieving most economical concrete mix design, followed by studies on fresh & hardened concrete to determine their durability properties. The centre has provided the services to various reputed clients like NTPC and its subsidiaries, NHPC and its subsidiaries, NUPPL, THDCIL, UPR Vidyut Utpadan Nigam Limited, HPVUNL, NBCC, PWD, CPWD, Municipal Corporations, Delhi Jal Board, IRCON ISL, RITES, L&T Limited and Shapoorji Pallonji Group. More than 30 admixtures were tested and mix designs with grades of concrete ranging from M10 to as high as M90, CLSM work, wet shotcrete, dry shotcrete were designed successfully.

Alkali Aggregate Reaction (AAR) studies on Aggregates

Alkali-aggregate reactions can be either alkali-carbonate reactions (ACRs) or alkali-silica reactions (ASRs). In ACR, the reaction is between the alkalies (sodium and potassium) and certain carbonate rocks, particularly calcitic dolomite and dolomitic limestones, present in some aggregates. In ASR, the reaction is between alkalies and certain siliceous rocks or minerals, present in some aggregates. NCB has been conducting AAR studies on coarse and fine aggregates as per relevant Indian and international standards. More than 80 number of aggregates were evaluated for Accelerated Mortar Bar test, Mortar Bar test, Potential alkali reactivity of carbonate rocks (rock cylinder method) & length change of concrete due to alkali carbonate reaction for various prestigious clients like NTPC and its subsidiaries, UPRVUNL, HPPCL, NHPC Ltd.

Development of Ultra High Performance Concrete (UHPC) – Including use of Nano Technology for UHPC

Over the last twenty years, remarkable advances have taken place in the research and application of ultra-high performance concrete (UHPC). Ultra High Performance Concrete (UHPC) has been defined as cementitious based composite material with compressive strength above 150 MPa and enhanced durability via their discontinuous pore structure. UHPC is the 'future' material with the

potential to be a viable solution for improving the sustainability of buildings and other infrastructure components. After several decades of development, a wide range of commercial UHPC formulations have been developed worldwide to cover an increasing number of applications and the rising demand of quality construction materials. UHPC has several advantages over conventional concrete but the use of it is limited due to the high cost and limited design codes. Looking at the benefits of UHPC, several countries including Australia, Austria, Croatia, Italy, Japan, Malaysia, the Netherlands, New Zealand, Slovenia, South Korea, and Switzerland have already incorporated the UHPC technology into their construction and building projects. Therefore, it is imperative to study and further develop the UHPC using the indigenous technology for production and usage in India.

In general, there are few conceptual guidelines for developing UHPC like elimination of coarse aggregates for enhancement of homogeneity; utilization of the pozzolanic properties of silica fume and other ultrafine cementitious materials; optimization of the granular mixture for the enhancement of compacted density (maximization of particle packing density); the optimal usage of superplasticizer to reduce w/b and improve workability; application of pressure (before and during setting) to improve compaction; post-set heat-treatment for the enhancement of the microstructure (curing Regimes – standard curing, hot water/steam curing and autoclaving) & addition of small-sized steel fibres to improve ductility.

NCB is working on an R&D project for development of UHPC. The objective of this project is to prepare guideline for developing the UHPC in India based on various international codal procedures, accepted research theories and experimental research. The project focuses deeply on the materials comprising UHPC and the mechanical behavior of the end product based on the production methodology adopted and the constituents involved. The project has been carried out in two steps. Firstly, the project study includes the design of concrete mixes for strength. Secondly, the mixes will be studied for mechanical and durability performance. In first phase, particle size distribution of all the materials has been measured using laser diffraction technique. Particle size range of materials is: OPC53G - 175 μ to 1.375 μ; GGBS- 250 μ to 1.15μ; UFGGBS- 15.0 μ to 1.00 μ; silica fume- 9.25 μ to 0.102 μ; quartz sand- 150 μ to 600 μ; ground quartz- less than 10 μ. To improve the packing density of the mixture, materials are combined in such

fractions that their combined grading lies close to a certain optimum curve given by Modified Andreasen and Andersen equation as mentioned below:

Around 40 mixes with cementitious materials of OPC-53, GGBS, UFGGBS & Silica fume were theoretically optimized for optimum particle packing with the help of above mentioned Modified Andreasen and Andersen equation. Selected Mixes were cast & compressive strength was tested for different curing regimes. Maximum compressive strength achieved so far 135 Mpa, which is still less than the target strength. Once we achieve the target strength, then in second phase mechanical and chemical properties of UHPC will be studied.

Studies for preparation of specifications and guidelines for use of coal based bottom ash as replacement of fine aggregate in concrete for M/s NTPC Netra.

Bottom Ash is the major by-product of the coal based power generation process. This study is a follow up work of the previous study conducted by NCB on use of bottom ash as replacement of fine aggregate in cement concrete. In this study, bottom ash from 12 sources from all over the country (5 from Northern India, 2 from southern India, 3 from central eastern region & 2 from western India) has been collected and characterized. Along with that, this study aims at the formulation of specifications of bottom ash and guidelines for designing concrete mixes using bottom ash as replacement of fine aggregate.

Investigation on application of Carbon Nanotubes for improving performance of cement concrete and concrete based precast building products for M/s Indian Oil Corporation, Faridabad.

M/s. Indian Oil Corporation Ltd. (IOCL), Faridabad is developing carbon nanotubes for various applications. One of the possible large scale applications of carbon nanotubes is in construction industry as a Nano sized fibrous reinforcing material. NCB has taken up an R&D project on investigation on application of Carbon Nanotubes for improving the performance and properties of cement concrete and concrete based precast building products. This project is a follow up work of a previous project work done by NCB for M/s. IOCL Faridabad in which

a study was done to evaluate the feasibility of developing OPC-CNT composites with improved performance characteristics.

Study on Use of ferrochrome slag as a fine aggregate (water cooled) and coarse aggregate (air cooled) in concrete for M/s Tata Steel.

Ferrochrome slag is waste material obtained from the manufacturing of high carbon ferrochromium alloy. Depending upon the cooling process, two types of ferrochrome slag are produced i.e. Air cooled by letting the molten slag cooled down under normal temperature and water cooled ferrochrome slag by quenching the molten slag. In this study characterization of both types of slag (air cooled and water cooled) has been carried out to check the feasibility of replacing natural aggregate with that of ferrochrome slag.

Durability Study on PSC made using composite slag (mix of BF slag and LD slag) for M/s Tata Steel

Slags are the main by-products generated during iron and steel production in the steel industry. Slags are generated at two different stages of steel production: Iron making and Steel making known as BF slag and Steel Slag respectively. At present, yearly generation of LD steel slag is approximately 20 million tonnes in India out of which 5 million is being utilized and 15 million tonnes remain unutilized. Generally, BF slags are granulated and used in cement making due to its high cementitious properties, however steel slags are not being used in cement making in principle because they have poorer hydraulic properties in comparison to blast furnace slags.

This study is an experimental work in which BF slag will be replaced by LD slag at 8 % and 15 % to make composite slag. Various PSCs' will be prepared using different proportions of composite slag. Those PSCs' will be studied for several physical and chemical properties of cement. Along with that, they will be used in concrete mixes to study several fresh, hardened and durability properties of concrete samples.

Concrete Mix Design for Special Applications

Self-compacting concrete

Concrete mix design for special applications such as Self-Compacting Concrete (SCC), High Performance Concrete with and without steel fiber has been

designed. Total 6 numbers of Self-Compacting Concrete (SCC) were designed by NCB for various clients such as CPWD and Ahluwalia Contracts Pvt Ltd, with grades varying from M25 to M40.

Abrasion Resistant Concrete with and without Steel Fiber

For hydraulic structures such as Dam spillways, the structure undergoes both the abrasion wear as well as impact load due to passage of large boulders and other debris materials. It is required to design concrete of high grade with the available site aggregates which are not conforming to the requirements of Wearing Surface Aggregates. NCB has designed mix of high performance concrete of Grade M 75 with steel fiber with the available site aggregates (Non Wearing Surface Aggregate) for NTPC, Joshimath. Impact resistance and abrasion resistance of concrete has been evaluated by underwater method and revolving disk method. Quality control at Maneri dam projects of UJVNL to repair spillway with M90 Grade concrete has been done and target required strength has been achieved successfully.

Concrete Mix Design of Various Grades done during the period 2018-19

Grade	M10 and M15	M20- M35	M40-M55	M60-M80	M90
Nos.	10	124	15	04	01

Evaluation of Corrosion Inhibitors

Centre has developed the facility for evaluation of corrosion inhibitors through modified accelerated corrosion test as per JIS Z 1535, rebar weight loss by immersion method as per ASTM G-1, polarization test as per ASTM G-3 and corrosion rate measurement as per ASTM G109 & AASTHO T259. The Centre has evaluated 5 samples of different brands of corrosion inhibitors that are being used in construction industry.

Construction Technology and Management

NCB - Inspection Body working under 'Centre for Construction Development and Research' carried out Third Party Quality Assurance/Audit (TPQA) for vide range of construction projects such as Buildings, Roads, Bridges & Tunnels, Construction Utility projects, Other civil Engineering Projects, Special

construction activities etc. and assisted various Central/ State/ Autonomous Organizations on PAN India basis in delivering durable buildings & structures and to meet specified quality standards by ensuring quality workmanship, good construction practices, use of quality materials etc. NCB-Inspection Body achieved ISO/IEC 17020:2012 Type 'A' Accreditation Certificate from National Accreditation Board for Certification Bodies (NABCB) during the year 2018. NCB initiated digitization of inspection activities through android mobile app/web based app. to monitor the activities on real time basis, data archival etc.

The Centre was assigned with the projects of national importance which include works for Integrated Exhibition cum convention Centre (IECC) at Pragati Maidan, Integrated transit corridor development in and around Pragati Maidan and India International Convention & Expo Centre at Dwarka, Delhi.

TPQA was carried out in construction sector for various clients viz., Govt. of India, State Govt. organizations, Autonomous units, under takings etc. on PAN India basis. During the year the Centre has executed prestigious projects, which include works for CPWD, Delhi PWD, AIIMS, Delhi Development Authority, IDCO-Bhubaneswar, Power Grid Corporation India Limited, etc. The Centre entered in MOU with Lala Lajpat Rai Veternery University, Hisar during this year for TPQA services of their construction projects at new campus.

The methodology of Third Party Quality Assurance/Audit (TPQA) are as per project specific Quality Assurance Plan which includes physical inspection of work at various stages, final inspection, in-service inspection, review of reports, review of documents, measurements on site by the inspector or witnessing the tests, random sampling and testing of materials for verifications as per contract specifications / relevant codes / standards such as IS codes, CPWD, IRC & MORTH specifications, limited non-destructive testing as and when needed, review of quality system & quality assurance measures. Performance testing of RCC structures with NDT included ultrasonic pulse velocity (UPV) test, Rebound Hammer Test (RHT), Core testing, Rebar locator, cover meter, etc.

The Centre continued to provide specialized services in the area of quality assurance/control and thereby contributing to the durable infrastructure.

India Trade Promotion Organization (ITPO)

Pile Integrity test at ITPO

Tunnel works in Pragati Maidan

India International Convention & Expo Centre (IICC)

Museum at Noida- CPWD

Mother & Child Block-AIIMS

DDA Quarters –Jasola

Construction of Sports Hostel at Nadiad

IT Incubation Center- Bhubaneswar

Shakti Bhawan Complex- Bhubaneswar

OPTCL Tech Tower- Bhubaneswar

Development & usage of Geopolymer Concrete

Geopolymers are a relatively newer class of building materials. Owing to increased environmental concerns as well as diminishing natural resources, geopolymers are spotted as a valuable alternative for Portland cement. Geopolymers can have similar cementing characteristics as Portland cement, but they can be produced out of by-products from other industry (e.g. fly ash) or less energy craving and less CO_2-emitting materials (e.g. calcined clay, alkali activators).

The study of the alkali activation process of aluminosilicate sources (e.g. fly ash and calcined clay) as a method of synthesizing new cementitious materials is gaining relevance in the scientific community. The increasing number of scientific publications as well as international events dedicated to this topic is a proof of it. Currently, there are, however, not that many practical applications.

NCB has taken up project on development of geopolymer concrete for its application in pavements and other precast concrete constructions. Paver blocks and other precast products have been developed and project is in progress for developing usage guidelines for this product. Cost of the developed products are comparable with cement concrete blocks in use. Field trials were carried out using developed products by NCB and draft guidelines preparations for usage is under progress.

Another project was sponsored by M/s JSW wherein study was taken up to develop Geopolymer concrete using high volume of GGBFS in combination with fly ash. Solid and hollow building blocks were developed.

Inaugration of trial stretch of pavement cast using geopolymer concrete interlocking paver blocks

Design of Low-Traffic Volume Concrete roads using C&D waste

Low-traffic volume roads are a facility that connect built up areas of cities, towns, and communities, and it shall have a traffic volume of less than 450 CVPD. Keeping in view the sustainability, a paradigm shift has been observed in research

with more inclination towards use of waste based materials as aggregates and SCM as supplement to cement in construction. In this project a sustainable approach to construction of low volume concrete roads using C&D aggregates as full replacement of natural aggregates in base and pavement layer has been adopted. The study includes testing of C&D aggregates for their suitability in base layer. It is observed that the recycled aggregates conform to the requirements laid by IRC SP-62:2014 for base layer. Experimental stretches with panel size of (1.33m X 1.25m) have been cast using supplementary cementitious materials (GGBS and flyash along with cement) and C&D aggregates (recycled concrete aggregates) at replacement of 75% and 100% to that of natural coarse and fine aggregates. The stretches were analyzed for strain and thermal stresses over a period of 28 days and the results were found to be comparable. Compressive Strength and Flexural Strength results were conforming to the requirements of IRC SP: 62-2014 even at 75% and 100% replacement of natural aggregates with recycled concrete aggregates for low volume concrete roads. Thus, it can be concluded that recycled concrete aggregates can be used as 100% replacement of natural aggregates in PQC in low volume concrete roads.

Casting of Pavement in progress

Load testing and monitoring of stresses

Structural Optimization and Design

Effect of Supplementary Cementitious Materials (SCMs) (single and multi blends) on service life of concrete structures-including studies to durability/service life

Cement is the third most energy-intensive material to produce after steel and aluminum. In general, production of each tonne of Portland cement contributes about 0.8-1.0 tonne of carbon dioxide (CO_2) into the atmosphere which largely contributes for global warming. Use of reclaimed and recyclable industrial by-

products, such as fly ash and slag in concrete reduces GHG emissions and results in sustainable "green" concrete. Additional benefits include minimization of waste disposal of these industrial by-products and lessened pressure on natural resources (such as limestone).

Durability of a Reinforced concrete structure is defined as the function of structure's performance under various environmental conditions. While designing a RCC, it is eminent to consider the type of mechanical and environmental loading; the structure may be exposed during its intended service life. At macro-level, permeability characteristic of the concrete coherently governs its durability aspect. Impermeability against the attack by deleterious acids, gases is considered as one of the main driving criteria's for durability design of concrete structures. While designing concrete structures against the aggressive environment, use of materials like fly ash, ground granulated blast furnace slag, silica fume, Metakaolin etc. is found to be advantageous.

Worldwide research has shown promising result of SCMs with respect to durability and sustainability but still research gaps exist in the existing study. Some of them are listed below:

- Corrosion model for multi blends of SCMs;
- Effect of ultrafine materials as durability enhancer in conjunction to SCMs and Existing international durability design code and guidelines for e.g. ISO 16204, EN 206 & EN 1990 and ACI 365 & ACI 201.2R are not able to address these issues holistically.

The project investigates the application of SCMs (single and multi) in high proportion as a part replacement of Ordinary Portland Cement and its impact on service life. The output of the project will be industry oriented design guideline that assures greater acceptability of these cementing materials across engineering fraternity. The study is broadly categorized into two parts a) laboratory studies and b) field studies. The results will be co-related and generated coefficients will serve as a design inputs for models. The present test results indicate that use of SCM's (single and multi) is highly advantageous in chloride rich environment whereas no considerable advantage is observed when concrete specimens were exposed to CO_2. The study with respect to carbonation and chloride induced corrosion on reinforced specimens for determination of corrosion rate is under progress.

Experimental Study on Shear & Compression Design of High Strength Concrete Including Effect of Fibre on Enhanced Ductility & Fire Resistance

With increase in the use of High Strength Concrete (HSC) in construction and lack of proper guidelines for design in Indian Standards, behavioral study of high strength concrete is an important aspect of research. Research on the behavior of HSC beams with concrete strength higher than 55 MPa has been carried out in the past and is still continuing, to understand the behavior of HSC beams. Still, the structural design parameters in various international codes are different. In current Bureau of Indian Standard (BIS) code IS: 456-2000, for concrete with compressive strength greater than M55, the design parameters given in the standard are not applicable. This research is intended to develop design parameters for high strength concrete so that designers can use high strength concrete in design of structures with confidence. The stress strain behavior of high strength concrete specimens were obtained in strain controlled compression testing machine of 3000 KN capacity.

Study on stress strain curves indicated that the stress strain curves for high strength concrete are more linear than parabolic and hence it is reasonable to infer that the current stress block parameters of IS:456-2000 needs revision. The Model proposed in European design standard EC: 02-2004 have been analysed to compare the experimental and theoretical moment capacities obtained from the flexural tests done. Based on the study done on flexural behaviour of RCC beams, revision of Stress Block Parameters and strain limits for High Strength Concrete and strain limits for reinforcement Steel will be recommended to Bureau of Indian Standard (BIS). The outcome of the studies completed were disseminated through papers in seminars & journals and findings were also presented to Bureau of Indian Standard for revision of IS: 456-2000. Beams were also tested in shear to understand the shear behaviour of the reinforced high strength concrete beams with and without shear reinforcement with respect to parameters such as strength, shear span to depth ratio a/d, the amount of shear reinforcement etc. The study on Compression behaviour of High Strength Concrete RCC members under axial compression on three different concrete grades will also be taken up under this project. The effect of concrete strength and fibre reinforcement on fire resistance behaviour of HSC has been studied. Various fracture parameters of High Strength Concrete with and without steel fibres like the fracture energy,

length of fracture process zone, critical crack tip opening displacement and the fracture toughness were determined experimentally by three-point bending tests on notched beams as per RILEM. The effect of steel fibres on stress-strain characteristics of high strength concrete in compression has also been investigated and results indicates that the steel fibre reinforced concrete exhibits far better post-cracking load resisting behaviour than plain high strength concrete.

Testing of Reinforced High Strength Concrete Beams in Shear

CENTRE FOR QUALITY MANAGEMENT, STANDARDS AND CALIBRATION SERVICES – CQC

The activities of the Centre for Quality Management, Standards and Calibration Services were organised under four programmes: Total Quality Management, Interlaboratory Services, Standard Reference Materials and Calibration Services. 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. The activities of Interlaboratory Services were given a boost and ten new proficiency testing (PT) schemes were completed in accordance with ISO 17043:2010. Three sponsored projects were completed by the centre.

Standard Reference Materials

Ten Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs) were developed by Centre for Quality Management, Standards and Calibration Services (CQC). These BNDs derive their traceability to SI units from CSIR-National Physical Laboratory (NPL), India, the custodian of national standards in India. Bhartiya Nirdeshak Dravya (BND) is an Indian Reference Material. BNDs would play key role in maintaining the quality infrastructure of the economy through testing and calibration with precise measurements traceable to SI units and also for evaluating proficiency of analysts, evaluating/comparing various test methods and calibration of equipment for analyzing minor constituents of the cementitious materials. The availability SI traceable BNDs will give a boost to "Make in India" programme and harmonize the quality infrastructure of the country. Following BNDs are now commercially available & these are going to replace earlier CRMs.

NCB has so far developed 79 types of CRMs. These CRMs are traceable to SI units of measurement. Now, the traceability of NCB CRMs has been certified by CSIR-NPL India, the National Metrology Institute (NMI) of India, by releasing these CRMs as BNDs. First batch of 6 NCB. BNDs was released by Honourable Minister Dr Harsh Vardhan (Ministry of Science & Technology, Ministry of Environment, Forest and Climate Change and Ministry of Earth Sciences) at a glittering function on 16th August 2018. The first lot of BND certificates has been received on 10th October 2018 and formally released by DG-NCB on 11th October 2018 in a special

meeting. Second batch of BNDs was released by Dr. B N Mohapatra, Director General-NCB on 27th December 2019 on NCB Day.

Sl. No.	BND No.	CRM No.	Material Description
1	5001	1001A18	OPC–Blaine fineness
2	5003	1002C3	PSC–Blaine fineness
3	5004	1001FC9	Fly ash–Blaine fineness
4	5051	1012M	OPC–Chemical
5	5052	1016D	PPC–Chemical
6	5002	1002A12	PPC-Blaine fineness
7	5006	1002E2	Composite Cement-Blaine fineness
8	5007	1001W3	WPC-Blaine fineness
9	5011	1001A2-400	OPC-Higher Blaine fineness
10	5054	1001FC9	Fly Ash-Chemical

Supply of developed Certified Reference Materials (CRMs) was continued to the cement and construction industry laboratories. A total of 9196 vials of different CRMs and 1483 sets of standard lime were supplied to 730 customers from cement plants, testing laboratories and R&D institutions. Satisfaction of customers showed very good to excellent satisfaction. White cement standard for chemical parameters was developed for this cement plant.

Signing of the MOU between CSIR-NPL and NCB for BND Certifications on the occasion of World Metrology Day on 21st May 2018. CSIR-NPL and NCB Team members are present on the Dais.

Release of NCB BNDs by Honourable Minister Dr Harsh Vardhan at CSIR-NPL on 16th August, 2018

A group Photograph of NCB Officials with Dr D K Aswal (Director, CSIR-NPL) after the Release of BNDs on 16th August, 2018

Sh Ashutosh Saxena, DG (Actg.) and other NCB Officials during the release of BND Certificates on 11th October 2018

Dr BN Mohapatra, Director General and other NCB Officials during the release of BND Certificates on 1st January 2018

Calibration Services

The calibration laboratories continued to implement Quality Management System as per ISO 17025:2005 requirements. 1700 equipment/apparatus including proving rings, compression testing machines, vibrating machines, dial gauges, Blaine cells, pressure gauges, sieves, thermometers, environmental chambers, ovens, furnaces, balances, rebound hammers etc. were calibrated. Satisfaction of customers from the calibration services showed very good to excellent satisfaction on timeliness, work quality and interaction dimensions.

Calibration services have ensured traceability of the laboratory equipment to SI units and reliability of the results of various tests carried out using these equipment. Reaccreditation of calibration laboratories as per ISO 17025:2005 by NABL was completed successfully in July 2018. The scope was expanded and facility for calibration of Measuring Tape and Steel Scale was added. Facility for calibration of tachometers was upgraded by procurement and successful installation of tachometer calibration system.

A View of Liquid Temperature Baths

Interlaboratory Services

In 2013, Interlaboratory Services (ILS) programme of Centre for Quality Management, Standards and Calibration Services (CQC) of NCB received first NABL accreditation for PT provider as per ISO/IEC 17043: 2010 in the country, and successfully completed several PT schemes thereafter.

ILS implemented QMS in line with ISO 17043:2010 as per accreditation norms. ILS was reassessed for reaccreditation by NABL in February 2017 with enhanced scope. The present scope of accreditation covers: limestone, clinker, cement, fly ash, concrete admixture, water for concrete & coal/pet coke in chemical field and cement, fly ash, aggregate, mortar/concrete, tile (ceramic), burnt clay building brick & steel bar in mechanical field. In 2018-19, ILS completed 10 PT schemes. These schemes were implemented in accordance with ISO 17043:2010.

The participating laboratories were provided homogenized samples of PT items for testing in their laboratories. The test data reported by the laboratories were statistically evaluated for central tendency, spread and Z-score. The robust average and standard uncertainty for each parameter were calculated after

normalizing the data as per ISO 13528:2015(E). Laboratories were evaluated on the basis of Z-Scores based on robust average and robust standard deviation.

Z-scores/Z'-scores of sample 'A' and sample 'B' for all the parameters in all schemes were calculated on the basis of results provided by the participant laboratories. N represents number of results considered in evaluation. As per the above standard, performance of the laboratories with $|Z| \leq 2.0$ is considered satisfactory. The laboratories getting $|Z| \geq 3.0$ are considered outliers and those getting $2.0 < |Z| < 3.0$ score are considered questionable performers. Outliers are encountered due to lack of statistical control and increase in variation in data.

Data received from the laboratories were studied for distribution and scatter. Out of 10 PT schemes, example for OPC-Chemical is illustrated here as under. The scatter of results in OPC-Chemical scheme show presence of bias. In the scatter plot of results, code number of the outlier laboratory is mentioned along with the data point. Z_A outliers are put in circle and Z_B in triangle. The scatter of results for Fe_2O_3 test of OPC-Chemical is shown in the following figure.

Scatter Plot of Test Results – Fe_2O_3 (%) of OPC-Chemical (ILS/PT/46)

In sample 'A' there is one questionable performer each in 'CaO', 'SO_3' & 'K_2O' and two each in 'SiO_2' & 'Fe_2O_3' test and number of outlying performer is one each in 'Fe_2O_3' & 'MgO' test. In sample 'B' there is one questionable performer each in 'SiO_2', 'Fe_2O_3', 'MgO', 'IR' & 'Na_2O' test and number of outlying performer is one in 'Fe_2O_3'.

Total Quality Management

Under this programme, Centre for Quality Management, Standards and Calibration Services (CQC) took up projects relating to quality improvement and

accreditation etc. Assistance was provided in ISO 17025 accreditation of quality control laboratories of two cement plants. One number of project was taken up for training laboratory personnel of public sector units in ISO 17025 accreditation requirements. These studies resulted in improvement of quality control system, proficiency and infrastructure of the laboratories.

During the year, re-certification audit of quality management system based on ISO 9001:2015 of NCB was successfully carried out. The scope of certification covers all the three units of NCB.

CENTRE FOR INDUSTRIAL INFORMATION SERVICES – CIS

The Centre pursued its activities through six programmes viz. Industrial Information and Data Bank, Integrated IT Solutions, Publications, Seminars and Conferences, International and National Linkages and Image Building. 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.

Industrial Information and Data Bank

NCB Library at Ballabgarh Unit serves as the national information centre for cement, building materials and construction industries. The holdings of the Library have grown to 46,710 documents. The library has a bibliographic data base consisting of about 42,914 entries derived from the journals received. NCB scientists as well as cement plants and other user industries utilize it for interactive searches. A library automation system called 'LIBSYS' has been installed. The system is user-friendly and compatible to network communication. Memberships of Indian and Overseas professional institutions, as listed below, were served.

NCB Ballabgarh Library

MEMBERSHIP	
Indian	**Overseas**
• Construction Industry Development Council (CIDC), New Delhi	• The American Concrete Institute (ACI), USA
• Indian Roads Congress (IRC), New Delhi	• Precast/ Pre-stressed Concrete Institute (PCI), USA
• Indian Mining & Engineering Jl, Bhubaneswar	
• Materials Research Society of India, Bengaluru	

Integrated IT Solutions

The Website, www.ncbindia.com was uploaded with promotional information about NCB's activities was done from time-to-time. The following services were continued:

- Indexing Services from Library, through Intranet site and www.ncbindia.com site.
- Announcements on 16th NCB International Seminar, Training Courses and quality related schemes.
- Employment opportunities & RTI related documents.
- Maintenance of hardware and software for whole of the institute including LIMS and LIBSYS.
- Bulk e-mailing services was continued for promotional information.

Publications

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 2017-18 in English and Hindi versions separately
- Compendium – "The Cement Industry - India 2018"
- Bulletin - 1 of 16th NCB International Seminar on Cement, Concrete and Building Materials, 03-06 December 2019, New Delhi

Other Institutional Events

National Technology Day: NCB celebrated the '*National Technology Day*' by organizing technology related programmes on 11 May 2018 at its Ballabgarh and Hyderabad units. On this occasion at Ballabgarh, **Dr D K Aswal CSIR NPL** delivered a lecture.

Hindi Pakhwada: *Hindi Pakhwada* was organized during 14-28 September 2018 at Ballabgarh. In the opening ceremony of *Pakhwada,* Shri Ashutosh Saxena (DG-Actg.) expressed his satisfaction on growth and development of Hindi in the organization. He exhorted NCB officials to further promote use of Hindi in their day-to-day interactions. During the *Pakhwada,* four competitions, i.e., *Sulekh,*

Nibandh Lekhan, Hindi Shabd Kosh Gyan, and *Kahani Lekhan Pratiyogita* were organized and a large number of officials participated.

Quami Ekta Week: '*Quami Ekta Week*' was observed during 19-25 November 2018 and National Integration Pledge was administered to the staff as a part of it.

NCB Day 2018: On 27 December 2018, *NCB Day* 2018 was celebrated. Dr B N Mohapatra, Director General NCB and **Chief Guest, Chairman Sh M S Singhi**, addressed the staff on the occasion. He gave away Awards to NCB officials who made outstanding contributions during the year in their respective fields of their activities. The '*Best Scientist Award*' was given to Shri P Anil Kumar, Shri D Pawan Kumar (Hyderabad), Sh Nitin Chowdhry, Shri P Srikanth, Dr Suresh Palla and Shri Ankit Sharma and the '*Best Supporting Staff Award*' was given to Shri Gaurav Bhatnagar, Sh Mahesh Mishra, Sh Manoj Khandai & Ms A Sushmitha (Hyderabad) in the *Technical Stream* and Shri Kapil Istwal, Shri Ajay Chauhan and Shri Ravindar Singh in the *Administrative Stream*.

Participation in Workshops, Seminars and Conferences

The following NCB officials participated in Seminar & Conferences shown against their names during the period.

Sl No.	Workshop/Seminar/Events/Conferences	Participant(s)
1.	Workshop on "Understanding of Regulations on Weight and Balance", 13th April 2018, New Delhi, Organized by CSIR-National Physical Laboratory (NPL) in collaboration with Mettler Toledo	Sh P Srikanth and Sh Vishnu Dutt
2.	7th Annual Conference on Mining Technology in India" on 16th & 17th April 2018, New Delhi Organized by India Infrastructure Publishing Pvt. Ltd.	Sh A K Dubey
3.	Circular Economy Symposium (CES)" on 14-15 May 2018, New Delhi, being organized by Federation of Indian Chambers of Commerce and Industry (FICCI)	Sh Kapil Kukreja and Sh Anand Bohra
4.	National Conference on "Future Trends in Mining	Sh A K Dubey

Sl No.	Workshop/Seminar/Events/Conferences	Participant(s)
	(Tomorrow Mine-Safe Mine)", 25th & 26th May 2018, Bengalure Organized by Mines Safety Association Karnataka	
5.	Seminar on " Disseminating Measurement Capabilities of the Weights, 21st June 2018, New Delhi Organized by CSIR-National Physical Laboratory (NPL)	Dr S K Breja and Sh P. Srikanth
6.	Seminar on "Introduction of New Seismic Guidelines on Highway Bridges (IRC:SP-114-2018)", 23rd June 2018, New Delhi, Organized by Indian Association of Structural Engineers	Sh T V G Reddy, Sh Arup Ghatak and Sh Naman Agarwal
7.	Workshop on "Necessity and Importance of Waterproofing & Protective Systems for Civil Engineering Structures", 28 & 29 June 2018, Goa, Organised by INSTRUCT Empowering India's Construction	Sh Ajay Kumar and Sh Arup Ghatak
8.	Seminar on "National Roads & Highways Summit 2018", 05th July 2018, New Delhi Jointly Organized by PHD Chamber and Ministry of Road Transport and Highways	Sh V V Arora, Sh P N Ojha, Sh B Pandu Ranga Rao, Sh Amit Trivedi, Sh Suresh Kumar and Sh AVS Manian
9.	Conference and Exhibition on Cable Supported Structures (Building Bridges) – Concrete 2018", 13-14 July 2018, New Delhi, Organised by Indian Concrete Institute	Sh Nitin Chowdhary, Sh Anil Agarwal, Mohd. Ali Saifi
10.	Seminar on "River Action Plan, Flood Management and Basin Development", 27th & 28th July 2018, New Delhi, Organized by Consulting Engineers Association of India.	Sh Brijesh Singh and Sh Vikash Patel
11.	BPM Asia Conference on "Transforming Business through Process Based Management" 08-09 August 2018, New Delhi, Organized by CII Institute of Quality and Q3Edge Leonardo Consulting	Dr S K Breja

Sl No.	Workshop/Seminar/Events/Conferences	Participant(s)
12.	7th Coal Summit 2018 on "Can India Grow Sustainably without Green Coal?", 5th & 6th September 2018, New Delhi, Organized by Indian Energy Forum	Sh M V Ramachandra Rao and Sh Prateek Sharma
13.	International Conference on "Health and Air Pollution : Effect and Management (ICOHAP-EM-2018)", 7th & 8th September 2018, New Delhi Organized by International Development Centre Foundation	Sh M V Ramachandra Rao, Sh Prateek Sharma and Sh Anand Bohra
14.	International Seminar on "Earthquake / Wind Resilience in Buildings and Bridges with Vibration Control – Base Isolation and Dampers", 14 – 15 September 2018, New Delhi, Organized by Indian Association of Structural Engineers	Sh B P R Rao, Sh Vaibhav Chawla and Sh Vikas Patel
15.	Conference on "Training programme for Measurement of Uncertainty as per requirement of NABL.", 17th & 18th September 2018, Mumbai, Organised by Bureau of Indian Standards (BIS)	Sh Amit N Gandhi and Sh Dipesh Tailor
16.	Conference on "Innovative World of Concrete ICI-IWC 2018 international Conference on Innovations in Concrete for meeting housing and Infrastructure Challenges", 19th - 22nd September 2018, Bangaluru, Organized by Indian Concrete Institute	Sh Amit N Gandhi and Sh Nikhil Kaushik
17.	International conference and Expo on "Uniting the world in Mitigating & Combating Corrosion", 30 Sept. to 03 Oct. 2018, Jaipur, Organized by NACE International Gateway India Section	Sh Puneet Kaura, Sh Y N Daniel, Sh Rizwan Anwar and Sh Piyush Mittal
18.	National Workshop on "Latest Investigations, Repair & Rehabilitation Technologies for Dams", 04-05 Oct. 2018, New Delhi, Organized by Aqua Foundation Academy	Sh V V Arora, Sh P N Ojha Sh Brijesh Singh, Sh Suresh Kumar and Sh Pritam Singh Rawat

Sl No.	Workshop/Seminar/Events/Conferences	Participant(s)
19.	Workshop on "National Building Code of India 2016", 30 - 31 October 2018, Bhubaneswar Jointly Organized by Bureau of Indian Standards (BIS) & Institution of Engineering (I)	Sh H K Gupta and Sh Shiba Shankar Satapathy
20.	International Conference on "Pavements and Computational Approaches (ICOPAC-2018)", 16 - 17 November 2018, New Delhi, Organized by CSIR-CRRI	Sh Lalit Yadav, Sh Vaibhav Chawla and Sh Nitesh Kumar
21.	Conference on "Roadways, Highways, Waterways 2018", 7th December 2018, New Delhi Organized by Jasubhai group	Sh V V Arora
22.	Conference & Gettu-Kodur International Symposium on Advances in Science & Technology of Concrete on 14 -15 December 2018, Mumbai at Organized by India Chapter of American Concrete Institute	Sh Brijesh Singh and Sh Amit Sagar
23.	International Seminar on "Construction and Rehabilitation of Rigid Pavement-Current Practice and Way Forward" on 18-19 January 2019, New Delhi, Organized by Indian Roads Congress (IRC) in association with MoRTH, Govt. of India; NHAI, NHIDCL, NRRDIA and International organization viz, World Road Congress (PIARC) & Japan Road Association	Sh Nikhil Kaushik and Sh Vaibhav Chawla
24.	Workshop cum Training Program "Treatment and Utilization of Industrial and Mining Waste for Sustainable Environment" on 28th January 2019, Bhubaneswar, Organized by CSIR-IMMT	Dr B N Mohapatra, Sh D Pavan Kumar, Sh H K Gupta, Sh Sunil Kr Soren and Sh Akash Pattnaik
25.	Technical Lecture on "Innovative Pre Casting Technologies in Transportation Structures", 28th March 2019, New Delhi, Organised by Indian Association of Structural of Structural Engineers	Sh Vaibhav Chawla

Important Visitors

Date	Name of Visitor	Organisation
21-06-2018	Dr S M Thakur	Yoga Expert
08-08-2018	Sh Anil Agarwal	Joint Secretary, DIPP
11-01-2019	Dr M L Agarwal	YMCA
27-12-2019	Sh Mahendra Singhi	Chairman - NCB
06-02-2019	Dr Abdullah Abbas Ahmed Sh Salem Abdullah Al-Hajry	OMAN Cement Company
07-02-2019	Dr B P Thapliyal,	Director, CPPRI
13-02-2019	Dr A K Gupta Dr Megha Mittal	Manav Rachna University
15-02-2019	Dr Rajbir Singh	General Manager, Rajbhasha, NHPC
08-03-2019	Dr Dhanada K Mishra	Visiting Research Scholar, University of Michigan, Hong Kong University of Science And Technology

International Linkages / Collaboration Programmes

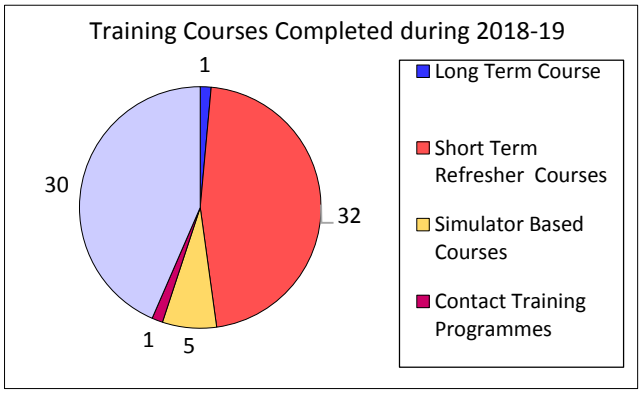
NCB has been actively interacting and liaising with a number of international bodies and exchanging knowledge and experience particularly in the area of cement and building materials industries.

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. So far, **2602** training programmes have been organized. A total number of **43,548** 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 2018-19, 69 training programmes were successfully organized with a total of 1309 participants attending the programmes.

The highlights of the training programmes conducted are as under:



Type of Course	Number
Long Term Course - *PG Diploma in Cement Technology*	**1**
Short Term Refresher Courses	**32**
Simulator Based Courses	**5**
Contact Training Programmes	**1**
Special Group Training Programmes	**30**

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.

Five self-sponsored participants admitted for 2017-18 session, comprising of two chemical engineers and three post graduates in chemistry and have successfully completed the course in July 2018. As in the past, all these students were placed in the cement industry. In the session 2018-19, eleven students were admitted in the course.

Short Term Refresher Courses

During the year, 32 Short Term Training Courses were organized wherein 590 professionals from cement and construction industries participated. In Cement Technology related area, special emphasis was given to courses such as Instrumental Methods of Analysis and Quality Control, Technologies for Reducing PM, NOx, SOx and CO_2 in Cement Industry; Optimisation of Grinding Systems; Calibration of Laboratory Equipment and Quality Assurance in Cement, Construction and Process Industries; Sampling and Testing of Cement as per BIS Standards; Optimization of Raw Mix to Improve Clinker and Cement Quality; Co-processing of Alternate Fuels in Cement Industry; Optimization of Pyroprocessing Systems in Cement Industry; Innovation in Area of Newer Cements and its Application; Optimization of Raw Mix to Improve Clinker and Cement Quality; Safety Practices in Cement Industry; Role of Construction Chemicals on Performance of Cements.

In Concrete and Construction related areas, the training programmes on specific topics such as Advances in Concrete Technology covering use of Admixture, Self Compacting Concrete and High Performance Concrete; Sampling, Testing and Evaluation of Concrete making Materials and Concrete; Cracks and Leakages in Concrete Structures - Causes, Prevention and Repair; Use of Fly Ash and Blended Cements for Durable Concrete; Quality Control and Quality Assurance in Concrete Construction; Compatibility of Admixtures with different types of Cements for Different Concrete Mixes; Design, Construction and Quality Control Practices for Concrete Roads for Highway & Low Volume Roads; Concrete Mix Design and Acceptance Criteria of Concrete for Different Types of Mixes; Corrosion in Reinforced Concrete Structures and its Remedial Measures; Quality Control and Quality Assurance in Concrete Construction including Extreme Weather Concreting; Non–Destructive Testing and Evaluation of Concrete Structures; Repair and Rehabilitation of Concrete Structures including Water roofing Materials and Techniques were organized.

A lecture session in progress in Training Hall at NCB-Ballabgarh Unit

Participants of M/s Dalmia Cement (Bharat) Ltd. during a Special Group Training Programme visiting Laboratory at NCB-Ballabgarh Unit

Simulator Based Courses

With the aim of providing comprehensive training on various aspects of kiln and mill operation, six training courses on Advanced Simulator trainer were organized at NCB's Ballabgarh and Hyderabad units for 19 professionals from cement plants in India and neighbouring countries and 24 participants from educational institutions. The participants were trained on Operation, Control and Optimization of Modern Grinding System based on Vertical Roller Mills, Roller Press and Ball Mills; Operation, Control and Optimization of kilns.

Participants from AKS University after successful completion of a Simulator based Training Programme at Ballabgarh Unit

Contact Training Programmes

On the request of industry, **one** tailor-made practice oriented contact training programmes for the professionals from cement and construction industries were organized to suit the specific requirement covering Chemical analysis of Cement.

Special Group Training Courses

Thirty special group training courses on specific topics for the group of engineers/professionals were organized for the following organizations either at NCB's units or sponsors' sites:

Sl No.	Organization	Topics of the Courses Organized
1	Birla White Cement	Physical Testing of Cement according to EN Standards
2	Shree Digvijay Cement Ltd. (SDDCL)	Testing of Cement as per IS 4032 and ASTM C114
3	Dalmia Cement (Bharat) Ltd.	Cement Manufacturing Technology Train the Trainers (Civil)
4	Bureau of Energy Efficiency (BEE)	Strengthening Capabilities of Accredited Energy Auditors focusing on Cement Sector
5	JC Bose University, YMCA	Cement, Building Materials and their Testing
6	AKS University	Simulator based course on Basics of Pyroprocessing for the students
7	RCCPL/Birla Corp. Ltd.	Energy Audit and Conservation
8	Nuvoco Vistas Corp.Ltd.,	Cement Manufacturing Technology
9	National Buildings Construction Corporation Ltd (NBCC)	Principles of Concrete Mix Design as per IS-10262 (5 training programmes) Cost Effective Construction Technologies
10	Hindustan Petroleum Corporation Ltd (HPCL)	Quality Control & Quality Assurance in Concrete Structure
11	NHPC Ltd.	Non-destructive Testing Techniques Concrete Technology and High Performance Concrete

Sl No.	Organization	Topics of the Courses Organized
13	Power Grid Corporation of India Ltd. (PGCIL)	Quality Control in Construction & Durability Assessment in Concrete Structures
14	Power Grid Corporation of India Ltd. (PGCIL), Jammu	Corrosion in RCC Structures: Prevention and Repair
15	Indian Aviation Academy	Concrete Technology and High Performance Concrete
16	Delhi Metro Rail Corporation Ltd (DMRC)	Quality Control and Quality Assurance in Concrete Construction
18	NCL Industries Ltd.	Concrete –Fundamentals and Mix design

Participants of M/s DMRC Ltd. during a Special Group Training Programme visiting at NCB-Ballabgarh Unit

Training of NCB Personnel

Learning is a Continuous Process and CCE taking this philosophy forward regularly trains it's personnel in various technical, managerial and behavioral fields:

Title of course	Name and address of Training Organisation	Duration and Period
Mechanical Testing of Cement, Fly ash and Building Materials like aggregate, building brick, tile, paver block, steel bar etc.	CDR-MPI	5 Days 02-06 April 2018
One day laboratory Course on Changes in ISO/IEC 17025:2005 to ISO 17025:2017	National Accreditation Board for Testing and Calibration Laboratories (NABL), Gurgaon	1 Day 16 April 2018
Instrumental Methods of Analysis of Quality Control	Centre for Continuing Education Services (CCE)	3 Days 02-04 May 2018
Sampling Testing and Evaluation of Concrete Making Materials and Concrete	Centre for Continuing Education Services (CCE)	4 Days 08-11 May 2018
In-house Workshop on "Personality Development"	Shri MVS Rao, M/s Lingua Encarta *Organised by* Centre for Continuing Education Services (CCE)	1 Day 10 May 2018
In-house Training / Workshop on "Digital Creativity Skills", Adobe Digital Disha Program (An AICTE approved Skill Development Workshop)	Adobe Systems India Pvt. Ltd. *Organised by* Centre for Continuing Education Services (CCE)	1 Day 23 May 2018
Awareness Training Program on ISO/IEC 17025:2017	Centre for Continuing Education Services (CCE)	2 Days 24-25 May 2018

Title of course	Name and address of Training Organisation	Duration and Period
Use of Fly ash and Blended Cements for Durable Concrete	Centre for Continuing Education Services (CCE)	3 Days 19-21 June 2018
Principles of Concrete Mix Design as per IS:10262	Centre for Continuing Education Services (CCE)	1 Day 04 July 2018
Cement Manufacturing Technology for Cement Professionals of M/s Dalmia Cement Bharat Ltd	Centre for Continuing Education Services (CCE)	Module I 09-27 July 2018
Calibration of Laboratory Equipment and Quality Assurance in Cement, Construction, Process and Power Industries	Centre for Continuing Education Services (CCE)	3 Days 10-12 July 2018
Soil Testing	Spectro Analytical Labs Ltd., New Delhi	16-20 July 2018
Business & Diplomacy Summit 2018	India Empire, India Habitat Centre, New Delhi	1 Day 17 July 2018
Concrete Mix Design and Acceptance Criteria of Concrete for Different types of mixes	Centre for Continuing Education Services (CCE)	3 Days 17-19 July 2018
Awareness Program on ISO 17025:2017	Centre for Continuing Education Services (CCE)	2 Days 26-27 July 2018
Technologies for reducing PM, NO_x, SO_x and CO_2 in Cement Industry	Centre for Continuing Education Services (CCE)	2 Days 02-03 August 2018
Design, Construction, Quality Control and Maintenance of Rigid Pavements	CRRI, New Delhi	5 Days 10-14 Sept. 2018
Sampling and Testing of Cement as per BIS Standards	Centre for Continuing Education Services (CCE)	3 Days 18-20 September 2018
NDT & Evaluation of Concrete Structures	Centre for Continuing Education Services	3 Days

Title of course	Name and address of Training Organisation	Duration and Period
	(CCE)	25-27 Sept. 2018
Measurement of Uncertainty as per ISO/IEC 17025 and NABL Requirements	(NITS), Bureau of Energy Efficiency, organizing at Mumbai	2 Days 19-20 November 2018
General Requirements for the Competence of Reference Material Producers as per ISO/IEC 17034	National Accreditation Board for Testing and Calibration Laboratories (NABL), Gurgaon	3 Days 13-15 February 2019
5 days Laboratory Assessor Training Course (Accreditation Criteria ISO/IEC 17025:2017)	National Accreditation Board for Testing and Calibration Laboratories (NABL), Gurugram	5 days 13-17 March 2019

NCB HYDERABAD

NCB HYDERABAD UNIT

NCB Hyderabad is the regional centre and is established 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, Third Party inspection and consultancy services to the industries:

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, testing and calibration services. Laboratories are NABL accredited, BIS recognised & ISO certified, and equipped with state-of-art facilities.

- **R&D activities:** Research work was carried out on the enhanced use of different industrial waste materials and by-products in the manufacture of cement including fly ash, GBF slag etc. Fly ash and other raw materials for preparation of PPC were collected from industry and studies were carried out to activate the fly ash and use it in the cement manufacture for improving the properties of cement at higher fly ash contents. Similarly, studies were taken up on the development of composite cements using fly ash and limestone in addition to already existing composition consisting of fly ash and GBF slag. Since GBF slag is only available in a few pockets and marginal, low grade limestone is widely available to plants, these studies may help the industry to show an alternate to GBF slag in the preparation of composite cements.

➢ **Establishing Limestone Consumption Factor (LCF):** LCF denotes the amount of limestone consumed by cement plant for production of 1T of clinker. This study helps the cement plants and government agencies to monitor the limestone reserves and planning of the mining activities. NCB-H unit conducts the LCF studies in the Southern states of India.

Major Testing Infrastructure of CRT laboratories:

X-Ray Diffraction (XRD)

X-Ray Fluorescence Spectroscopy (XRF)

Particle Size Distribution Analyzer (PSD)

Optical Microscopy

Construction, Development and Research (CDR)

Structural Assessment and Rehabilitation (SAR):

CDR, NCB-H carried out structural assessment and rehabilitation studies of around 20 structures for various organizations such as NTPC, CPWD. Power grid etc. The studies were carried out using various Non-Destructive Evaluation Techniques to evaluate the existing condition of the structures and to provide recommendations for repair and restoration measures to enhance the Service life of these structures. NCB-H also provided Third Party Quality Assurance Services for the ongoing repair and restoration of RCC Structures based on our assessment report in NSPCL Bhilai.

Extraction of Concrete Core from the Inner Shell of RCC Chimney of NTPC Ramagundam

Rebound Hammer Testing being done on RCC Column of TG Unit#1 of NTPC Unchahar

Third Party Quality Assurance

CDR, NCB – H provided TPQA services for Construction of various multistoried structures for educational institutions such as NIT Warangal, IIT Madras, IISc Chellakere and also for other public sector organizations such as CIPET and Powergrid Corporation. TPQA assures that the quality of the work being carried out at site is as per the requirement of that particular site and also according to various provisions prescribed by Indian Standards and CPWD Specifications.

Checking of Lap length provided to a Column at IIT Madras campus

Verification of Reinforcement detailing before concreting at IISc Chellakere, Karnataka

Concrete Technology

This programme evaluates the concrete making materials such as Cement and cementitious Materials such as OPC, PPC, PSC, Fly Ash, Slag, etc. for complete physical and chemical analysis and Alkali-Aggregate Reactivity of aggregates etc. Under this programme following concrete mix design are conducted.

- Ordinary concrete, standard concrete and High Strength Concrete using OPC, PPC, PSC, OPC + Fly Ash/GGBFS, OPC + Fly Ash/GGBFS+ Silica Fume etc.
- Special Concrete such as High Performance Concrete, Self- Compacting Concrete, Pavement Quality Concrete (PQC), Dry Lean Concrete (DLC), Fiber Reinforced Concrete etc.

Continuing Education (CCE)

Centre for Continuing Education (CCE) at NCB-Hyderabad organizes 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 & wifi facilities. A hostel block attached to the training complex is also available for providing residential facility to participants.

The centre is organizing various short term courses, contact training and special training programmes related to cement, concrete and construction areas. A modern simulator trainer covering different grinding and pyro-processing systems is also available in the unit for providing hands-on training to mill and kiln operators of cement plants.

The recent programmes organized by CCE on cement includes Raw Mix design, testing of cement, Calibration methods, environment emissions management, optimization of grinding & pyro systems and safety practices in cement industry. CCE has conducted various programmes on concrete mix design, maintenance of civil structures & buildings, non-destructive testing methods for concrete structures, quality control and quality assurance in constructions for civil and construction professionals.

A Glimpse of training programmes conducted at NCB-Hyderabad

Mining, Environment, Plant Engineering and Operations (CME)

Centre for Mining, Environment, Plant Engineering and Operations (CME) at NCB- Hyderabad is instrumental in carrying out various process & environment diagnostic studies and energy audits to cater the needs of South Indian Cement plants. The centre is equipped with latest instruments like Portable Gas Analysers, Digital Pyrometers, Stack monitoring equipment, digital anemometers and Power & Harmonic Analysers. The above measuring equipments are useful in technical studies for proper assessment of cement plant process and equipment parameters. The recent studies handled by this centre include BEE mandatory energy audits, heat balance studies, WHR feasibility studies and environmental studies at various cement industries. The centre has contributed and also associated with NCB-B in completing some of the international assignments at Bhutan and Oman.

Measurement of Stack Parameters

Inspection of Cement Plant by NCB-H Team

Third Party Quality Assurance (TPQA)

NCB-Hyderabad is handling third party quality assurance activities of electrical & mechanical works of South India & Odisha projects in various multi storied buildings. The main TPQA activities of Electrical & Mechanical Engineers includes verification of specifications against bill of quantities of client/work order and factory inspection for major items such as transformers, diesel generators and street light poles etc.

The electrical TPQA includes verification of Transformers, Diesel generators, Essential & Non Essential Panels/feeder pillars, Earth pits, PVC & MS conduits, PVC Insulated Copper Wire, Cables, Light Fittings and Street Light Poles etc. Mechanical TPQA includes verification of Sprinkler System, Wet Riser System, Down Comer System, Fire Alarm & Fire Alarm Panel, Pumps, Air Conditioning Systems and Lifts.

Measurement of Conduits and Switch Boards

Verification of Electrical Panels

NCB AHMEDABAD

NCB AHMEDABAD UNIT

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.

Facilities includes Universal Testing Machine (UTM), Automatic Compression Testing Machine (ACTM), Physical Testing Laboratory, CBR Testing Machine and Non-Destructive Testing (NDT) equipment such as Rebound hammer, Ferroscan & Ultrasonic Pulse Velocity Test (UPV).

Unit is using these facilities to provide testing and TPQA services to various government agencies of Gujarat, Union Territory (UI) of Daman & Diu and Dadra & Nagar Haveli. The unit is ISO 9001:2015 certified and has ISO 17025:2017 accredited testing laboratories.

Following facilities are available in NCB-Ahmedabad unit.

Testing Facilities

- Cement and Cementitious Materials such as OPC, PPC, PSC, Fly ash, Slag, Silica-fume etc.
- Aggregates – Complete physical and chemical analysis, Soundness
- Special Concrete, Advance Concrete Composite & Standard Concrete Mix Designs
- Ordinary concrete, standard concrete and High Strength Concrete using OPC, PPC, PSC, OPC + Fly ash, OPC+ Fly ash + Silica fume etc.

Structural Assessment & Rehabilitation Services Offered

- In-situ quality assessment, durability investigation and residual life assessment of concrete structures
- NDT, Pile integrity testing
- 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

Construction Technology & Management
Services Offered

- Quality control services to construction project through mobile laboratories
- 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.
- Consultancy for fly ash based building products such as fly ash bricks, paver blocks, kerb stones, aerated concrete block etc.

Studies Undertaken

- 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.

A glimpse of Laboratory Activities and TPQA at NCB-Ahmedabad

NCB BHUBANESWAR

NCB PROJECT OFFICE AT BHUBANESWAR

NCB has signed an MoU with Industrial Development Corporation of Odisha (IDCO) **on 08.03.2016 valid for five years for providing** Third Party Quality Assurance of various construction projects costing more than 25 Lacs. **In order to provide Quality Assurance and Quality Control (QA/QC) and Third Party Quality Assurance (TPQA) services to IDCO, NCB has setup its site office cum laboratory at Central Stores, Mancheswar, Bhubaneswar with essential facilities for testing of cement, concrete and soil.**

Facilities includes Universal Testing Machine (UTM), Automatic Compression Testing Machine (ACTM), Physical Testing Laboratory and Non-Destructive Testing (NDT) equipments such as Rebound hammer**. NCB Bhubaneswar is using these facilities to provide QA-QC and TPQA services to various projects of IDCO undertaken by its 11 Divisions. The projects are spread in 14 Districts of Odisha. Some of the photographs of completed projects are as under:**

500 seated Thakarbapa Hostel Building, Bhubaneswar

Krushi Bhawan at Bhubaneswar, Bhubaneswar

Aranya Bhavan, Bhubaneswar

Commercial Complex at Mehisapat, Denkanal

Testing Facilities Available at NCB Bhubaneswar

NCB has also developed laboratory infrastructure for testing of cement, water coarse aggregate, fine aggregate, concrete, bricks and soil.

HOC-CDR Visit to NCB Bhubaneswar

PAPERS PRESENTED IN WORKSHOPS, SEMINARS CONFERENCES AND JOURNALS

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

CORCON 2018 ON CORROSION SCIENCE AND ENGINEERING, 30 SEPT. - 03 OCT. 2018, JAIPUR

Performance of Evaluation of Corrosions Inhibitors and their Corrosion Inhibiting Efficiency for RCC Structures by P N Ojha, Puneet Kaura, Piyush Mittal and V V Arora

WORKSHOP ON LATEST INVESTIGATIONS, REPAIR AND REHABILITATION TECHNOLOGIES FOR DAMS, 4-5 OCTOBER 2018, NEW DELHI

1. *Importance of Detailed Investigations of Large Concrete Dams in India for Accurate Analysis and Repair Strategy* by V V Arora and Brijesh Singh (NCB) and Pramod Narayan (CWC)

2. *Laboratory Evaluation and Field Execution of Concrete Repair for Concrete Dams in Himalayan Regions* by P N Ojha, Suresh Kumar, P S Rawat and V V Arora

8th INTERNATIONAL CONFERENCE ON SUSTAINABLE WASTE MANAGEMENT, 22-24 NOVEMBER 2018, VIJAYWADA

Experimental Studies on Bottom Ash Fine Aggregate in Concrete by V V Arora & P N Ojha

3rd R N RAIKAR MEMORIAL INTERNATIONAL CONFERENCE & GETTU-KODUR INTERNATIONAL SYMPOSIUM ON ADVANCES IN SCIENCE & TECHNOLOGY OF CONCRETE, 14-15 DECEMBER 2018, MUMBAI

Study on Flexural Behaviour of High Strength Concrete using Granite Aggregate by V V Arora, Brijesh Singh & Vikas Patel

INTERNATIONAL SEMINAR ON CONSTRUCTION AND REHABILITATION OF RIGID PAVEMENT – CURRENT PRACTICE AND WAY FORWARD, 18-19 JANUARY 2019, NEW DELHI

A Sustainable Approach to Construction of Low Volume Concrete Roads using C&D Aggregates and Supplementary Cementitious Materials by Vaibhav Chawla, Amit Trivedi & V V Arora

INTERNATIONAL DAM SAFETY CONFERENCE – 2019 BHUBANESWAR, ODISHA, 13-14 FEBRUARY 2019

Detailed Investigation of Large Concrete Dams in India for Finite Element Analysis and Repair Strategy by V V Arora and Brijesh Singh (NCB) and Pramod Narayan (CWC)

ENCO 2019 (AN INTERNATIONAL SEMINAR ORGANIZED BY CIMFR-CSIR), 19-21 FEB 2019, NEW DELHI

Oxygen enrichment technology- an innovation in coal combustion in cement rotary kilns by Sh Ankur Mittal, Sh Ashutosh Saxena

PAPERS PUBLISHED

The following papers were contributed by NCB scientists to outside technical journals:

1. S K Agarwal, S K Chaturvedi and Ashutosh Saxena, "*Effect of Mineral Addition on the Mechanical Properties of Portland Slag Cement*". **International Cement Review, December 2018, p.37-45.**
2. S K Agarwal, S Vanguri, S K Chaturvedi, B N Mohapatra (NCB), Anil Kumar, Subhdra Sen, A S Reddy, Ashok Kumar (Tata Steel Limited), "*Investigations on mechanical properties of GBFS-steel slag based Portland slag cement*", **(Accepted for publication in Zement Kalk Gips (ZKG).**
3. Brijesh Singh, V V Arora, Vikas Patel & Nitin Chowdhary "*Non-Destructive Testing of Bored Piles using the Low Strain Pile Integrity Method*". **Indian Concrete Journal**
4. V V Arora & Brijesh Singh, "*Field and Laboratory Investigation on Ageing Effect in Concrete Arch Dam-Indian Case Study*". **Dam Engineering Journal, UK**
5. Vikas Patel, Brijesh Singh, B P R Rao & V V Arora: *Challenges in quality Assurance in Construction Industry-A Case for Delhi*. **CE&CR Magazine**
6. V V Arora, Brijesh Singh & Vikas Patel: *Study on Flexural Behaviour of Reinforced High Strength Concrete Beams*. **Indian Concrete Journal**
7. Brijesh Singh, V V Arora & Vikas Patel: *Study on Stress Strain Characteristics of High Strength Concrete*. **Indian Concrete Journal**
8. Vikas Patel, Brijesh Singh, B P R Rao and V V Arora: *Quality Assurance in Construction Industry*. **Concrete Update, E-Bulletin, CE&CR**
9. T V G Reddy & Ankit Sharma: *Condition Assessment and Repair of RCC Structures- Case Studies*. **Advanced Research in Civil and Environmental Engineering**

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 B N Mohapatra, Director General

a. Member, Panel for Building Materials (CED 46:P3), Bureau of Indian Standards, New Delhi.
b. Member of BIS Cement & Concrete sectional committee CED 2, Cement pozzolana and Cement Additives sub-committee CED 2:1 and Concrete Sub-committee CED 2:2
c. Member of BIS Technical Committee (P4)
d. Member of technical Committee for development of Low Calcined Clay Cement (LC3) with of IIT- Mumbai, Delhi & Chennai & TARA
e. Member of Research Advisory Committee at DISIR (Dalmia Institute of Scientific and Industrial Research, Rajgangpur, Orissa
f. Member of scientific committee of 15th International Congress on the Chemistry of Cement (ICCC) held at Prague at 2019.
g. Member in their Technical Committee for the development of Standards for RMC. (Formed by CII – Confederation of Indian Industry)

Sh Ashutosh Saxena, Joint Director

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

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

Sh V V Arora, Joint Director

a. Chairman, Cement Matrix Products Sectional Committee, Bureau of Indian Standards, New Delhi.
b. Member, Civil Engg. Divisional Council (CEDC), Bureau of Indian Standards, New Delhi.
c. Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.
d. Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.
e. Member, Panel for Revision of Handbooks (CED 2/P2), Bureau of Indian Standards, New Delhi.
f. Member, Panel for Aggregates from other than Natural Sources (CED 2/P3), Bureau of Indian Standards, New Delhi.
g. Member, Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.
h. Member, Concrete Sub Committee (CED 2:2), Bureau of Indian Standards, New Delhi.
i. Member, Panel for Revision of IS 3370 (Part I & Part II) (CED 2:2/P1), Bureau of Indian Standards, New Delhi.
j. Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.
k. Convenor, Panel for Revision of IS 457 (CED 2:2/P6), Bureau of Indian Standards, New Delhi.
l. Member, Panel for Revision of Indian Standards on Test Methods for Concrete (CED 2:2/P7), Bureau of Indian Standards, New Delhi.
m. Member, Structural Safety Sectional Committee (CED 37), Bureau of Indian Standards, New Delhi.
n. Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi.
o. Member, National Building Code Sectional Committee (CED 46), Bureau of Indian Standards, New Delhi.

p. Member, Panel for Fire protection (CED 46:P2), Bureau of Indian Standards, New Delhi.
q. Member, Panel for Building Materials (CED 46:P3), Bureau of Indian Standards, New Delhi.
r. Member, Panel for Load, Forces and Effects (CED 46:P4), Bureau of Indian Standards, New Delhi.
s. Member, Panel for Soil and Foundation/Panel for Plain Reinforced & Prestressed Concrete (CED 46:P5), Bureau of Indian Standards, New Delhi.
t. Member, Panel for Masonry (CED 46:P7), Bureau of Indian Standards, New Delhi.
u. Member, Panel for Plain Reinforced & Prestressed Concrete (CED 46:P8), Bureau of Indian Standards, New Delhi.
v. Member, Panel for Prefabrication and Systems Building (CED 46:P10), Bureau of Indian Standards, New Delhi.

Sh P N Ojha, General Manager

a) Member, Laboratory and RAMCO subcommittee, Bureau of Indian Standards, New Delhi.
b) Member, CIVIL Engg. Divisional Council (CEDC), Bureau of Indian Standards, New Delhi.
c) Member, Panel for Revision of Handbooks (CED 2/P2), Bureau of Indian Standards, New Delhi.
d) Member, Concrete Sub Committee (CED 2:2), Bureau of Indian Standards, New Delhi.
e) Member, Panel for Revision of IS: 456 and IS: 1343 (CED 2:2/P5), Bureau of Indian Standards, New Delhi.
f) Member, Cement Matrix Products Sectional Committee (CED 53), Bureau of Indian Standards, New Delhi.
g) Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1), Bureau of Indian Standards, New Delhi.

Dr D Yadav, General Manager

a) Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.
b) Member, Cement, Pozzolana and Cement additives Subcommittee (CED 2:1), Bureau of Indian Standards, New Delhi.

c) Member, Panel for Revision of Cement Standards (CED 2:1/P1), Bureau of Indian Standards, New Delhi.
d) Member, Methods of Analysis Sub Committee (PCD 7:4), Bureau of Indian Standards, New Delhi.

Sh Amit Trivedi, General Manager

a) Member, Panel for work relating to ISO/TC71 and ISO/TC74 (CED2/P1), Bureau of Indian Standards, New Delhi.
b) Member, Panel for Aggregates from other than Natural Sources (CED 2/P3), 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, Planning, Housing and Prefabricated Construction Sectional Committee (CED 51), Bureau of Indian Standards, New Delhi.
e) Member, Concrete Pipes Sub Committee (CED 53:2), Bureau of Indian Standards, New Delhi.
f) Member, Concrete Reinforcement Sectional Committee (CED 54), Bureau of Indian Standards, New Delhi.

Sh Anupam, General Manager

a) Member, Environmental Protection and Waste Management Sectional Committee (CHD 32), Bureau of Indian Standards, New Delhi.
b) Member, Environmental Management Sectional Committee (CHD 34), Bureau of Indian Standards, New Delhi.
c) Member, Coal Beneficiation & Lignite Sub Committee (PCD 7:6 & PCD 7:9), Bureau of Indian Standards, New Delhi.

Sh B P Ranga Rao, General Manager

a) Member, National Building Code Sectional Committee (CED 46), Bureau of Indian Standards, New Delhi.
b) Member, Planning, Housing and Prefabricated Construction Sectional Committee (CED 51), Bureau of Indian Standards, New Delhi.
c) Member, Water Proofing and Damp Proofing Sectional Committee (CED 41), Bureau of Indian Standards, New Delhi.

Dr D K Panda, General Manager

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

Sh M Selvarajan, General Manager

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

Sh T V G Reddy, General Manager

a) Member, Panel for Revision of IS 3370 (Part I & Part II) (CED 2:2/P1), Bureau of Indian Standards, New Delhi.
b) Member, Structural Safety Sectional Committee (CED 37), Bureau of Indian Standards, New Delhi.
c) Member, Panel for Administration, Development Control Rules and General Buildings (CED 46:P1), Bureau of Indian Standards, New Delhi.
d) Member, Panel for Load, Forces and Effects (CED 46:P4), Bureau of Indian Standards, New Delhi.

Dr N K Tiwary, General Manager

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

Sh P Anil Kumar, Group Manager

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

Sh Sanjay Mundra, Group Manager

a) Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1), Bureau of Indian Standards, New Delhi.
b) Member, Panel for Soil and Foundation/Panel for Plain Reinforced & Prestressed Concrete (CED 46:P5), Bureau of Indian Standards, New Delhi.
c) Member, Water Proofing and Damp Proofing Sectional Committee (CED 41), Bureau of Indian Standards, New Delhi.

Sh G J Naidu, Group 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.

Sh Ankur Mittal, Manager

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

Sh Amit Prakash, Manager

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

Sh Brijesh Singh, Manager

a) Member, Cement and Concrete Sectional Committee (CED 2), Bureau of Indian Standards, New Delhi.
b) Member, Cement, Pozzolana and Cement additives Subcommittee (CED 2:1), Bureau of Indian Standards, New Delhi.
c) Member, Earthquake Engineering Sectional Committee (CED 39), Bureau of Indian Standards, New Delhi.
d) Member, Panel for Prefabrication and Systems Building (CED 46:P10), Bureau of Indian Standards, New Delhi.
e) Member, Concrete Reinforcement Sectional Committee (CED 54), Bureau of Indian Standards, New Delhi.

Sh Kapil Kukreja, 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.

Sh S K Agarwal, Manager

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

Sh Suresh Kumar Shaw, Manager

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

Sh Suresh Kumar, Manager

a) Member, Panel for Revision of IS 457 (CED 2:2/P6), Bureau of Indian Standards, New Delhi.
b) Member, Panel for Revision of IS 2386 (CED 2:2/P10), Bureau of Indian Standards, New Delhi.
c) Member, Precast Concrete Products Sub Committee (CED 53:3), Bureau of Indian Standards, New Delhi.
d) Member, Sieves, Sieving and other Sizing Methods Sectional Committee (CED 55), Bureau of Indian Standards, New Delhi.

Sh M K Mandre, Manager

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

Sh Nitin Chowdhary, Manager

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

Dr (Mrs) Pinky Pandey, Manager

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

Dr (Mrs) Varsha T Liju, Deputy Manager

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

Sh Anand Bohra, Deputy Manager

a) Member, Environmental Protection and Waste Management Sectional Committee (CHD 32), Bureau of Indian Standards, New Delhi.
b) Member, Air Quality Sectional Committee (CHD 35), Bureau of Indian Standards, New Delhi.

Sh Saurabh Bhatnagar, Deputy 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 M V Ramachandra Rao, Deputy Manager

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

Sh Prateek Sharma, Deputy Manager

a) Member, Coal Beneficiation & Lignite Sub Committee (PCD 7:6 & PCD 7:9), Bureau of Indian Standards, New Delhi.

Sh P Srikanth, Deputy Manager

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

Sh Puneet Kaura, Deputy Manager

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

Sh K P K Reddy, Deputy Manager

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

Sh Nikhil Kaushik, Deputy Manager

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

Sh Amit Sagar, Deputy Manager

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

Sh Arup Ghatak, Deputy Manager

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

Sh Ajay Kumar, Deputy Manager

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

Sh Giasuddin Ahamed, Deputy Manager

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

Sh Y N Daniel, Deputy Manager

a) Member, Fibre Reinforced Cement Product Sub Committee (CED 53:1), Bureau of Indian Standards, New Delhi.
b) Member, Precast Concrete Products Sub Committee (CED 53:3), Bureau of Indian Standards, New Delhi.

Sh Munish Kumar, Assistant Manager

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

Mrs Mithlesh Sharma, Assistant Manager

a) Member, Methods of Analysis Sub Committee (PCD 7:4), 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, Coal Sub Committee (PCD 7:3), Bureau of Indian Standards, New Delhi.

Rolling Plan of Missions within the Framework of Centres

A. 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

B. 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

C. 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

D. 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

E. 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

F. 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

Programmed Projects Completed During the Year 2018-19

Sl. No.	Code	Project Title	Date of commencement	Target Date of Completion
1.	PRP-06	Application of CFD in Indian Cement Industry	1/4/2017	31/03/2019
2.	CTM-01	Cost Effective Technology for Low Traffic Volume Concrete Roads	1/4/2016	31/03/2019
3.	ENV-19	Impact of Ammonia on Environment due to use of Ammonia for secondary abatement of NOx Control in Cement Industries in India	1/4/2018	31/03/2019
4.	FBR-15	Improving The Reactivity of Fly Ash and Their Effect on Cement And Concrete Performance	1/4/2017	31/03/2019

Sponsored Projects Completed During the Year 2018-19

National Council for Cement and Building Materials has completed 371 sponsored projects in the year 2018-19. Centre for Cement Research and Independent Testing (CRT) completed 40 nos. of projects, Centre for Centre for Mining, Environment, Plant Engineering & Operation (CME) have completed 43 nos. of sponsored projects, Centre for Construction Development and Research (CDR) have completed 284 nos. of sponsored projects and Centre for Quality Management, Standards and Calibration Services (CQC) have completed 3 nos. of sponsored projects.

Centre for Cement Research and Independent Testing (CRT)

Centre for Cement Research and Independent Testing (CRT) has completed 40 nos. sponsor projects during the year 2018-2019, the distribution of 40 number sponsor projects as under:

Title of the Project	Sponsors	No. of Projects
Establishing limestone consumption factor	ACC, Ultra Tech Cement, Ramco Cement, Dalmia Cement(Bharat), Maihar Cement, J K Cement, Emami Cement, Prism Johnson Cement, Rain Cement, J K White Cement, Diamond Cement, KJS Cement, Sagar cements, My Home Cement	19
Burnability investigations of raw mix samples and testing of limestone, clinker and coal samples	ACC, Ambuja Cement, Ultra Tech Cement, Reliance Cement Limited, Century Cement, Manikgarh Cement, Wonder Cement, J K Cement, Birla Corporation	16
Optimization of raw mix design for manufacture of cement	Palpa cement-Nepal, KHD Humboldt,	2

Investigation on reduction of normal consistency of cement	UltraTech Cement	1
Preparation and evaluation of white Portland cement containing upto 35% dolomite as additive	UltraTech Cement	1
Investigation of utilization of leather sludge in cement & concrete	DPIIT, Govt. of India	1
Total		**40**

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

Center for Mining, Environment, Plant Engineering & Operation (CME) has completed 43 nos. of sponsor projects in the year 2018-2019. Details of projects are given below:

Title of the Project	Sponsors	No. of Projects
Mandatory Energy audit for various cement plants in India	Shree Digvijay Cement Co Ltd, J K Lakshmi Cement Ltd, Mangalam Cement, Dalmia Cement, Ariyalur, ACC Ltd, Penna Cement, KCP Cement Ltd, Bhavya Cement Ltd, JK White Cement	14
Monitoring of Stack emissions for PM, SO_2, NOx at boiler stack of Unit 7 & Unit 8, Panipat Thermal Power Station, Panipat	Panipat Thermal Power Station, HPGCL	02
Environment Monitoring at South Asian University, Maidan Garhi, Delhi	Ahluwalia Contracts (India) Ltd	02
Monitoring of Point Source Emission	Harduaganj Thermal Power Plant, UPRVUNL, Aligarh & Parichha Thermal Power Plant,	02

Title of the Project	Sponsors	No. of Projects
Capacity Assessment Study	Goldstone Cements Alshtom inudstries	02
Technical Due Diligence & Asset evaluation for Delhi Grinding unit & Bhatinda Grinding unit	Cement Corporation of India Ltd.	02
Preliminary Investigation for Beneficiation on Laboratory Scale for Low/Marginal Grade Limestone" for Singsar Limestone mines, Tehsil Kodinar, Dist. Gir Somnath, Gujarat.	Ambuja Cements Limited	01
Preliminary Investigation for Beneficiation on Laboratory Scale for Low/ Marginal Grade Limestone" for Singsar Limestone mines, Tehsil Kodinar, Dist. Gir Somnath, Gujarat.	Purbanchal Cement Ltd.	01
Process Measurements of existing Air Pollution Control Equipment for Kiln and VRM at Cement Corporation of India Ltd., Rajban, Himachal Pradesh	Cement Corporation of India Ltd.	01
Assessment study for SO_2 & NOx generation and mitigation measures from pyro- processing system of SCML & SCL	Star Cement Ltd, Lumshnong	01
Feasibility study for capacity upgradation	Saurashtra Cement Ltd.	01
Plant Technical Audit	Purbanchal cement Ltd.	01
Diagnostic Study for Improving Productivity & Process Optimisation	Hill Cement Ltd	01
Diagnostic study for minimizing excessive kiln build-ups	Star Cements Ltd,Meghalaya	01
Optimization of raw material grinding and cement grinding circuit	UltraTech Cement Ltd, Sewagram	01
Heat and gas balance study	Hemadri Cements	01
Study of flue gas availability for WHRS (JayaJyothi Cements Limited)	APT Power Engineering, Hyderabad	01

Title of the Project	Sponsors	No. of Projects
Plant Energy Audit	Dungsam Cement, Bhutan	01
Strengthening capabilities workshop organized through BEE for AEA focusing on cement sector	Bureau of Energy Efficiency	01
DPR Preparation work for setting up a 600 tpd cement plant in Republic of Congo.	Government of Republic of Congo	01
TEFR for setting up a 1.00 MTPA Cement Grinding Unit at Rashtriya Ispat Nigam Limited (*RINL*) for Cement Corporation of India Ltd.	Cement Corporation of India Ltd.	01
Detailed TEFR for setting up a 1.0 mtpa cement plant at Mynkree, East Jaintia Hills, Meghalaya.	Taj Cement Mynkree Ltd	01
Project losses estimation and project revival study for new 1200 tpd clinkerisation line project at CCI Bokajan, Assam	Cement Corporation of India Ltd	01
Detailed Technical Feasibility Report for setting up a ball mill circuit along with existing VRM at Guwahati, Assam	Star Cements Ltd	01
In-house training & safety audit for coal mill for	CMS Industries,Malaysia	01
Total		**43**

Centre for Construction Development and Research (CDR)

Centre for Construction Development and Research (CDR) has completed 284 nos. sponsored projects during the year 2018-19. Total 43 projects complete under Programme Structural Assessment and Rehabilitation (SAR), 30 projects completed under programme Concrete Technology (CON) & 211 projects completed under programme Construction Technology Management (CTM). The details are given below:

Structural Assessment and Rehabilitation (SAR)

Title of the Project	Sponsors	No. of Projects
Carrying Out Rebound Hammer, UPV Test & Concrete Core Testing of RCC	Power Grid Corporation of India Limited: Delhi,	11

Title of the Project	Sponsors	No. of Projects
Structures of various Power Stations of PGCIL	Kurukshetra, Vadodara, Aligarh, Orai, Secundarabad	
Condition Assessment of various RCC Structural elements of various NTPC plants using Non-Destructive Testing (NDT) Technique	NTPC Limited : Unchahar, North Karanpura, Sipat, Korba, Dadri, Simhadari, Faridabad, Rihand & Kamagundam	9
Carry out Condition Assessment using Non Destructive Evaluation Technique including preparation of BOQ/Specifications of (G+8) RCC Framed Structure, K Block - Married Sailor accommodation at Chanakyapuri, Delhi , Dwarka, Delhi Cantt., Bhaderwah, J&K	Military Engineering Services	4
Condition Assessment using Non Destructive Evaluation Technique including preparation of BOQ/Specifications of RCC Framed Structure for DDA Flats at Lok Nayak Puram & Dwarka, Delhi	Delhi Development Authority, New Delhi	2
To carrying out Non-destructive test (NDT) tests and preparation of typical BOQ covering rate analysis as per DSR & Preparation of specification & methodology for carrying out effective repair	Reserve Bank of India, Ahmedabad	2
Distress Condition Assessment of RCC Members, Preparation of Bill of Quantities (BOQ)/Specifications/Cost Estimate for Repair items for Repair & Restoration Works of Identified 10	Indraprastha Power Generation Co Ltd New Delhi	1

Title of the Project	Sponsors	No. of Projects
Blocks (16 Quarters/Block) at Type-II Quarter, Vidyut Vihar Colony, Sarai Kale Khan, New Delhi		
Post Repair Non-Destructive Evaluation of RCC TG Deck of TG Foundation Unit # 1 (1x600 MW) of Jhabua Power Ltd., Village Barela, Distt. Seoni, Madhya Pradesh	Jhabua Power Limited, Seoni, Madhya Pradesh	1
Study on Bonding of High Performance Concrete with Old Concrete	NHPC Limited, Faridabad,	1
Determination of strength of precast members by core cutting method at your site in Delhi.	Delhi Development Authority, New Delhi	1
Condition Assessment using Non Destructive Evaluation Technique including preparation of BOQ/Specifications	Bhagirathi Apartments, Noida	1
Condition Assessment using Non Destructive Evaluation Technique of Bhartiya Vidya Bhawan's Mehta Sadan Building at Kasturba Gandhi Marg, New Delhi	Bhartiya Vidya Bhawan New Delhi	1
Ultrasonic Pulse Velocity (UPV) Testing of structures a) TDBFP (A&B)-1 No., b) MDBFP-1 Nos., c) PA foundation -1 Nos., d) ID Fan-2 Nos. & Mill Foundation-5 Nos. at North Karanpura STPP, Jharkhand as per IS:13311-1992 (Part-I)	Shankaranarayan, Constructions (P) Ltd	1

Title of the Project	Sponsors	No. of Projects
Concrete Core Testing, Ultrasonic Pulse Velocity Test and Rebound Hammer Test on RCC Columns, RCC Shear Walls, RCC Beams and RCC Slabs of under construction Hospital at Sector-71. Noida	Kailash Healthcare Ltd, Noida	1
Condition assessment and remedial measures for RCC pedestals (Total-4No's) of wagon tippler no-3 & 4 at CHP, SSTPS, Suratgarh, Rajasthan	Rajasthan Rajya Vidyut Utpadan Nigam Ltd, Suratgarh, Rajasthan	1
Condition Assessment Using Non-Destructive Evaluation Technique for STBP building at NSIC Complex, Okhla Industrial Estate, New Delhi	The National Small Industries Corporation Ltd., New Delhi	1
Condition Assessment of underground structure on back side of PM Office, South Block, New Delhi using Non Destructive Evaluation Technique including Preparation of Typical Schedule of Items for Repair and Rehabilitation	Central Public Works Department	1
Ultrasonic Pulse Velocity (UPV) Testing of TG Deck and its supporting RCC Columns of 1x660MW Harduaganj Thermal Power Station Extension Phase-II at Aligarh, UP as per BS 1881: Part 203: 1986 & IS: 13311 – 1992 (Part-1).	Uttar Pradesh Rajya Vidyut Utpadan Nigam	1
Concrete Core Testing on RCC Columns, RCC Shear Walls of under construction Hospital at Sector-71. Noida.	DYNACON Projects Pvt. Ltd., Noida	1

Title of the Project	Sponsors	No. of Projects
Condition Assessment and Recommendations on Repair & Restoration Measures of Forensic Science Laboratory Building (4 Storey) at Sector-14, Rohini, Delhi	Public Works Department, Delhi	1
Core Testing of 6 Nos. of 9 Mtr. PCC Poles & 6 Nos. of 11 Mtr. PCC Poles for BSES	BSES Rajdhani Power Limited, Delhi	1
Concrete Technology (CON)		
Evaluation of Materials and Concrete Mix Designs for the various structural elements of Thermal Power Plants of NTPC	NTPC Limited:	9
Evaluation of Materials and Concrete Mix Designs for the Work of Construction of Steam Generator & Auxiliaries Package for different packages of Ghatampur Thermal Power Project	Neyveli Uttar Pradesh Power Limited, Kanpur, UP	4
Evaluation of Corrosion Inhibiting Admixture for Fosroc Chemicals (India) Pvt. Ltd.	Fosroc Chemicals (India) Pvt. Ltd., Noida	2
Evaluation of Auramix BRI Bipolar – Corrosion Inhibiting Admixture for Fosroc Chemicals (India) Pvt. Ltd. as per G 109		
Testing of Ground Granulated Blast Furnace Slag (GGBFS)	JSW Cement Limited, Mumbai	1
R&D Studies of Fiber Reinforced Concrete (FRC) and Mortar Evaluation for Building Construction Applications	Gujarat State Fertilizers & Chemicals Limited, Vadodara, Gujarat	1
Evaluation of Dredged Marine Sand	Adani Ports and Special	1

Title of the Project	Sponsors	No. of Projects
(Sea Sand) and River Sand for Usage in Structural Concrete	Economic Zone Limited, Navinal Island, Mundra, Gujarat	
Concrete Mix Design & Third Party Quality Assurance for Production and Placement of Concrete at Ichari Dam Site	Dakpath Uttrakhand Jal Vidyut Nigam Ltd., Uttrakhand	1
Additional Work for Evaluation of Cement and Potential Alkali-Aggregate Reactivity as per ASTM C1293	THDCIL Tehri Dam Project,Uttrakhand	1
Creep Test of Concrete up to 180 days as per ASTM C512	NUVOCO Vistas Corp. Ltd., Formerly Lafarge India Limited, Mumbai	1
Testing of Master Emaco 580 (Crystalline)	BASF India Limited, New Delhi	1
Evaluation of Materials and Concrete Mix Design for the Work of Construction of Steam Generator & Auxiliaries Package (GA 1) for 3X660 MW Ghatampur Thermal Power Project	Larsen & Toubro Limited	1
Evaluation of Rock Sample for Concrete Construction Works Purpose for Source Approval for Larsen & Toubro Limited	Larsen & Toubro Limited	1
Testing of Crystalline Proofing Compound (M/s Kryton)	Public Works Department, Delhi	1
Evaluation of fine aggregate for alkali aggregate reactivity	SJVN Limited, Uttrakhand	1
Evaluation of aggregates for Potential Alkali Aggregate Reactivity and suitability of aggregate for Concrete works to be used for Varanasi-Gorakhpur NH-29 Road Project, Pkg-3&4.	Jaiprakash Associates Limited,	1

Title of the Project	Sponsors	No. of Projects
Evaluation of Materials and Concrete Mix Designs for the Work of "Main Plant, Chimney, CHP and Associated Civil and Mechanical, Electrical Works etc. for EPC Package for PVUN (Patratu) (3X800MW) (Contractor Shree Vijaya Engineering & Construction Pvt. Ltd.)	Patratu Vidyut Utpadan Nigam Limited., Jharkhand	1
Conduct of trial mix design for High Performance Concrete of M80/A20 and M70/A20 grade of concrete	NHPC Limited	1
Evaluation of Manufactured Geopolymer Flyash Sand	Visvesvarya National Institute of Technology	1
Construction Technology Management (CTM)		
Third Party Quality Assurance/ Quality Audit in Construction Projects such as Buildings (Residential, Commercial, Hospital), roads, bridges, retaining walls, drains, ETP's, Multilevel Car Parking etc.	Municipal Corporation of Delhi, Delhi	172
Third Party Quality Assurance/ Quality Audit for Construction of Buildings, Academic infrastructures, Road works, Interior, public health and sanitary works.	Odisha Industrial Infrastructure Development Corporation, Bhubaneshwar, Odisha	23
Third Party Quality Assurance/ Quality Audit in Security Infrastructure, construction of Residential Building, Academic complex and hostel	Central Public Works Department, Delhi, Chennai, Hyderabad	4

Title of the Project	Sponsors	No. of Projects
Third Party Quality Assurance/ Quality Audit for construction of Academic Infrastructure, Elevated road, FOB, RCC drain, Footpath, Cycle track, Rain water harvesting scheme, road strengthening/widening electrical works etc.	Public Works Department, Delhi	3
Third Party Quality Assurance/ Quality Audit of Community Hall, Utility Buildings	Delhi Urban Shelter Improvement Board, Delhi	2
Third Party Quality Assurance/ Quality Audit for Sports Infrastructure	Sports Authority of Gujarat (SAG), Gandhinagar	2
Third Party Quality Assurance/ Quality Audit for Foundations in Transmission Lines	Power Grid Corporation of India Limited, Secunderabad	2
Third Party Inspection and monitoring of Quality for Construction of Bridge	Public Works Department, Daman	1
Third Party Quality Assurance and Audit for Construction of Hostel building	All India Institute of Medical Sciences, New Delhi	1
Third Party Inspection and monitoring of Quality for the Construction of Bridge	Omnibus Industrial Development Corporation of Daman & Diu and Dadra and Nagar Haveli Limited Moti Daman	1

CENTRE FOR QUALITY MANAGEMENT, STANDARDS AND CALIBRATION SERVICES (CQC)

Centre for Quality Management, Standards and Calibration Services (CQC) has completed 3 nos. of sponsored projects during the year 2018-19. The details are given below:

Title of the Project	Sponsors	No. of Projects
Assistance in ISO 17025 (NABL) Accreditation of Quality Control Laboratory for	My Home Industries Pvt. Ltd. (MHIPL), Mellacheruvu Cement Works (MCW), Nalgonda Dist. Telangana	01
Four-Day Training Workshop on Laboratory Management System and Internal Audit as per ISO/IEC 17025:2005 for NABL Accreditation for	Regional Quality Control Laboratory, NHPC Limited, Siliguri	01
Assistance in ISO 17025 (NABL) Accreditation of Quality Control Laboratory for	Sree Jayajothi Cements Pvt. Ltd. (SJPL), Yanakandla Cement Works, Kurnool Dist., Andhra Pradesh	01
Total		03

Appendix - IV

Research and Development Programme 2019-20

S. No.	Code	Project Title	Start Date	End Date
		PROJECTS UNDER DCCI		
1	COB-09	Development of Reactive Belite Cement Using Low Grade Lime Stone and different dopants	April 2017	March 2020
2	COB-10	Improving The Performance of Composite Cement By Separate Grinding of Constituents	April 2017	March 2020
3	WAU-14	Improvement of Fly Ash Quality, Through Chemical / Mineral Doping In Coal During Its Generation In Thermal Power Plant, and Study Its Effects In Cement And Concrete.	April 2017	March 2020
4	WAU-15	Investigations of Multi Component Blended Cements Using Limestone, Calcined Clay and Other Mineral Additives	April 2017	March 2020
5	COB-11	Formulation of new clinker standard for blended cements	April 2019	March 2021
6	WAU-16	Development of Portland composite cement based on flyash and limestone	April 2019	March 2022
		PROJECTS UNDER PROJECTS BASED SUPPORT TO AUTONOMOUS INSTITUTION		
1	SOD-09	Effectiveness of Different Repair Systems for Repair of Corrosion Damaged Structures	April 2016	March 2020
2	CTM-02	Development of Geopolymer Concrete For Application In Pavements and Precast Concrete Construction	April 2017	March 2020

S. No.	Code	Project Title	Start Date	End Date
3	CON-14	Development of Ultra High Performance Concrete (UHPC)-including use of Nano Technology for UHPC	April 2017	March 2020
4	CON-15	Enhancing The Utilization of Construction and Demolition Waste and Other Waste Based Aggregates In Concrete Structures and Pavements	April 2017	March 2020
5	SOD-10	Effect of Supplementary Cementitious Materials (SCM's- Single And Multi Blends) on Service Life of Concrete Structures Including Studies To Improve Green Cements To Meet Durability/Service Life Requirements	April 2017	March 2020
6	CTM-03	Use of Advanced Electronics in Construction And Condition Assessment of Concrete Structures	April 2017	March 2020
7	CTM-04	Model low cost housing sustainable technology for Mass EWS & LIG/MIG housing schemes-using precast / prefab systems with emphasis On maximization of waste based materials	April 2017	March 2020
8	SOD-11	Experimental study on shear and compression design of high strength concrete including effect of fibre on enhanced durability and fire resistance	April 2017	Sept. 2019
9	CLS-02	Development of calibration methodologies with improved accuracy	April 2017	March 2020
10	CON-16	Fresh, hardened and durability performance evaluation of concrete made with Portland Limestone Cement (PLC)	April 2019	March 2021

NCB Patents Granted/ Filed During 2010-2019

NCB Patents Granted

Sl.No	Application No.	Title	Name of Inventors
1	248230	A Ceramic Composition for Preparing Scientific Pottery ware and Process of Preparation thereof (Date of Grant: 28-06-2011)	Shri S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Dr D Yadav Sh S K Agarwal
2	251637	A decorative plaster coating (Date of Grant: 27-03-2012)	Shri S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
3	288839	Decorative tiles utilizing marble dust and a process for preparation thereof (Date of Grant: 27-10-2017)	Sh S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
4	289766	Cement and flyash based aesthetic building bricks tiles utilizing marble dust and a process for preparation thereof (Date of Grant: 21-11-2017)	Sh S Raina Dr K Mohan Dr K M Sharma Dr M M Ali Sh S K Chaturvedi Sh S K Agarwal
5	294833	A process of preparation of ordinary Portland cement (Date of Grant: 23-03-2018)	Sh M Vasudeva Dr M M Ali Dr D Yadav Dr J M Shatma NALCO Officials
6	295058	A process for preparation of synthetic slag from low grade limestone and dolomite (Date of Grant: 27-03-2018)	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

Sl.No	Application No.	Title	Name of Inventors
			Sh Tashi Tshering Sh Udai Kaflay
7	314591	Rationalizing formulations and curing conditions for improving properties of hardened Geopolymeric Cement (Date of Grant: 25-06-2019)	Sh Ashwani Pahuja Dr M M Ali Dr R S Gupta Dr S Vanguri Dr V Liju

NCB Patents Filed

Sl.No	Application No.	Title	Name of Inventors
1	2598/DEL/2014	Marble dust as mineral additive in the manufacture of ordinary Portland cement	Shri A Pahuja Dr M M Ali Sh P S Sharma Sh S K Agarwal Sh Ashish Goyal
2	2599/DEL/2014	Mineralizing effect of "barium sludge- an industrial byproduct" in the manufacture of ordinary Portland cement	Shri A Pahuja Dr M M Ali Dr V P Chatterjee Sh S K Chaturvedi Sh S K Agarwal
3	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
4	1194/DEL/2015	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
5	1196/DEL/2015	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
6	1964/DEL/2015	Method for rapid estimation of Na_2O and K_2O in different types of cement and raw materials	Sh Ashwani Pahuja Dr M M Ali Sh S K Chaturvedi Sh S C Sharma

Sl.No	Application No.	Title	Name of Inventors
7	201611029136	Fast process for determining expected 28-day compressive strength of concrete made with Portland Pozzolana Cement (PPC)	Sh V V Arora Sh Suresh Kumar Sh Manish Kumar Mandre
8	201711000524	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 MNK Prasad Bolisetty
9	201811047884	Geopolymer concrete paving block and a preparation thereof	Sh V V Arora Sh Amit Trivedi Sh Lalit yadav

FINANCE AND ACCOUNTS

FINANCE

CONTRIBUTIONS

Ministry of Commerce & Industry Grant

During the year 2018-19, Grant of Rs. 30 Crores received.

FOREIGN EXCHANGE

During the year 2018-19, the Council earned Foreign Exchange amounting to US$93149, CHF 1950 & GBP 5205 towards Training Fee, Testing Charges, Sponsored R & D, Seminar Delegate Fee, Technical Exhibition Etc.

AUDITORS

M/s K S Aiyar & Co, Chartered Accounts, Mumbai were the Auditors of the Council for the year 2018-19.

ACCOUNTS

The Accounts for the 2018-19 duly audited by the Auditors of the Council are given at Annexure (Balance Sheet as at 31st March 2019 and Income & Expenditure Accounts for the year ended 31st March 2019).

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, 2019 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, 2019, 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 Responsibilities 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 our 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, Income and Expenditure Account and Fund Flow Statement dealt with by this report are in agreement with the books of account.

For K. S. Aiyar & Co.
Chartered Accountants
Firm Registration No. 100186W

Raghuvir M. Aiyar
Partner
Membership No. 038128

Place: Mumbai
Date: 07/11/2019

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

BALANCE SHEET AS AT MARCH 31, 2019

	Schedules		As at March 31, 2019		As at March 31, 2018
SOURCES OF FUNDS					
Capital Fund	A	68,076,146		68,076,146	
Reserves and Surplus	B	1,148,879,670		664,362,854	
Building Fund		4,500,000		4,500,000	
Gratuity Fund		127,147,745		202,212,171	
Provision For Leave Encashment		174,327,157		180,828,115	
Capital Grant from Govt of India	C	442,383,777		442,383,777	
Current Liabilities & Provisions	D	173,584,749	2,138,899,243	277,749,917	1,840,112,980
			-		-
Total			**2,138,899,243**		**1,840,112,980**
APPLICATION OF FUNDS					
Fixed Assets					
Gross Block	E	853,352,637		809,951,630	
Less : Depreciation		447,041,237	406,311,400	410,345,954	399,605,676
Net Block					
Gratuity Fund Investment					
(Fixed Deposit / Savings Bank / Interest Accrued)		212,342,516		197,049,916	
Leave Fund account		105,640,711		61,893,708	
Current Assets Loans & Advances					
R&D Contribution Outstanding		101,839,976		8,056,771	
Sundry Debtors	F	23,024,075		19,632,505	
Loans and Advances (unsecured and considered good)		154,014,734		129,225,915	
Cash and Bank Balances	G	1,103,218,046	1,700,080,058	888,736,590	1,304,595,405
FDR In lien			11,082,408		14,572,765
Investments					100,000,000
Interest Accrued on Bank Deposits			21,425,377		21,339,132
Total			**2,138,899,243**		**1,840,112,980**
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
K. S. Aiyar & Co.
Chartered Accountants

Dr S K Chaturvedi
Joint Director(Finance & Accounts)

Dr B N Mohapatra
Director General

Raghuvir M. Aiyar
Partner
M.No. 38128
Mumbai
Date: 30/10/19

Shri Mahendra Singhi
Chairman -NCB

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED MARCH 31, 2019

		For the Year ended March 31,2019	For the Year ended March 31,2018
INCOME			
Research & Development Contribution	H	420,226,090	323,940,093
Other Income	I	99,621,825	86,553,699
Grant-in-Aid (Revenue) from Ministry of Commerce & Industry	J	300,000,000	291,600,000
		819,847,915	**702,093,792**
EXPENDITURE			
Employee's Cost	K	215,735,514	370,526,841
Travelling & Conveyance (Including Overseas Travelling)		12,933,641	10,671,929
Lab. Stores Serv.& Comp.(S.W.)		21,657,629	15,621,306
Symposia & Seminars		1,125,704	11,553,483
Training Programmes		3,488,039	2,702,441
Repairs and Maintenance		8,565,996	5,556,526
Other Expenses	L	35,129,295	33,255,466
Depreciation		36,695,283	9,382,164
Add. Provision of Depreciation of previous Year	-		
Less : Transfer from Capital Grant from Govt of India	-		
		335,331,099	**459,270,156**
Surplus for the year transferred to Reserve Fund		**484,516,816**	**242,823,636**
Significant Accounting Policies			
Notes on Accounts		-	

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
K. S. Aiyar & Co.
Chartered Accountants

Dr S K Chaturvedi
Joint Director(Finance & Accounts)

Dr B N Mohapatra
Director General

Raghuvir M. Aiyar
Partner
M.No. 38128
Mumbai
Date: 30/10/19

Shri Mahendra Singhi
Chairman -NCB

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

SCHEDULES FORMING PART OF THE ACCOUNTS AS AT MARCH 31, 2019

Particulars	As at March 31, 2019 (Amount in Rs.)	As at March 31, 2018 (Amount in Rs.)
SCHEDULE - A		
Capital Fund		
As per the last Balance Sheet	68,076,146	68,076,146
Includes UNIDO Equipment valued at Rs 20,187,535 (Previous Year Rs 20,187,535) (Refer Note 3 (b) of Schedule M)		
TOTAL	**68,076,146**	**68,076,146**
SCHEDULE - B		
Reserves and Surplus		
As per the last Balance Sheet	664,362,854	421,539,218
Add: Surplus for the year	484,516,816	242,823,636
TOTAL	**1,148,879,670**	**664,362,854**
SCHEDULE - C		
Capital Grant from Govt of India		
As per the last Balance Sheet	442,383,777	442,383,777
Add : Plan Grant received during the year	-	-
	442,383,777	442,383,777
Less : Grant transferred to Income & Expenditure Account to the extent depreciation charged during the year on assets purchased out of capital grant	-	
TOTAL	**442,383,777**	**442,383,777**
SCHEDULE - D		
Current Liabilities and Provisions		
Retention & Security Money	19,274,643	19,081,854
Other Liabilities	154,310,106	258,668,063
TOTAL	**173,584,749**	**277,749,917**

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

SCHEDULE E

DEPRECIATION AS AT 31 MARCH 2019

(Amount in Rs.)

	GROSS BLOCK						DEPRECIATION											NET BLOCK	
Particulars	Cost upto March 31, 2001	Cost from April 1, 2001 to March 31, 2018	Total cost as at March 31, 2018	Addition During the Year 2018-2019	Disposal/ Adjustment out of cost before 2001 2018-2019	Disposal/ Adjustment out of cost after 2001 2018-2019	Total cost as at March 31, 2019	On Old Assets Upto March 31, 2001	On Assets from April 1, 2001 to March 31, 2018	Op.Bal Depreciation as at April 1, 2018	Rate %	On Assets Prior to 1 Aprl 01 during the year 2018-19	Rate %	On Additions after 1 Aprl 01 2018-19 (Amt.)	Depreciation/ Adjustment on cost before 2001 2018-19	Dep. / Adj. on cost after 2001 2018-19	Total Depreciation as at March 31, 2019	WDV As at March 31, 2019	WDV As at March 31, 2018
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16	18	19	20
LAND (FREE HOLD)	3,924,748		3,924,748				3,924,748			-			-	-		-		3,924,748	3,924,748
VEHICLES	833,717	5,365,103	6,198,820				6,198,820	780,464	4,423,670	5,204,134	20.0	10,651	20.0	188,287			5,403,071	795,749	994,686
COMPUTER INCLUDING ACCESSORIES		48,324,477	48,324,477	2,988,491			51,312,968		46,700,281	46,700,281			60.0	2,767,613			49,467,894	1,845,075	1,624,196
FURNITURE AND OFFICE EQUIPMENTS	10,263,037	14,991,136	25,254,173	6,746,750			32,000,923	9,545,402	(2,252,827)	7,292,575	10.0	71,764	10.0	2,399,071			9,763,410	22,237,513	17,961,598
LABORATORY EQUIPMENT	79,479,641	283,467,707	362,947,348	29,158,080			392,105,428	73,800,479	210,681,626	284,482,105	10.0	567,916	25.0	25,486,040			310,536,061	81,569,367	78,465,243
MOBILE Quality Control Laboratory		5,268,489	5,268,489				5,268,489		5,164,218	5,164,218			20.0	20,854			5,185,072	83,417	104,271
SOLAR POWER PLANT				2,501,000			2,501,000						40.0	1,000,400			1,000,400	1,500,600	
CENTRE FOR CONTINUING EDUCATION										-									
BUILDINGS	1,922,707	42,119,827	44,042,534				44,042,534	1,146,574	7,558,925	8,705,499	2.5	19,403	2.5	864,023			9,588,924	34,453,610	35,337,035
OTHER SERVICES	535,144	24,826,311	25,361,455	-			25,361,455	523,054	1,821,714	2,344,768	10.0	1,209	2.5	575,115			2,921,092	22,440,363	23,016,687
LABORATORY PROJECTS										-									
BUILDINGS	27,973,919	93,144,934	121,118,853	2,006,685			123,125,538	16,786,545	13,369,554	30,156,099	2.5	279,684	2.5	2,044,552			32,480,335	90,645,203	90,962,754
CAPITAL WORK IN PROGRESS																			
BULDG (PG) UNDER CONST.		142,148,598	142,148,598				142,148,598			-				-				142,148,598	142,148,598
OTHER SERVICES	10,046,554	5,849,746	15,896,300	-			15,896,300	9,808,580	4,722,378	14,530,958	10.0	23,797	25.0	281,842			14,836,598	1,059,702	1,365,342
STAFF HOUSING	8,386,427		8,386,427				8,386,427	5,014,819	-	5,014,818	2.5	84,290	-	-			5,099,108	3,287,319	3,371,609
PILOT PLANT FACILITIES										-									
BUILDINGS	778,010		778,010				778,010	456,425	-	456,425	2.5	8,040		-			464,465	313,545	321,585
Equipment	301,399		301,399				301,399	294,075	-	294,075	10.0	732		-			294,807	6,592	7,324
Total	144,445,303	665,506,328	809,951,630	43,401,006	-		853,352,637	118,156,417	292,189,537	410,345,954		1,067,486	-	35,627,796	-	-	447,041,237	406,311,401	399,605,676

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

SCHEDULES FORMING PART OF THE ACCOUNTS AS AT MARCH 31, 2019

Particulars	As at March 31, 2019 (Amount in Rs.)	As at March 31, 2018 (Amount in Rs.)
SCHEDULE - F		
Sundry Debtors (Unsecured and Considered Good)		
More than three years		
Others	23,024,075	19,632,505
TOTAL	**23,024,075**	**19,632,505**
SCHEDULE - G		
Cash and Bank Balances		
In Fixed Deposits	756,667,605	753,195,096
In Saving Accounts	346,047,607	134,975,261
Cash in hand including postage imprest	501,697	565,096
UNESCO Coupons (US Dollar 132.10)	1,137	1,137
TOTAL	**1,103,218,046**	**888,736,590**
SCHEDULE - H		
Research and Development		
Sponsored Research and Development Contribution	342,042,362	217,541,737
Standardisation and calibration	58,528,117.92	66,246,127
Symposia & Seminars	1,848,809.46	36,038,229
NCB Proficiency Testing Programme	17,806,801	4,114,000
TOTAL	**420,226,090**	**323,940,093**
SCHEDULE - I		
Other Income		
Interest	69,843,199	68,836,681
Sale of Publications	-	1,295
Training Programmes	15,215,389	16,549,668
Miscellaneous Receipts	1,503,215	86,484
Licence Fee (Housing Colony)	1,277,559	931,315
National Awards for Energy Efficiency	-	-
Foreign Exchange Fluctuation	1,460,762	148,257
Investement Inccome(STCG)	10,321,700	
TOTAL	**99,621,825**	**86,553,699**

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

SCHEDULES FORMING PART OF THE ACCOUNTS AS AT MARCH 31, 2019

Particulars	As at March 31, 2019 (Amount in Rs.)	As at March 31, 2018 (Amount in Rs.)
SCHEDULE - J		
Grant from Ministry of Commerce & Industry		
Towards Plan Grant	-	-
Less : Towards Capital Expenditure	-	-
Towards Non-Plan Grant from Cement Cess	300,000,000	291,600,000
Grants from Ministry of Enviroment		
TOTAL	**300,000,000**	**291,600,000**
SCHEDULE - K		
Employee's Cost		
Establishment Charges	236,441,725	331,989,667
Contribution to Provident Fund & other Fund	24,297,101	23,201,501
Gratuity (Refer Note 4 of Schedule - M)	(48,193,769)	12,059,052
Social Security & Welfare	3,190,457	3,276,621
TOTAL	**215,735,514**	**370,526,841**
SCHEDULE - L		
Other Expenses		
Rent, Rates and Taxes	2,907,661	3,102,839
Electricity and Water Charges	10,858,774	10,351,901
Postage, Telegrams & Telephones	2,586,608	2,213,037
Publications	388,247	217,766
Stationery & Miscellaneous Stores	3,091,735	3,264,934
Books, Periodicals and Membership Fee	921,163	1,170,846
Exhibition, Publicity and Advertisements	341,289	284,892
Legal Expenses	474,600	601,314
Patents	171,200	474,800
Audit Fees - Statutory Auditors	75,000	75,000
Bank Charges	75,751	191,183
Insurance of Assets	779,280	228,341
Sundry Expenses	5,476,252	6,686,416
Collaborative Assistance in R&D and	6,981,735	4,392,197
TOTAL	**35,129,295**	**33,255,466**

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, the Council has decided to change the depreciation rates prospectively i.e., new rate will be applied only to the additions made from the financial year 2001-02 onwards and are depreciated on written down value basis at the following rates:

		Old Rates % p.a.	New Rates % p.a.
*	Vehicles	20	20
*	Office Furniture and Equipment	10	10
*	Laboratory Equipment	10	25
*	Laboratory Projects Services	10	25
*	Building including Staff Housing	2.5	2.5
*	Computers	-	60
*	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) ` 19,564,057 for Laboratory Equipment and ` 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.

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 is being 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. 21,23,42,516/- (Rs. 19,70,49,196). There is a shortfall of Rs. Nil (Rs. 51,62,255) in the "Gratuity Fund Investment Account" as compared to the "Gratuity Fund account" as at 31st March 2019.

5. The Council has got an actuarial valuation of the leave encashment for and upto the year ended 31st March 2019 and the liability computed is Rs. 17,43,27,157 (Rs. 18,08,28,115).

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. The encashment of valuation of UNESCO Coupons of US $ 132.10 are subject to ascertainment and confirmation.

8. R&D Contribution has been arrived after adjusting R&D Contribution received in advance of Rs. 2,75,00,489 (Rs. 12,05,96,000).

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

IMPORTANT EVENTS

Compendium on "The Cement Industry – India 2018"

National Council for Cement and Building Materials (NCCBM) compiled compendium on "The Cement Industry – India 2018" in association with Department for Promotion of Industry and Internal Trade (DPIIT). The compendium contains key information about technology development, challenges & opportunities for Indian cement industry along with an exhaustive directory of cement plants in India, which would be beneficial to cement industry, policy planners, OEMs, academicians etc.

Release of Compendium by Hon'ble Minister of Commerce Shri Suresh Prabhu at Rajiv Gandhi Bhawan, New Delhi on 5th February 2019

The compendium was released by Hon'ble Minister of Commerce Shri Suresh Prabhu at Rajiv Gandhi Bhawan, New Delhi on 5th February 2019. Shri Mahendra Singhi (Chairman, BOG and President CMA), Shri Anil Aggarwal (Joint Secretary, DPIIT) along with DG-NCB were also present during the release. The event was attended by senior officials from Ministry of Commerce and Industry (MoC&I), NCB officials, cement industry and representatives of cement manufacturers association. Shri Suresh Prabhu during the release emphasized that the cement industry plays a vital role in the growth and economic development of India and industry has focused on improving energy efficiency in plant operations. He urged NCCBM to think of recycling of material used in production of cement.

Launch of Indian Certified Reference Materials (BNDs) Developed by NCB in the area of Building Materials

Reference Materials (RM) play pivotal role in maintaining the quality infrastructure of any economy through testing and calibration with precise measurements traceable to SI units. The Govt. of India (GoI) has supported NPLI to strengthen its Bhartiya Nirdeshak Dravya-BND® program under Make in India initiative by developing BNDs in the area of AYUSH, Materials, Nanotechnology, Medicine, Food & Agriculture and Biologics. The availability SI traceable BNDs will give a boost to "Make in India" programme and harmonize the quality infrastructure of the country.

An MOU between CSIR-NPL and National Council for Cement and Building Materials NCB for BND Certifications was signed on the occasion of World Metrology Day on 21st May 2018 in CSIR-NPL. First batch of 6 NCB BNDs was released by Honorable Minister Dr. Harsh Vardhan at a glittering function on 16th August 2018 in CSIR-NPL auditorium in New Delhi, in the presence of Dr D K Aswal (Director-NPL), Sh Ashutosh Saxena then DG (Actg.)-NCB, Dr S K Breja (Centre Head, CQC) and NCB team. The second batch of NCB BNDs was released on NCB day on 01st January, 2019 by DG-NCB and Head of Centres. NCB is the first organization in the country, outside (CSIR-NPL), to get BND marking for its reference materials.

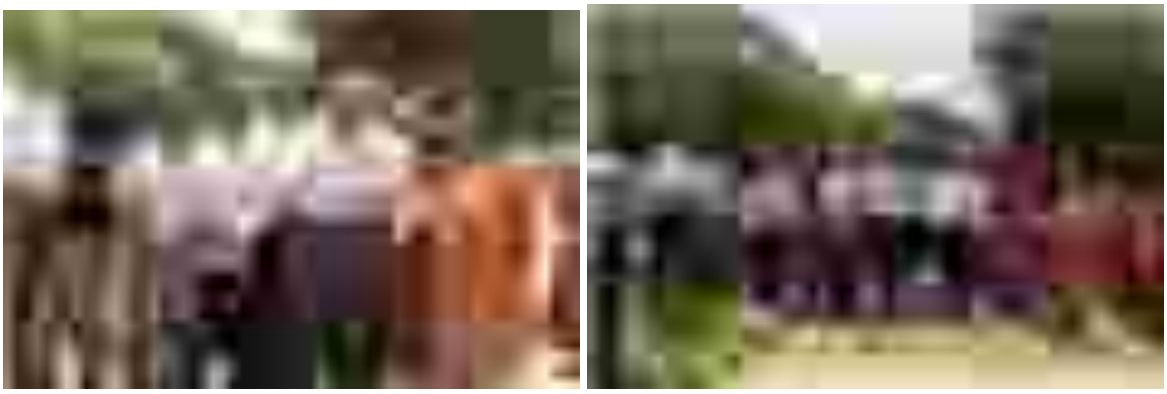
Signing of the MOU between CSIR-NPL and NCB for BND Certifications on the occasion of World Metrology Day on 21st May 2018.

Release of First Batch of NCB BNDs by Honourable Minister Dr Harsh Vardhan at CSIR-NPL on 16th August, 2018

Release of Second Batch of NCB BNDs by DG-NCB and Head of Centres on the Occasion of NCB Day celebrated on 01st January, 2019

Visit of Sh. Anil Aggarwal, Joint Secretary-DPIIT, to NCB-Ballabgarh

Sh. Anil Aggarwal, JS-DPIIT, visited NCB Ballabgarh campus on 8th August 2018 for reviewing NCB activities. He was briefed about the various activities and R&D projects carried out by NCB. During the visit, discussions were held regarding various R&D projects. Some of the projects that were discussed include high strength concrete, usage of construction and demolition waste based aggregates in concrete, cement production using low grade limestone, geopolymer concrete etc.



Inauguration of trial pavement stretch laid using Geopolymer concrete interlocking paver blocks at NCB-B by Sh. Anil Aggarwal, Joint Secretary-DPIIT

He also inaugurated trial pavement stretch laid using Geopolymer concrete interlocking paver blocks (alkali activated, developed using Ground Granulated Blast Furnace Slag & Fly Ash) developed by Centre for Construction Development and Research (CDR) at NCB Campus.

During the visit, JS-DPIIT emphasized the proactive role of NCB in imparting technical skills through summer internship programme for students of reputed institutions like IIT, BITS-Pilani etc. He also focused on role of NCB in augmenting training needs and imparting skills to professionals of cement and construction industry. He suggested DG-NCB to explore role of NCB in supporting start-ups and bringing innovations in the sector.

Review of R&D Projects at DPIIT, Udyog Bhawan, New Delhi

A presentation on the various R&D projects of National Importance undertaken by NCB was held in DPIIT, Delhi on 09th May, 2019. Sh. Anil Aggarwal, Joint Secretary-DPIIT reviewed the progress and findings of various R & D projects along with DG-NCB, Head of Centres, Scientists and Engineers of NCB. The Head of Centres of NCB also presented the various activities of their respective centres.

Joint Secretary-DPIIT Reviewing R&D Projects at Udyog Bhawan, New Delhi

During the meeting discussions were held regarding various R&D projects. Some of the projects include high strength concrete, cement production using low grade limestone, durability of composite cements, geopolymer concrete, blended cements etc.

Joint Secretary (DPIIT) appreciated and complemented NCB Scientists and Engineers for their good work. He also emphasized that the R&D projects should be completed in a time bound manner.

National Technology Day

National Technology Day is observed every year on 11th of May in India, acting as a reminder of the anniversary of **Shakti. Shakti** is the Pokhran nuclear test which was held on 11th of May, 1998. The day highlights the important role of Science in our daily lives. National Technology Day was celebrated in NCB on 11th May, 2018 with enthusiasm and fervor.

Sh D K Aswal, Director, CSIR – NPL, New Delhi graced the occasion as Special Guest and delivered the talk highlighting the role of measurement in our daily lives, science and technology. He also enlightened the listeners on the Pokhran Nuclear test, missile technology and the role of Late Dr. A P J Abdul Kalam, in making India a Nuclear Power.

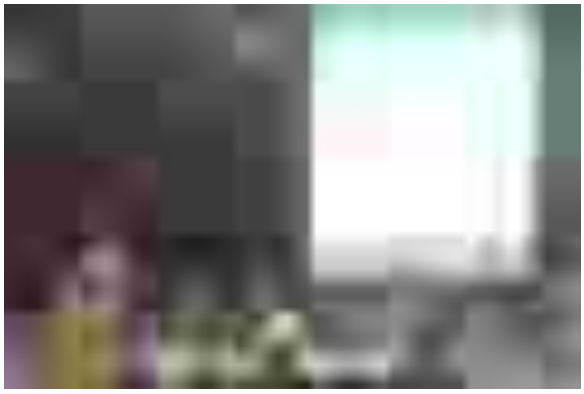
हिन्दी

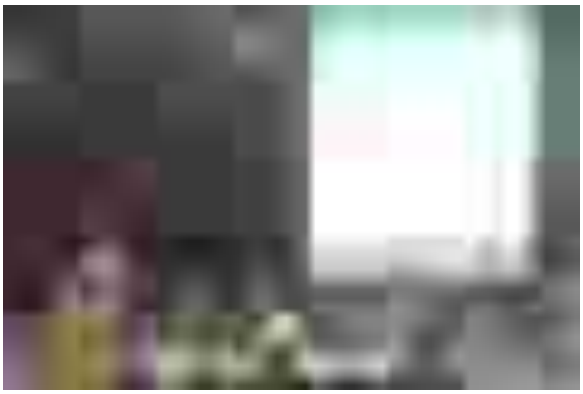
राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् (एन सी बी) के बल्लभगढ़ इकाई में हिन्दी पखवाड़ा का आयोजन 14–28 सितम्बर 2018 को हिन्दी कार्यान्वयन समिति द्वारा किया गया। पखवाड़े के उद्घाटन पर महानिदेशक श्री आशुतोष सक्सेना ने हिन्दी की उपयोगिता के बारे मे लोगो को अवगत कराया तथा इसके प्रचार प्रसार के लिए हिन्दी में कार्य करने पर बल दिया। श्री विनोद कुमार (अध्यक्ष एन सी बी राजभाषा कार्यान्वयन समिति) ने अपने भाषण मे हिन्दी के महत्व पर प्रकाश डाला तथा हिन्दी को अपने दिनचर्या में शामिल करने के लिए प्रेरित किया। हिन्दी अधिकारी–मिथलेश शर्मा ने हिन्दी कार्यान्वयन समिति द्वारा संस्थान मे वर्ष भर किए गए कार्यो के बारे मे सभी को अवगत कराया।

हिन्दी पखवाड़े के दौरान कार्यालय में विभिन्न प्रतियोगिताएं जैसे निबंध लेखन, कहानी लेखन तथा श्रुत लेख का आयोजन किया गया जिसमे प्रतिभागियो ने बढ़ चढ़ कर भाग लिया।

राजभाषा नीति के अनुपालन पर कार्यशाला

भारत सरकार की राजभाषा नीति के अनुपालन तथा महानिदेशक के निर्देशन में, एन सी बी कार्यान्वयन समिति द्वारा 15 फरवरी 2019 को एक कार्यशाला आयोजित की गई। जिसका उदघाटन महानिदेशक डॉ बी एन महापात्र ने किया। जिसमे संस्थान के सभी अधिकारीयों तथा कार्मिको ने भाग लिया। इस अवसर पर एन एच पी सी, फ़रीदाबाद के डॉ. राजबीर सिंह, महाप्रबंधक, द्वारा राजभाषा नीति अनुपालन से संबन्धित वार्ता प्रस्तुत की गई ताकि संस्थान मे हिन्दी के उपयोग को प्रोत्साहन मिल सके।





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08 दिसंबर 2018 को माननीय संसदीय राजभाषा समिति की बैठक जो की अशोका होटल, नई दिल्ली मे आयोजित की गई। बैठक में महानिदेशक डॉ बी एन महापात्र, संयुक्त निदेशक श्री आशुतोष सक्सेना, श्री विनोद कुमार (अध्यक्ष), श्रीमती मिथलेश शर्मा (हिन्दी अधिकारी) तथा मोहम्मद इकबाल (सदस्य) ने भाग लिया। संसदीय राजभाषा समिति ने हिन्दी के प्रचार प्रसार के लिए संस्थान प्रमुखो को राजभाषा नीति को संस्थान में पूर्णतः लागू करने का आग्रह किया।

[redacted]

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् (एन सी बी) की बल्लभगढ़ इकाई में एन. सी. बी. राजभाषा कार्यान्वन समिति द्वारा राजभाषा अधिनियम पर कार्यशाला का आयोजन किया गया। इस कार्यशाला का मकसद प्रचार एवं प्रसार में हिन्दी के प्रभावी उपयोग को बढ़ाना था।

इस कार्यशाला का उद्घाटन डॉ बी एन महापात्र, माननीय महानिदेशक, एन. सी. बी. के द्वारा 14 जनवरी 2019 को किया गया। डॉ. बी. एन. महापात्र, ने कार्यशाला के प्रतिभागियो को संबोधित करते हुए हिन्दी के प्रचार प्रसार के लिए अधिकतम कार्य हिन्दी में करने पर बल दिया और संस्थान में लक्ष्य प्राप्ति के लिए सभी को साथ मिल कर कार्य करने का भी आह्वान किया। इस अवसर पर समिति के अध्यक्ष श्री विनोद कुमार ने अधिनियम पर चर्चा की एवं श्री आशुतोष सक्सेना (संयुक्त निदेशक, मानव संसाधन विभाग) कार्यशाला की सफलता पर प्रसन्नता व्यक्त की एवं समिति का आभार जताया।

**** राष्ट्रीय व्यवहार में हिन्दी को काम में लाना देश की उन्नति के लिए आवश्यक है: महात्मा गांधी ****

Forum for Science and Technology (FST) / Scientific & Technological Interactive Meet (STIM)

The forum provides interactive discussion among the scientific staff of NCB. The meeting serves as a platform for keeping the scientists and engineers informed on the latest developments and trends in in diverse fields of science and technologies of cement, chemistry, civil engineering, environment, process technologies, energy, management, measurement etc.

During the year 2018-19, 7 meetings of FST were held:

Sl. No.	Date	Topic of Lecture	Speaker
1	24 July 2018	Processing and Use of C & D Waste	Sh Arun Kumar Sharma AVP-Operations IL&FS Environmental Infrastructure &
2	28 December 2018	Methodology for Development of CRM-Composite Cement	Sh V Naga Kumar Sh Suresh Shaw
3	12 February 2019	Construction and Rehabilitation of Rigid Pavement-Current Practice and Way Forward	Sh Nikhil Kaushik Sh Vaibhav Chawla
4	15 February 2019	Co-processing of Hazardous Combustible Wastes in Cement Rotary Kiln	Sh RamaChandra Rao Sh Prateek Sharma Sh Anand Bohra
5	08 March 2019	High Volume Fly ash Applications in India and China for Climate change Mitigation	Dr Dhanada Kanta Mishra Visiting Research Scholar, Deptt. of Civil & Environmental Engg. Hong Kong University of Science & Technology
6	13 March 2019	LCF Study of Cement Plant/LCF for Different Fuels	Sh G J Naidu Dr Suresh Palla
7	15 March 2019	Ultra High Performance Concrete	Sh Abhishek Singh Sh Piyush Mittal

Prof. Dr Dhanada Kanta Mishra, visiting research scholar at Hong Kong University of Science and Technology delivered a talk on "High Volume Fly ash Applications in India and China for Climate Change Mitigation"

NCB Day Celebrations

56th NCB day was celebrated on 27th December, 2018 with great enthusiasm and fervour. Shri Mahendra Singhi, Chairman-NCB, graced the occasion. He addressed the gathering and interacted with staff of NCB.

As part of the celebrations, scientists, engineers and support staff who excelled in their fields were recognized and awarded. Shri Mahendra Singhi, Chairman-NCB and Dr B N Mohapatra, DG-NCB awarded to the achievers. The 'Best Scientist Award' was given to Shri P Anil Kumar, Shri D Pawan Kumar (Hyderabad), Sh Nitin Chowdhry, Shri P Srikanth, Dr Suresh Palla and Shri Ankit Sharma and the 'Best Supporting Staff Award' was given to Shri Gaurav Bhatnagar, Sh Mahesh Mishra, Sh Manoj Khandai & Ms A Sushmitha (Hyderabad) in the Technical Stream and Shri Kapil Istwal, Shri Ajay Chauhan and Shri Ravindar Singh in the Administrative Stream.

NCB-Technology Resource Centre (TRC) was also inaugurated by Shri Mahendra Singhi, Chairman-NCB, on this occasion.

Inauguration of NCB-Technology Resource Centre (TRC) by Honrable Shri Mahendra Singhi Chairman-NCB

Address by Shri Mahendra Singhi Chairman-NCB

Address by Director General-NCB

Awardees with Chairman NCB and DG-NCB

Republic Day Celebrations at NCB

NCB celebrated 70th Republic Day with full enthusiasm and high spirits. Dr B N Mohapatra, DG-NCB graced the occasion by hoisting the National Flag. The event was attended by NCB officials and their family members.

On this occasion DG-NCB remembered freedom fighters who fought for the freedom of the country. He asked NCB officials to work for the benefit of the society and country. He motivated everyone to meet the International & National expectations in Cement and construction Sectors. The event was concluded with prize and sweet distribution.

Highlights of NCB Activities

SPECIAL TRAINING PROGRAMMES CONDUCTED AT CCE

Centre for Continuing Education Services (CCE) at NCB conducted special group training programs in the [illegible]d of energy audit and conservation, concrete technology, high performance concrete, cement manufacturing technology, quality control and quality assurance, non-destructive testing, evaluation of concrete structures, construction chemicals on performance of cements. The training programs were well received by professionals from the industry and students alike. Centre also offers AICTE approved Post Graduate Diploma in Cement Technology for last two decades. Centre also organizes special training programs like Management of Air Pollution in Pulp & Paper Industry where information is disseminated by notable speakers. The Centre also works in close partnership with academia to organize interactive training programs [illegible] and construction technology.

INTERACTIONS WITH ACADEMIA

DG-NCB inaugurated courses on "Recent Advances in Green Chemistry & Technology" at Manav Rachna University Campus, Faridabad and highlighted the emerging Trends in Green Cement/Clinker

DG-NCB and higher officials from Manav Rachna University (MRU), discussed possibility of empaneling NCB Experts as faculty.

DG-NCB visited National Institute of Technology, Warangal (NITW) & interacted with Director (Actg.) & Sr. faculty of NITW to enhance Industry - R&D organization & Academia interaction for technology transfer: healthy for the nation's sustained growth.

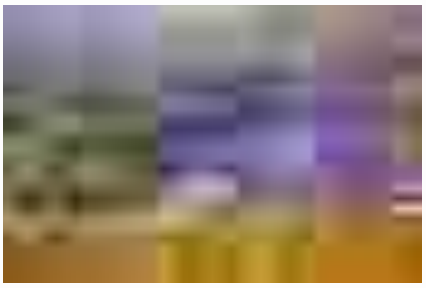
DG-NCB delivered a Guest Lecture on "Total Quality Management" to the students of Kakatiya Institute of Technology & Science (KITS), Warangal, Telangana in the One Day Workshop organized by KITS- Civil Engineering Department.

Prof. Dhanada Kanta Mishra, visiting research scholar at Hong Kong University of Science and Technology delivered a talk on "High Volume Fly ash Applications in India and China for Climate Change Mitigation" in the Forum for Science and Technology of NCB.

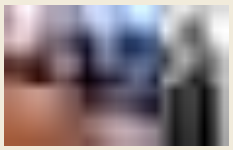
NCB and Birla Institute of Technology and Science (BITS), Pilani have undergone a collaboration wherein BITS-Pilani students will do their internship at NCB. BITS Pilani deputed their first batch of their three students at NCB under Practice School (internship)-II for the period of 5 months (starting Jan'19).

INTERACTIONS WITH INDUSTRY

NCB officials meeting for exploring the possibilities of using current facilities and expertise for improving life of Railway Sleepers



DG-NCB highlighted importance of recycling industrial and mining wastes for value added cement and building materials for sustainable development in workshop cum training program on " Treatment and Utilization of Industrial and Mining Wastes for Sustainable Environment" organized by CSIR-Institute Materials Management Technology (IMMT), Bhubaneswar



Signing of Memorandum of Understanding between NCB and Oman Cement Company for co-operation in setting-up of a cement R&D centre in Muscat. NCB is proud to provide its consultancy services and expert advice to Oman for setting up of Centre.

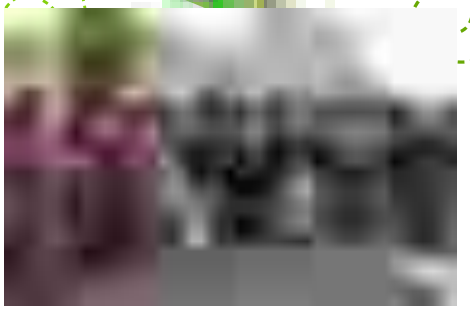
Discussions with Technical Team of Ambuja Cement, Corporate Office at Mumbai.

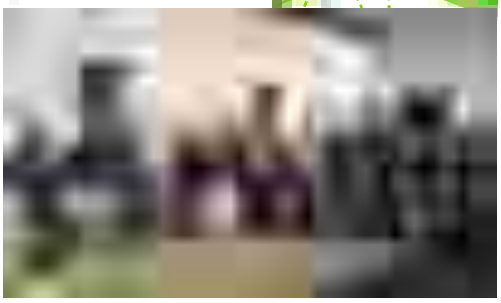
NCB interacted with cement industry professionals from southern India to fine tune its activities with the latest requirement of the industry.

NCB technical team visited Oman Cement Company with core objectives of reducing cost of production of cement as well setting up state of the art R&D centre in Oman.

Discussion with Technical Team of UltraTech Cement at Mumbai.

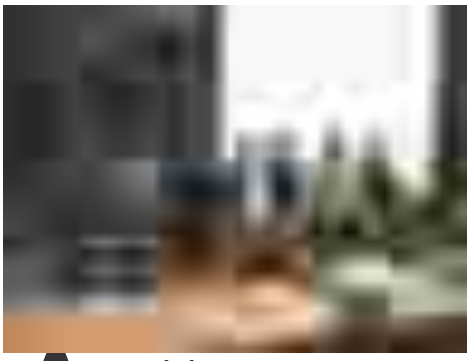
STAFF CLUB ACTIVITIES AT NCB



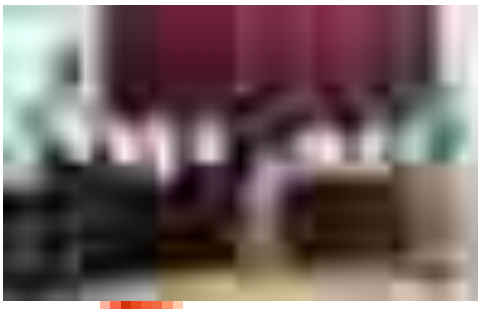


NCB Staff Club Sports Tournament: 2018-19 was inaugurated today by DG, NCB in the presence of Head of Centres & NCB of[redacted] at Ballabgarh Unit. Sports tournament started with Table Tennis Match for Men category and Badminton Match for Women Category.

EMPLOYEE WELFARE AT NCB

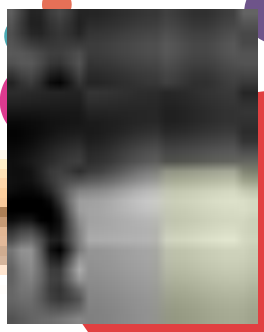


A training program on road safety and defensive driving was organized in Feb'19 by Safety Committee. During the training, videos related to road safety awareness were shown to the audience along with point wise narration of the methods/precautions one must take while on the road; either as a car driver, motorcyclist, a walking pedestrian or just a passenger. Training was dispensed on various factors that should be kept in mind whilst driving defensively which ultimately leads to reduction in accidents and injuries due to such accidents.

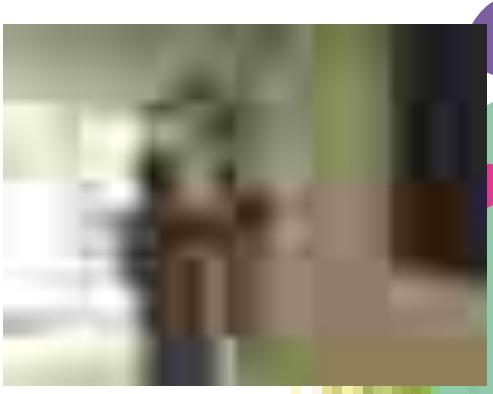


"Internal Communication from Top Management" is regularly held wherein employees' who have contributed [redacted] towards the organization in their respective [redacted]elds are awarded. Besides, various achievements on the technical front were discussed.

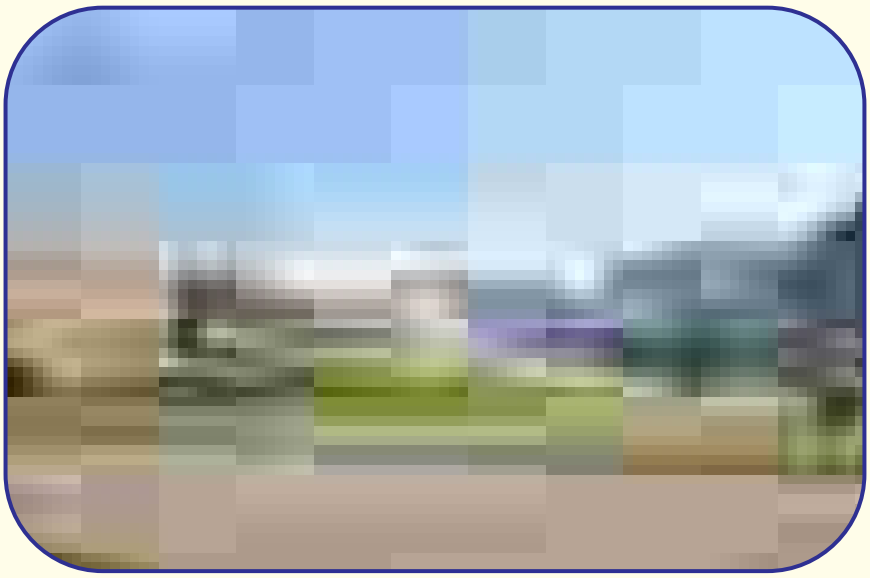
Internal Complaints Committee formed under the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013. Ms Vidhu Grover (external member) interacted with the women staff of NCB.



A fi re demo drill was organized during which, staff was briefed about types of fi re, its causes and steps to be taken in case an incident of fi re takes place within the premises.



A demonstration for the fi re alarm system was organized during which discussions about operation of fi re alarm panel were held. Steps to be taken in case an incident of fi re takes place in the premises were also discussed.



NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS

34Km Stone, Delhi-Mathura Road (NH-2), Ballabgarh-121 004, Haryana, India