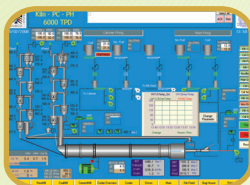
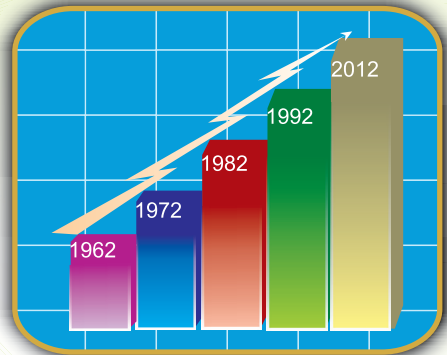
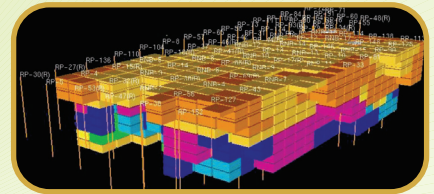




# 50

Years  
of  
service  
to the  
Nation



**National Council for Cement and Building Materials**

## From the Desk of Director General



NCB, then Cement Research Institute of India (CRI) was founded on 24<sup>th</sup> December 1962. With its main laboratories in Ballabgarh, Haryana and its other units in Hyderabad and Ahmedabad, its journey through these 50 years would not have been that exciting but for the continued support of the cement industry fraternity, construction sector and government. NCB is committed to pursue global standards of excellence in all its endeavours covering Research, Design and Development, Technology Transfer, Continuing Education, Calibration and Testing Services in the areas of Cement, Construction and Building Materials. **Specific areas of activities pursued during the last five decades are highlighted in this publication.**

NCB has carried out significant studies in the areas of low grade limestone and other industrial wastes/by-products, non-conventional fuels in cement manufacture to increase sustainability of natural resources, maximizing use of fly ash and slag to reduce consumption of clinker/limestone and to harness benefits in terms of Energy Conservation and CO<sub>2</sub> abatement. NABL accredited laboratories of NCB, with state-of-the-art equipment, provide Testing, Calibration and Evaluation services as per National and International Standards.

NCB's services in the areas of Computer aided Deposit Evaluation and Mine Planning, Raw Mix Design & Optimisation, Limestone Consumption Factor, Energy Conservation and Audit, Alternate Fuels, Process Optimisation and Productivity improvement, EIA/EMP Studies, Plant Maintenance, Quality Assurance & System Design are well accepted by the Industry. Widespread acceptance of NCB publications like *Norms for Proving Limestone Deposits for Cement Manufacture* and *NCB Guide Norms for Cement Plant Operations* shows the level of confidence reposed by the industry in NCB.

Technological support has been provided to various projects of national importance, like dams, thermal power plants and other structures. NCB is actively involved in formulation/revision of various National Standards like IS: 456. Support to construction industry is also being provided through a large number of quality assurance projects.

The NCB International Seminars have emerged as singular biennial events in this part of the globe which the cement and construction industries the world over look forward to for participation. Towards human resource development, NCB trained about 35,000 personnel from cement and construction industries so far.

This publication is being brought out to rededicate ourselves to the nation. We are thankful to the industry and government who reposed faith in NCB which has encouraged and inspired us in all our endeavours.

**Ashwani Pahuja**

## CENTRE FOR CEMENT RESEARCH & INDEPENDENT TESTING

### Raw Materials, Cements and Special Formulations

- Technological assessment of raw materials for cement manufacture and productivity enhancement
- Designing and optimization of raw mixes for improved production and kiln stabilization
- Techno-economic feasibility studies for utilization of mineralizers and additives for fuel economy and improved cement quality
- Development of special cementitious formulations having regulated setting and strength or non-shrink properties
- Optimization of geopolymeric cementitious compositions and composite cements
- Techno-economic feasibility of utilization of low and marginal grade limestone for cement manufacture
- Assessment and evaluation of silt sediments of reservoirs, dams and river bed sediments for power plants and irrigation projects.
- Cement performance enhancement through optimization of raw mix design, sulphate content and particle size distribution.
- Maximization of fly ash content in PPC through optimization of raw mix design.
- Improvement in clinker quality through optimization of raw mix design
- Raw mix design for manufacture of special cements including white Portland cement and sulphate resisting Portland cement
- Optimization of masonry cement compositions using clinker, limestone, fly ash and other filler materials
- Investigations and remedial measures for minimizing lumping and strength loss on storage in cement silos/ cement bags



Particle size analyzer



Induction coupled plasma spectrometer



Scanning electron microscope

### Wastes Utilization

- Techno-economic feasibility studies for utilization of industrial, agricultural and mine wastes such as fly ash from thermal power stations, slag from metallurgical industries, sludge from paper, sugar, fertilizer, soda ash, refinery industries, red mud from aluminum industry, phosphogypsum from fertilizer industry, jarosite from zinc industry, marble dust/ slurry from marble industry and agricultural wastes such as rice husk, bagasse etc.



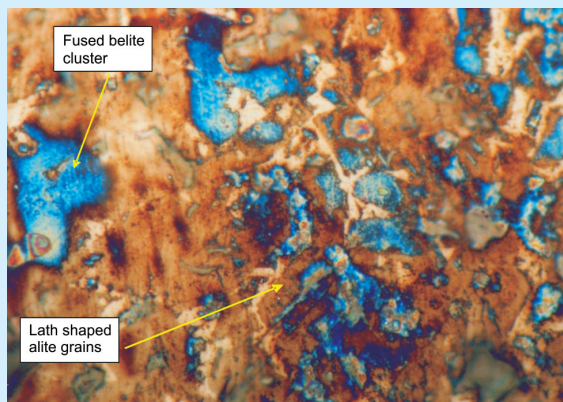
- Development of value added products like tiles, bricks, blocks, boards, wood substitute, plaster coating etc. using wastes such as marble slurry, phosphogypsum, red mud, fly ash etc.
- Development of light weight sintered aggregates from red mud and fly ash for use in construction industry
- Establishing utilization of different types of slag from metallurgical industries as replacement of conventional sand in construction industry

## Refractory Development and Management

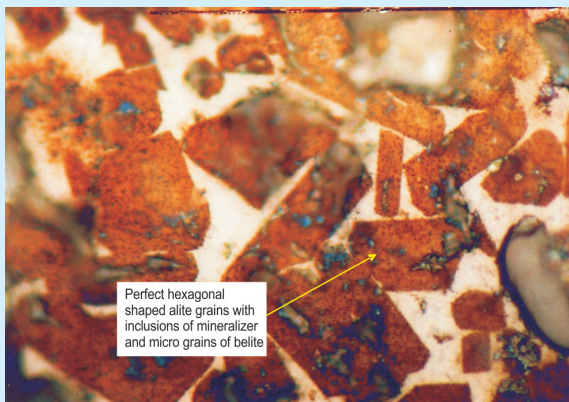
- Refractory engineering services covering selection, evaluation and design of refractories etc in cement rotary kiln (CRK) system
- Diagnosis of premature refractory failure, kiln shell corrosion and remedies
- Development and application of high performance refractory materials and bricks like magnesia-spinelide, alumina zircon and coating repellent refractory bricks for specific applications
- Complete quality evaluation of cement kiln refractories

## Testing and Evaluation

- NABL accredited and BIS recognized testing laboratories
- Complete physical and chemical testing and evaluation of cement raw materials, raw meal, coal/ coke, kiln feed, gypsum, clinker, cement, pozzolana, aggregates, building bricks, concrete, mortar, steel and water, etc as per various national and international standards
- Mineralogical, morphological and microstructural evaluation of raw materials and cement clinkers by Optical Microscopy (OM) and X-Ray Diffraction (XRD)
- Morphological and microstructural analysis of clinkers, hydrated cements etc. using scanning electron microscope (SEM)
- Diagnostic studies on concrete such as ASR, sulphate attack, carbonation etc., by SEM
- Point to point elemental analysis along with elemental dot maps using SEM/ EDAX
- Petrographic examination of coarse and fine aggregates by polarizing and stereoscopic microscopes as per BIS methods
- Detailed mineralogical evaluation of raw materials, clinkers, aggregates, gypsum, clay, soil and other building materials by XRD



Optical micrograph of control OPC clinker fired at 1450°C (50x)



Optical micrograph of mineralized OPC clinker fired at 1400°C (50x)

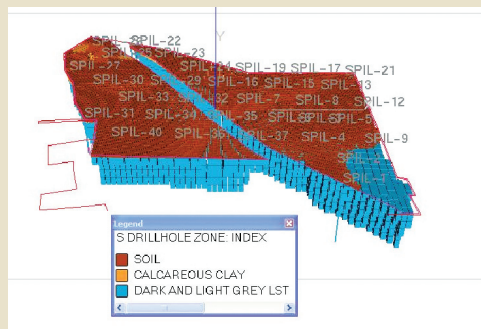


- Characterization of polymorphism of clinker phases using XRD
- Diagnostic studies on ring formation, build ups in kiln by XRD
- Rapid chemical analysis of raw materials, clinker, cement, slag, fly ash and other materials using XRF
- Analysis of trace elements in various materials using ICP spectrometer
- DTA, TGA and DTG Analysis to evaluate thermal characteristics of materials including burnability index for cement raw mixes
- Mechanical properties of limestone, coal, core samples e.g. crushability, grindability, and bond work index etc.
- Testing & evaluation of refractories and materials of diversified nature
- Particle size distribution of cement, pozzolana and raw meal using LASER technique
- Mineralogy, glass, morphology and microstructure of fly ash and various slags by Optical Microscopy (OM)

## CENTRE FOR MINING, ENVIRONMENT, PLANT ENGINEERING & OPERATION

### Geology and Mining

- Raw material feasibility studies for green field as well as brown field cement projects.
- Reassessment and performance audit of captive limestone mines.
- Appraisal of exploration data and preparation of geological reports
- Planning, supervision and execution of detailed geological exploration
- Computer-aided deposit evaluation, mine planning, production scheduling including multi-mine scheduling and blending studies.
- Long term mine sensitivity analysis based on radical constraints.
- Detailed engineering of open cast mines including equipment selection and deployment for mining limestone and other minerals.
- Performance evaluation of mining equipment.
- Technical auditing of mining operations for productivity enhancement.
- Dry beneficiation of low/marginal grade limestone.



3-D block model of a limestone deposit site

### Productivity Enhancement and Process Optimisation

- Trouble-shooting in cement plants covering areas such as preheater build-up/coating, ring formation, unstable burning in kiln, lower degree of calcination, higher temperature/pressure in preheaters etc.
- Diagnostic studies for plant's specific process problems viz corrosion of kiln shell, lump formation in cement silos, fan build-ups and wear.
- Optimization and stabilization of operation of kilns and grinding mills including ball mills, vertical roller mills and roller presses.
- Productivity Enhancement Programme (PEP) covering entire spectrum of cement manufacture.
- Technical evaluation of cement plants to establish output capacity of various core equipment including scope of further upgradation and capacity balancing.

- Improving blending effect in pre-blending stock piles and blending of silos
- Utilization of alternate fuels in cement manufacture
- Establishing guide norms for cement plant operations
- Optimization studies of grinding mills covering ball mills, vertical roller mills and roller presses including performance assessment of separators and measures for improvement in output capacities and particle size distribution.
- Optimization of operations and improvement in the performance of kiln preheater and coolers
- Assessment of fan performance including its efficiency
- Gas and air balancing in kiln-preheater-cooler and mills including leakages-survey
- Establishing guide norms/benchmarks for performance monitoring of main operations/processes

### Energy Management

- Comprehensive energy audit studies
- Heat and gas balance studies
- Identification of potential for thermal and electrical energy savings and suggesting improvement measures
- Energy monitoring and target setting
- Techno-economic evaluation of energy efficient equipment/systems in cement plants

### Pollution Control & Environmental Management

- Rapid/Comprehensive EIA/EMP studies
- Environmental Audit
- Life Cycle Assessment (LCA) studies
- Comprehensive studies for performance evaluation and improving efficiency of pollution control equipment
- Pollution Load Assessment
- Application of Computational Fluid Dynamics (CFD)
- Environmental Monitoring (Point Source & Ambient Air)
- Water & Waste water Analysis
- Soil Analysis
- Analysis of Solid & Hazardous waste
- Indoor & Work-zone Air Quality Monitoring: PM<sub>10</sub>, VOC, Formaldehyde, NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub>, Temperature, O<sub>2</sub> and Humidity
- Utilization of Waste Derived Fuels
- Noise & Ground Vibration studies
- Carbon & Water Footprint Assessment
- Technical support to cement industry for improving environmental performance.



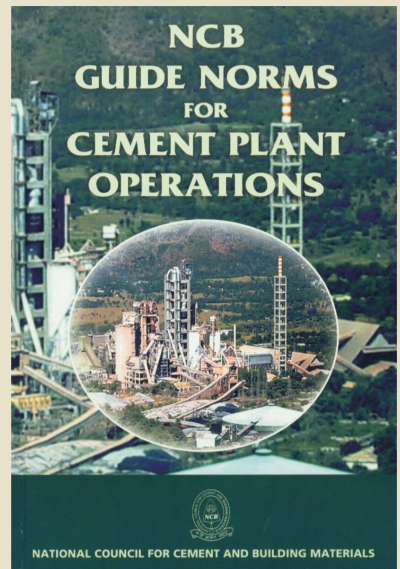
Monitoring of Gaseous Pollutants at Kiln Stack

## Plant Maintenance

- Technical audit of plant including mechanical, electrical, process, mining & environment aspects
- Hot kiln alignment and supervision of corrective actions in cement plants
- Shell ovality measurements and shell profile evaluation
- Compressed air audit in cement plants
- Evaluation of maintenance system and Audit
- Computerised maintenance and inventory control packages
- Total Productive Maintenance System (TPM)

## Project Engineering and System Design

- Complete range of services from concept to commissioning of cement projects - new project as well as expansion / modernization project in an existing cement plant
- Bankable techno-economic feasibility studies for green field cement plants
- Preparation of tender document and evaluation of bids for main and auxiliary equipment
- Detailed engineering for mechanical, electrical and civil works
- Inspection of equipment
- Site supervision
- Project monitoring
- Technical appraisal for financial institution/Govt. organisations for capacity assessment/ performance review/inspection of an operating cement plant
- Techno-economic appraisal for rehabilitation of a sick unit / modernization / wet to dry conversion



## CENTRE FOR CONSTRUCTION DEVELOPMENT & RESEARCH

- Third Party Quality Assurance services to enhance the Quality & Durability for sustainable & valuable assets covering Concrete structures of Buildings, Roads, Flyovers and other related Infrastructure projects in Delhi.
- Distress Evaluation of Concrete in damaged RCC structures including buildings, bridges, dams etc. due to aggressive environmental conditions for Structural Rehabilitation using State of the Art Repair and Restoration techniques.
- Quality and Durability Assessment of Concrete in Heavy engineering power house structures covering TG foundation, ID/FA/PA for structures, RCC chimneys and RCC cooling tower in Thermal Power Projects. Here QA is done by NCB to ensure trouble free infra construction in India.



Measurement of crack depth using UPV technique on sea side RCC basin wall of cooling tower unit III of Dabhol Power Project, Ratnagiri



- Field investigation to find a durable and cost effective solution to Structural Residual Life enhancement and increasing the stability of various Concrete Structures. Field investigation includes Air and Water Permeability studies, Rapid Chloride test of cover concrete, Carbonation of cover concrete, Corrosion test (Half cell potential & Electrical Resistivity tests), Concrete Core extraction and testing for equivalent cube compressive strength Non destructive test of concrete using Ultrasonic pulse velocity and Rebound Hammer testing, Pile Integrity tests and Radar technique.
- Quality Assessment of Hydro Electric Power Structures covering Heat of Hydration & mineralogy of aggregate to resist Alkali attacks on Dam.
- Laboratory investigation for complete assessment of Concrete making materials in our state-of-the-art Concrete Investigation Laboratory. Basic Concrete Mix Design optimization services are also provided using various grades of OPC and PPC incorporating supplementary materials such as Fly ash, Silica and Steel Fibers for design of different grades of Concrete upto M100 grade.
- Investigation on Residual Life Assessment of Concrete Structures in different Environmental and Exposure conditions.
- Optimization of Steel Fiber Reinforced Concrete (SFRC) for different applications. Laboratory Evaluation of Fibers and the effects of PCE grade High Range Water Reducing agent (HRWR) and Viscosity Modifying Agent (VMA) on the fresh properties of SFRC are also evaluated. Mix Design evaluation for different usage in Hydraulic Structures, Pavements, Tunnel linings, Slabs, Shotcrete, Airport Pavements, Bridge deck slab & Tunnel Construction etc. Laboratory evaluation covering Toughness, Impact, Flexural, MOE behaviors of SFRC for different grades of hardened concrete is carried out as per ASTM guidelines.
- Evaluation of Concrete making & supplementary materials.
- SEM & XRD study & Petrography study on materials/ concrete.
- Durability study in old & new reinforced concrete construction projects executed by NCB covering Half Cell Potential Test in field, Rapid Chloride test & water permeability test as well as carbonation study of cover concrete. Lab test to check chloride diffusion/penetration resistance & water permeability, drying shrinkage test on concrete.



UPV testing being carried out on cross beam of Turbo Generator Deck at NTPC Barh, Patna



Reinforcement checking of raft being done at RUB Mundka, New Delhi



Rebound hammer test on a segment at Dabri Flyover, Delhi

## CENTRE FOR INDUSTRIAL INFORMATION SERVICES

- Library with 46,280 documents
- Membership of 11 Indian/Overseas professional institutions
- Modern information retrieval facilities with - 39,580 records for quick interactive searches and bibliographies on cement and building materials
- NCB Publications for dissemination of NCB's activities amongst the cement, construction and related building materials industries in terms of technologies developed and industrial support services provided including the Seminar & Workshop Proceedings organized by NCB.
- National and International Seminars & Exhibitions



Chief Guest Shri Talleen Kumar, Joint Secretary-DIPP, Govt. of India, releasing the special publication during the 12<sup>th</sup> NCB International Seminar held in New Delhi

## CENTRE FOR CONTINUING EDUCATION SERVICES

The Centre for continuing Education Services (CCE) has been organizing entry and post entry level training courses for cement, concrete and construction sectors since 1972 at Ballabgarh and Hyderabad units besides on-site/sponsor's site. The objective of CCE is to create technological talent and enhance and continuously upgrade the intellectual capital that exists in Cement, Concrete, Construction and allied Building Materials Sectors through refresher courses on specific areas. Training courses organized by the centre include:

- AICTE-recognized one year Post Graduate Diploma Course in Cement Technology
- Certificate Course in Cement Manufacturing Technology
- Short-term courses for cement, concrete and construction Technology
- Special group training programmes
- Orientation programmes for newly recruited graduates and engineers of cement industry
- Simulator-based courses for cement plant operation
- Contact training programmes for laboratory personnel
- Worker's development programmes
- Pedagogy covers lectures, group discussions, case studies, field visits, audio-visual presentation, educational films, demonstrations and hand-on-training, experience sharing
- Facilities includes:
  - Spacious class rooms with state-of-the art training aids
  - Well furnished, air-conditioned lodging accommodation
  - State-of-the art simulator for cement plant operation
  - Library



Participants in the classroom

- Few Key assignments completed recently:
  - Training and retraining of newly recruited civil engineers and senior engineers of M/s DMRC Ltd
  - Training of engineers of Water resource department of Govt. of Maharashtra, Odisha, Tamil Nadu, Gujarat etc
  - Training of civil engineers of M/s NHPC Ltd, NTPC Ltd, PWD, MCD etc
  - Training of newly recruited civil engineers of M/s Hindustan Petroleum Corporation Ltd
  - Orientation programmes for GETs of M/s ACC Ltd and M/s Dalmia (Bharat) Cement Ltd on Cement Manufacturing Technology
  - Orientation Training Programmes for Marketing Executives of Cement Industry – Orient Cement, Shree Cement Ltd, Sriram Cement Works, J K Cement Ltd, Jaiprakash Associates Ltd etc
  - Training of civil engineers from various departments of Afghanistan and Sri Lanka
  - Training of process engineers of M/s Kuwait Cement Company



Trainees in hands-on practice session



Simulator based training programme for cement plant operation

## CENTRE FOR QUALITY MANAGEMENT, STANDARDS AND CALIBRATION SERVICES

### Calibration Services

- Providing wide range of calibration services to quality control & quality assurance  
Laboratories of cement plants, process industries, construction sites, testing / R&D laboratories, equipment manufacturers, etc.
- Traceable to national/international standards  
Through dynamic quality system accredited by NABL
- Providing measurement uncertainties as per ISO/ IEC 17025 and NABL guidelines



Calibration of sieve at Profile Projector



- NABL accredited services:
  - Pressure : Dead weight testers, Pressure gauges
  - Temperature : Thermometers, Relative humidity sensors, PRT Thermocouples etc
  - Dimension : Test sieves, Scales, Dial gauges, Vernier calipers, Micrometers, Glass scales
  - Revolution : Tachometers, Vibrating machines
  - Force : CTM/UTM
  - Mass/Volume : Weights, Weighing balance, Blaine Cell, Volumetric glassware
- Other services traceable to national standards from National Physical Laboratory, New Delhi/Overseas national bodies:
  - Force measuring devices (proving rings, load cells, Compression testing machines, Universal testing machines)
  - Rebound test hammer
  - Flow table
  - Stop watch

### Certified Reference Materials

Development and supply of following Certified Reference Materials (CRMs):

- Ordinary Portland cement, Portland pozzolana cement, Portland slag cement, granulated slag, flyash and white cement for specific surface determination
- Hydrated lime for lime reactivity test of pozzolana
- CRMs for chemical parameters of limestone raw meal, clinker, gypsum, cements etc.
- Development of plant specific CRMs for calibration of X-ray Analyser



NCB developed certified reference materials

### Total Quality Management

- Assistance in setting up quality control laboratories
- Assistance in documentation and installation of laboratory quality management system and NABL accreditation
- Assessment of testing laboratories and proficiency improvement of laboratory personnel
- Conducting Proficiency Testing (PT) programmes as NABL accredited PT provider
- Assistance in application of statistical techniques for ISO 9000 compliance and TQM
- Assistance in implementation of ISO 9000 quality management system
- Quality monitoring services and evaluation of testing equipment
- Process capability studies and six Sigma studies
- Application of TQM tools and techniques, including Japanese improvement techniques

## NEW PRODUCTS AND TECHNOLOGIES DEVELOPED

- NCB – MVSK Technology
- Special Cement Formulations for shotcreting and rapid demoulding applications
- Lime-flyash bricks
- Alumina-Zircon refractory and Magnesia-Spinel refractory Bricks
- Oil-fired VSK for converting industrial wastes like paper sludge etc into useful building materials like lime, cement etc.
- Indigenous Precalculator for Small Cement Plants
- Composite Jute Bags
- Masonry/Pozzolanic cement using rice husk ash
- High volume flyash concrete hollow blocks
- Artificial marble coating utilizing marble waste
- Gypsum bricks/Board using by-product gypsum



### **National Council for Cement and Building Materials**

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