NCB NEWS LETTER

December 2023

NATIONAL COUNCIL FOR CEMENT AND BUILDING MATERIALS
(Under the Administrative Control of Ministry of Commerce & Industry, Govt. of India)
34km stone, Delhi-Mathura Road, Ballabgarh-121004, Haryana, India
Ph: +91-129-2666600; E-mail: nccbm@ncbindia.com
Website: http://www.ncbindia.com

NCB NEWS is exclusively electronic and for internal circulation only

CONTENTS

Select Research and Development Projects

- Cement Research & Testing
- Construction Development & Research
- Mining, Environment, Plant Engineering and Operation

Select Industry Sponsored Projects

- Cement Research & Testing
- Construction Development & Research
- Mining, Environment, Plant Engineering and Operation

Activities of Other Centres

- Quality Management, Standards and Calibration Services
- Continuing Education Services
- Industrial Information Services

18th NCB Intl' Conference

Important Events, Activities and Days Observed at NCB and its Units

Interaction with Industry, Academia and Government Institutions

dedicated to the doyens of cement and concrete

Newsletter Committee

Sh. S K Shaw (Convenor)
Sh. S Bhatnagar (Member)
Sh. Arup Ghatak (Member)
Dr. (Ms.) Varsha Liju (Member)

Editor: Sh. S Bhatnagar
Design: Sh. Devender Baghel

Ballabgarh Unit

Hyderabad Unit

Bhubaneswar Unit

Ahmedabad Unit

महानिदेशक के डेस्क से

वंदे मातरम! प्रिय पाठकों,

सबसे पहले, मैं आपको जानकारी देना चाहूंगा कि मैं इस महान संस्थान के शीर्ष पर कार्यभार संभालने के बाद गौरवान्वित महसूस कर रहा हूं। जिसे सीमेंट, कंक्रीट और निर्माण सामग्री उद्योग के लिए एक महत्वपूर्ण ज्ञान भंडार के रूप में मान्यता प्राप्त है। एनसीबी परिवार के प्रमुख के रूप में, मैं अपने सभी पाठकों को नववर्ष 2024 पर अपनी हार्दिक शुभकामनाएं देता हूं जो हमारे दरवाजे पर दस्तक दे रहा । उम्मीद है, आने वाला वर्ष समस्त मानव जाति के लिए शांति लाएगा और इस वर्ष की तुलना में कम अशांत होगा जो मानव जाति के इतिहास में अब तक के सबसे अशांत वर्ष स्थापित होने जा रहा है। गत वर्ष न केवल अशांत था, बल्कि मौसम की चरम घटनाओं से भी प्रभावित था, जो दुनिया भर में चक्रवात, बाढ़ और भूकंप के रूप में दर्ज किए गए थे, जिससे जीवन और संपत्ति को गंभीर नुकसान हुआ था। यदि इसमें हमारे जटिल दिमाग और उद्देश्य भी जोड़ दें, जो वैश्विक संघर्षों की ओर ले जाते हैं तो इस तरह हम आपदा के लिए एक साधन तैयार करते हैं।

आस-पास में होने वाली घटनाओं के बावजूद, भारत की अध्यक्षता में जी20 की घोषणा को सर्वसम्मति से स्वीकार करना, विभिन्न उद्देश्यों के बीच आम सहमति उत्पन्न करने की हमारे देश की क्षमता को दर्शाता है। मानव जाति एक बार फिर दुबई मे आयोजित सीओपी 28 शिखर सम्मेलन में एक साथ आई, जहां इतिहास बनाया गया जब 196 देशों ने एक न्यायसंगत, व्यवस्थित तरीके से जीवाश्म ईंधन से दूर जाने पर सहमति व्यक्त की। जैसा कि हमारे माननीय प्रधानमंत्री जी द्वारा कल्पना की गई है, हमारे देश के भविष्य के विकास को नवीकरणीय ऊर्जा के उत्पादन में वृद्धि,जीवाश्म ईंधन के उपयोग को कम करके और गैस आधारित अर्थव्यवस्था की ओर बढ़ते हुए हरित विकास और ऊर्जा संचरण के स्तंभों पर आधारित होने की योजना है।

स्थिरता, आज इसका हिस्सा बनने के बजाय यह व्यवसाय करने का मुख्य उद्देश्य बन गया है। सीमेंट उद्योग स्थिरता के चार सिद्धांतों पर काम कर रहा है अर्थात् उत्सर्जन को कम करके, और अधिक ऊर्जा निपुण बनकर पर्यावरण प्रोफ़ाइल में निरंतर सुधार तथा समाज से संचालित होने का अधिकार अर्जित करना और उद्योग के साथ समाज को साथ लेना, ये सिद्धांत पर्यावरण के लिए व व्यापार दोनों के लिए अच्छे है। सीमेंट उद्योग, अन्य उद्योगों के कचरे का उपयोग करके हमारे देश में चक्रिये अर्थव्यवस्था की अवधारणा में एक महत्वपूर्ण भूमिका निभा रहा है। मुझे यह बताते हुए हर्ष का अनुभव हो रहा है कि जो भारतीय सीमेंट उद्योग, जो 595 MTPA की स्थापित क्षमता के साथ दुनिया का दूसरा सबसे बड़ा उद्योग है, जो पहले से ही हरित विकास के स्तंभों के साथ जुड़ा हुआ है। कम क्लिंकर सीमेंट, ऊर्जा दक्षता, वैकल्पिक ईंधन, डब्ल्यूएचआरएस (WHRS) और नवीकरणीय ऊर्जा को अपनाने जैसे पहचाने गए लेवेर्स के माध्यम से पहल कर रहा है जिसके परिणामस्वरूप प्रत्यक्ष रूप से CO_2 में कमी आई है।

लेकिन मुझे लगता है कि उद्योग को अभी कार्बन अवशोषण और उपयोग/भंडारण के विषय पर चर्चा करनी चाहिए। हमारे उद्योग के लिए डीकार्बोनाइजेशन के लक्ष्यों को प्राप्त करना सीसीयूएस जैसी प्रौद्योगिकियों के बिना संभव नहीं है और इस तकनीक को अलग-थलग अपनाना एक कठिन काम होगा। एनसीबी में हमारा मानना है कि उद्योग और शिक्षाविदों, विशेष रूप से युवा पीढ़ी के साथ नेटवर्किंग इस क्षेत्र में त्वरित अपनाने के लिए नए लेकिन अधिक महत्वपूर्ण रूप से व्यवहार्य समाधान के साथ आने के लिए महत्वपूर्ण है।

एनसीबी न्यूज के इस विशेष अंक को आप सभी के सामने पेश करते हुए मुझे प्रसन्नता हो रही है। इस संस्करण में पिछले वर्ष में एनसीबी द्वारा विभिन्न केंद्रों, चुनिंदा उद्योग प्रायोजित परियोजनाओं, महत्वपूर्ण घटनाओं, गतिविधियों व परस्पर विचार विमर्श के तत्वाधान में किए जा रहे नवीनतम अनुसंधान ओर विकास परियोजनाओ को शामिल किया गया है। एनसीबी की अनुसंधान और नवाचार पहल भारत सरकार के विजन और मिशन के साथ पूर्ण रूप से जुड़ी हुई हैं, ताकि डीकार्बोनाइजिंग, एक चक्रिये अर्थव्यवस्था को सक्षम किया जा सके और आजीविका में सुधार किया जा सके।

मुझे यह बताते हुए भी प्रसन्नता हो रही है कि एनसीबी को सीमेंट के रसायन विज्ञान पर 17 वीं अंतर्राष्ट्रीय कांग्रेस (ICCC) का आयोजन करने का कार्य सौंपा गया है। भारत तीन दशकों से अल्पाधिक समय में ऐसा पहला राष्ट्र बन गया है, जिसे दो बार इस तरह के एक उच्च प्रतिष्ठित कार्यक्रम की मेजबानी करने का मौका मिला है। मेरे सहयोगी जिसे "सीमेंट का ओलंपिक" कह रहे हैं, उसके लिए प्रारंभिक काम पहले ही शुरू हो चुका है। 1992 में इसे सफलतापूर्वक पूरा करने का अनुभव होने के बाद, हमारी टीम 2027 में इसे फिर से शानदार तरीके से आयोजित करने के लिए आश्वस्त है।

साथ ही, आने वाला वर्ष के दौरान एनसीबी का सीमेंट, कंक्रीट और निर्माण सामग्री पर 18 वां अंतर्राष्ट्रीय सम्मेलन "सीमेंट के महाकुंभ" का होगा। मुझे जानकारी दी गई है कि पेपर प्रेजेंटेशन और प्रदर्शनी के लिए सीमेंट उद्योग से वार्तालाप की प्रक्रिया पहले ही शुरू हो चुकी है, जो हमारे प्रमुख आयोजन की गंभीरता के बारे में बताती है। आगामी सम्मेलन में भारत और दुनिया भर के विभिन्न उद्योग, सरकार, विश्वविद्यालय और सलाहकार शामिल होंगे और उत्तरदायी संसाधन खपत और उत्पादन और उपभोग खपत से उत्सर्जन में कमी के उद्देश्य से भविष्य की कार्य योजनाओं पर चर्चा करने के लिए उद्योग के नेताओं, नीति निर्माताओं, विशेषज्ञों, इंजीनियरों और वैज्ञानिकों को एक साथ लाने की उम्मीद करते है। वर्तमान प्रतिक्रिया और प्रश्नों को देखते हुए, समवर्ती तकनीकी प्रदर्शनी से भी अधिक भागीदारी को आकर्षित करने की उम्मीद है। यह आयोजन, अपने पूर्ववर्तियों की तरह, सीखने और नेटवर्किंग का एक दुर्लभ अवसर प्रदान करेगा। मैं आप सभी से इसका अधिकतम लाभ उठाने की अपील करता हूं तथा सम्मेलन में आपकी उपस्थिति की प्रतीक्षा करता हूं और आशा करता हूं कि इस माध्यम से ज्ञान और जानकारी साझा करने के हमारे प्रयासों को सीमेंट और निर्माण उद्योग द्वारा उन्नत तरीके से उपयोग किया जाएगा। मैं आप सभी के एक बहुत ही उज्जवल और सफल भविष्य की कामना करता हूं। जय हिंद!

डॉ लोक प्रताप सिंह
महानिदेशक

From the desk of Director General

Vande Mataram! Dear Readers,

At the outset, I would like to inform you that I am humbled after assuming charge at the helm of this great institution, recognized as a pivotal knowledge bank for the cement, concrete and building materials industry. As head of NCB family, I also extend my heartiest greetings to the readers on the New Year 2024 which is knocking on our doors. Hopefully, the coming year will bring peace for all of mankind and will be less hot than this year which is going to gain the dubious distinction of hottest year ever in the history of mankind. The year gone by was not only hot but marred by extreme weather events which were reported throughout the globe in the form of cyclones, floods and earthquakes, causing severe damage to life and property. Add to it, our complex minds and motives leading to global conflicts and that's how we prepare a recipe for disaster.

Irrespective of such events unfolding in the neighborhood, a unanimous adoption of the G20 declaration under India's presidency signifies our country's ability to generate consensus among a diverse set of motives. Mankind once again came together at Dubai CoP 28 summit where history was made when 196 countries agreed to transition away from fossil fuels in a just, orderly and equitable manner. As envisioned by our Hon'ble Prime Minister, our country's future development is planned to be based on pillars for green growth and energy transmission by increasing production of renewable energy, reducing usage of fossil fuels and moving towards a gas-based economy.

Sustainability today has become the core purpose of doing business rather than becoming a part of it. Cement industry has been working on four principles of sustainability viz. continuous improvement of environmental profile by reducing emissions and becoming more energy efficient; principle of good for environment is good for business; earning the right to operate from society and taking the society along with the industry. The industry plays a pivotal role in circular economy concept in our country by utilizing wastes of other industries.

I'm glad to place on record that the Indian cement industry, the second largest in the world with an installed capacity of 595 mtpa is already aligned with the pillars of green growth and taking initiatives through the identified levers like low clinker cement, energy efficiency, alternative fuels, adoption of WHRS and renewable energy resulting into reduction of direct CO_2.

But I feel that the industry is yet to broach upon the subject of Carbon Capture and Utilization/ Storage. Achieving the targets of decarbonisation for our industry doesn't appear to be possible without technologies like CCUS and adoption of this technology in isolation will be a herculean task. We, at NCB, believe that networking with industry and academia, especially the young minds, is vital to come out with novel but more importantly viable solution for quick adoption in the sector.

I'm glad to present before all of you, this Special Issue of NCB News. This edition covers the latest R&D projects being carried out under the aegis of various Centres, select industry sponsored projects, important events, activities and interactions carried out by NCB in the year gone by. NCB's research and innovation initiatives are well aligned with the vision and mission of the Government of India to decarbonize, enable a circular economy and improve livelihoods.

I'm also pleased to inform that NCB has been entrusted with organizing the 17th International Congress on Chemistry of Cement, becoming the first nation in a little more than three decades to get a chance of hosting such a highly reputed event, twice. The initial work for what my colleagues are calling as "Olympics of Cement" has already started and having the experience of carrying it out successfully in 1992, our team is confident to execute it again in 2027, in a spectacular fashion.

Also, during this time, the coming year will be of the "Mahakumbh of Cement", the 18th NCB International Conference on Cement, Concrete and Building Materials. I have been informed that enquiries have already started from the industry for paper presentation and exhibition which speaks volumes about the gravity of our flagship event. The upcoming Conference will have various industries, government, universities and consultants from India and the around the globe and is expected to bring together industry leaders, policy makers, experts, engineers and scientists to discuss future action plans aimed at responsible resource consumption and reduction in emissions from production and consumption. Gauging at the present response and queries, the concurrent technical exhibition is also expected to attract more participation. This event, like its predecessors, will provides a rare learning and networking opportunity and I appeal to all of you to take maximum advantage of it. I look forward to your presence in the Conference and hope that our efforts to share knowledge and information through this medium are well received by the cement and construction industry. I wish all of you, a very innovative and successful future. Jai Hind!

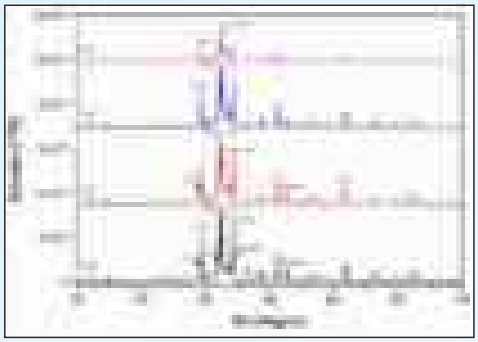
Dr. L P Singh
Director General

CEMENT RESEARCH AND TESTING

Utilization of Lime Sludge from Indian Paper Industry to achieve circular economy for Indian Cement Industry

Lime Sludge (LS) an industrial waste produced in paper and pulp industries during paper manufacturing, generally disposed outside for land filling creates an adverse impact on environment. The chemical composition of lime sludge sample contains CaO of around (52-55)%, SiO2 (1-4)%, Al_2O_3 and Fe_2O_3 makes up <1% by weight. Minor alkalis of Na_2O, K_2O and SO_3 content are <1 wt%. XRD profile and TG/DTA results showed that all lime sludge samples have major calcite ($CaCO_3$) phase. Investigation by optical microscopy of micro structure and morphology revealed that calcite grains were present as rounded shape agglomerated form. Portland Cement Clinker was prepared using lime sludge from 30-50% by weight replacement of limestone and these clinkers were compared with clinkers made of conventional raw materials. Burnability investigation of clinkers showed free lime content with the limit specified by Indian Standards. Mineralogical characterizations using X-Ray Diffraction and Optical microscopy showed desirable clinker phases formation with required quantity. The characterizations of all obtained results were found encouraging for replacement of limestone in cement and construction industry by using lime sludge which is technically suitable and economically viable for waste management and in favour of circular economy.

Lime sludge waste generated in paper industry

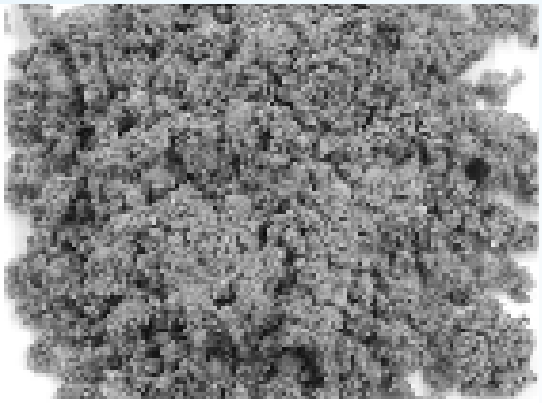


XRD patterns of lab fired clinkers

Hence, as valuable replacement of limestone, lime sludge may be utilized as raw material for Portland Cement Clinker which will promote circular economy.

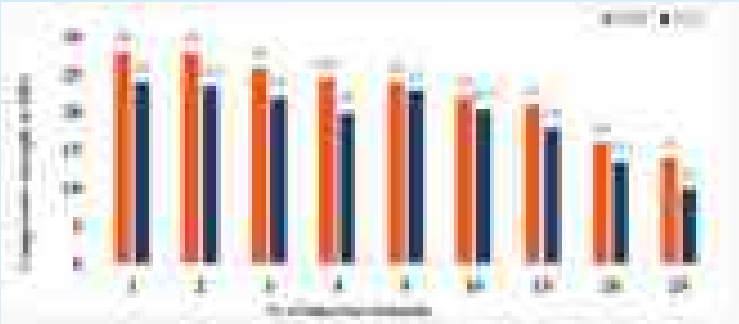
Formulation of Chemical Admixture Using Lignosulphonate Waste

Chemical admixtures are an essential part of modern concrete to achieve desirable qualities along with a view to promote sustainability in it. Small addition of chemical admixture facilitates huge impact on concrete properties in terms of performance, durability and environmental optimization. This study on utilization of lignosulfonate from paper and pulp industry compares the differences and similarities of different types of superplasticizers like poly carboxylate ether (PCE), polyethylene glycol (PEG) and triethylamine(TEA) in cement mortar systems, in terms of NC, setting time and compressive strength. It was observed that PCE is less efficient in decreasing the compressive strength than lignosulfonate. More importantly, the setting time patterns and compressive strength trends are different with lignosulfonate and PCE additions; this is tied to the adsorption and dispersing mechanisms of these two types of superplasticizers. But for their formulation in the ratio of 1:1, 1:2 and 2:1, both admixtures showed different setting time and compressive strength. The results for LS: PCE 1:2 result is encouraging in terms of delayed setting time without affecting compressive strength. The utilization of lignosulfonate waste from paper and pulp industry with PCE for 1:2 composition to adjust comparable properties with PCE can be carried out to cover circular economy. NCB has taken initiatives for utilization of ligno sulfonate waste from paper and pulp industry by formulation with other chemical for circular economy in construction sector.



Lignosulfonate waste generated in paper and pulp industry

Development of Portland Dolomite Cement



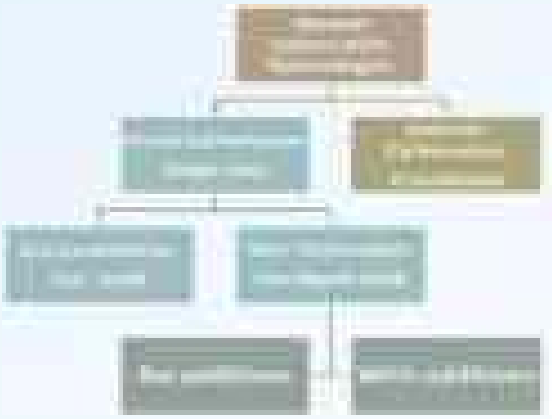
Early age (1 day) compressive strength of PDC and PLC at varying replacement levels

High MgO or dolomitic limestone shows synergetic effect on the performance of different cements (blended cements). These materials are abundantly available with cement plants of some region. So far, 75% $CaCO_3$ containing limestone is allowed for the production of OPC as a PI according to Indian Standard codes. The main objective of the study is to investigate the feasibility of using dolomite in development of Portland Dolomite Cement in order to formulate new Indian Standard for its commercialization along with lowering in clinker factor in cement for environmental sustainability. To carry out the study, different Portland Dolomite Cement blends were prepared by inter-grinding of varying percentages of dolomite collected from different parts of the country with OPC clinker and gypsum. OPC and Portland Limestone Cement (PLC) blends were also prepared as control samples. The cement blends were prepared from raw materials collected from four different regions of the country and performance characterization was studied. The trend of compressive strength development showed enhancement in compressive strength of Portland Dolomite Cement at all ages with (1-5)% dolomite addition in comparison to Portland Limestone Cement blends. At higher addition levels, the strength of PLC and PDC are comparable. Durability studies of PDC with higher additions are underway. Figure above shows the early age (1 day) compressive strength of PDC and PLC at varying replacement levels.

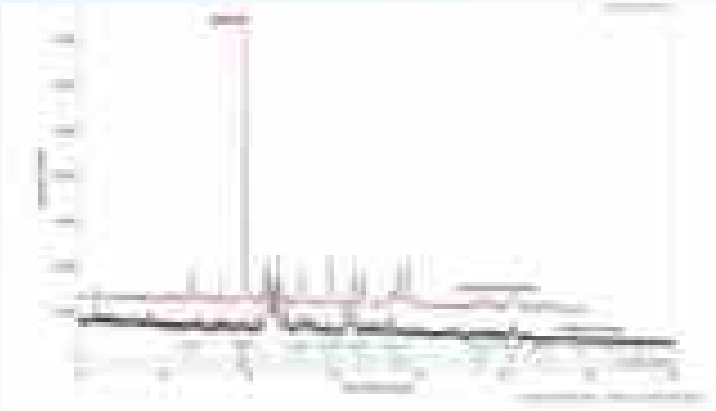
Investigation on Mineral Carbonation Mechanism of Various Industrial Waste and By Products

This project aims at identifying various industrial wastes/by-products having an adequate quantity generation and having desired chemistry for mineral carbonation. Accordingly, material such as various types of iron and steel slag, CKD, C&D waste etc. were utilized for mineral carbonation study. Solid industrial wastes/by-products which are generally alkaline, inorganic and rich in Ca can be applied as an additional feedstock for mineral carbonation. In this project, 15 different types of industrial wastes selected for mineral carbonation study through direct carbonation route by dry process which is gas solid carbonation and wet process which is gas-solid-liquid carbonation. The samples were further processed for fine powdered material through crushing and grinding mechanism in jaw crusher and ball mill respectively. These samples were characterized for their constituent's oxides and mineralogy by conventional chemical and analytical instrumental techniques.

To achieve carbonation, samples were kept in accelerated carbonation environment inside the carbonated chamber. The carbonation chamber operates at atmospheric pressure, 4 ± 0.5% CO_2 concentration, 27°C temperature and 65% relative humidity (RH) condition. The samples were kept for accelerated carbonation for different time period and then the carbonated samples were analyzed chemically as well as mineralogically with different instrumental methods.



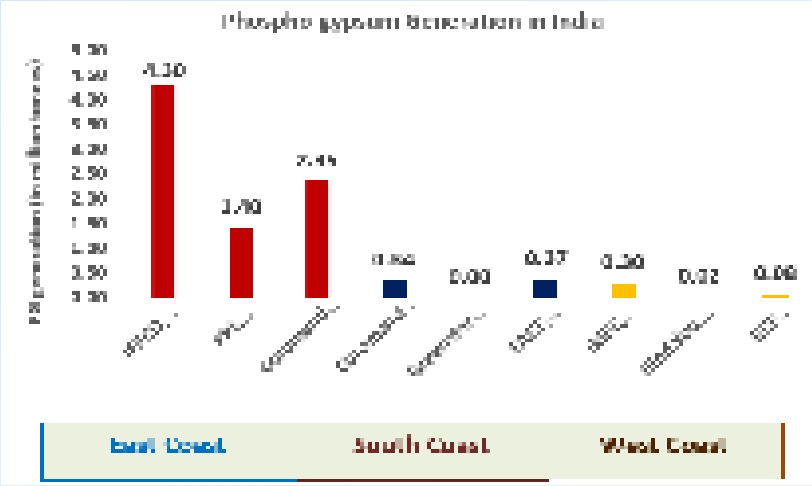
Mineral carbonation methodologies



XRD diffractogram showing original sample and carbonation in carbonated sample

Utilization of Phospho-gypsum in Cement Manufacturing under Circular Economy

Phosphogypsum generation in India at various fertilizer plants was estimated to be ~9.1 million tonnes per annum (mtpa) in 2022-23. Apart from the yearly generation of phosphogypsum, there is an additional issue of legacy stock of unutilized phosphogypsum of about 69.8 Mt at various fertilizer plants especially in the eastern cost of India accumulated over the years. Gypsum is an integral component of cement production and the sector has to rely on costly imports due to shortage of quality gypsum in India.The most important and motivating use of phosphogypsum could be in the cement industry to reduced the import of mineral gypsum.



Legacy phosphogypsum accumulated in India

In this study phosphogypsum along with mineral gypsum and clinker from different sources were collected and their chemical, mineralogical and thermal characterizations were carried out. Mineralogical investigation of phosphogypsum sample by XRD showed that gypsum and quartz mineral present where gypsum is the predominant phase similar to mineral gypsum. OPC blends were prepared using phosphogypsum and evaluated for chemical and physical properties and the initial results were found to be encouraging. Further investigation is in progress.

Evaluating the potential for using Indian C&D Waste Fines as Supplementary Cementitious Materials (SCM)

Studies were taken up to evaluate the potential for using Indian C&D waste fines as Supplementary Cementitious Material (SCM). Concrete waste accounts for approximately 65% of C&D waste. It is a common approach to crush the concrete wastes into particles with appropriate size to be used as coarse or fine aggregates in new concretes. However, this process can generate 5% to 20% fine particles with size less than 0.15 mm which cannot be used as aggregates in new concrete. These are C & D waste fines which were siliceous in nature with SiO_2 of 62.77%, CaO of 14.74%, Al_2O_3 and Fe_2O_3 of 5.55% and 2.38% respectively and the Insoluble Residue (IR) of 63.28%. The sample showed a low lime reactivity value of 0.4 N/mm^2. The XRD shows major peak of quartz and minor peaks of calcite, albite, dicalcium silicate, chlorite, ettringite, etc. The sample fines were carbonated for two weeks in the carbonation chamber at atmospheric pressure, 4±0.5% CO_2 concentration, 27°C temperature and 65% relative humidity condition. The carbonated fines were then analyzed for their chemical and mineralogical properties. The chemical analysis was similar as non-carbonated fines and its lime reactivity value was 1.2 N/mm^2.

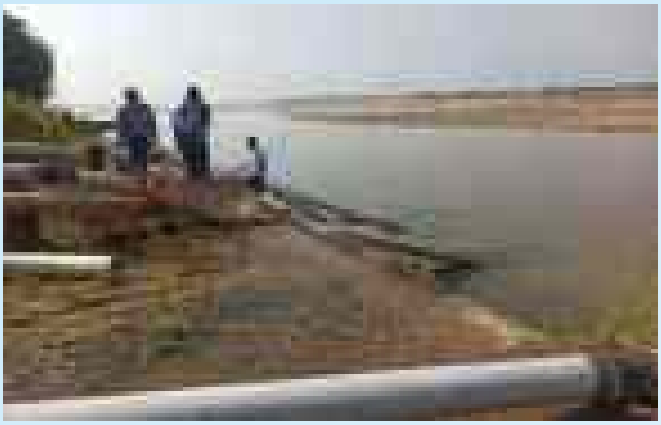
The compressive strength of cement blends prepared by replacing 20% of OPC with C&D fines and carbonated C&D fines showed that both the cement blends showed appreciable strength. The strength performance of both improved by age with latter ages reaching 80% of control OPC.

Petrographic evaluation to study the quality of silt sediments

Studies were taken up for providing expert services for Petrographic analysis, chemical analysis and particle size distribution of the silt sediments including chemical analysis of water samples from the site. In this study, water samples were collected, silt sediment containing water samples and silt sediments. Detailed Petrographic studies of all the fractions of silt sediments were done by using Polarizing Microscope, NIKON POL 100 LV. The major mineral constituent in all silt sediment samples was quartz. Feldspar and Mica were also present in appreciable amounts in all samples.

Morphology of quartz grains were subhedral to anhedral and highly fractured and shattered. Its grain size variation was too large in all fractions. The silt sediment samples were composed of five fractions viz. very coarse fraction (+300 µm), the coarse fraction (-300 µm to +150 µm), the medium fraction (-150 µm to +90 µm), the fine fraction (-90 µm to +75 µm) and a very fine fraction (-75 µm). Coarse fraction was found to be maximum. Mica grains were partially fractured, shattered, twisted, highly iron leached and sticky. The chemical analyses of silt (as per IS 1727, and IS 4032) indicated that they were rich in SiO_2. PSD indicated that average coarse particles and average fine particles range from 363 µm to 808µm and 61 µm to 131µm

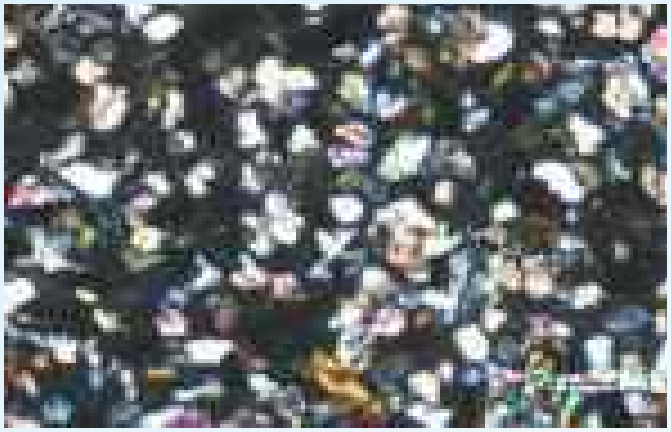
respectively. The chemical analysis of water samples was carried out by using IS 456 and IS 3025. Langelier Saturation Index (LSI) of the water samples were in the range of -0.28 to +0.25. LSI within range and found suitable for use.



Collection points to collect water, silt sediment samples.

Polarizing Microscope, Make: NIKON Japan, Model: POL 100 LV

Distribution of mineral grains in the silt sediment sample (Size fraction-300 to +150µm). (5x, x-Nicols), Microphotographs captured by Polarizing microscope



Distribution of mineral grains in the silt sediment sample (Size fraction-90 to +75µm). (5x, x-Nicols) Microphotographs captured by Polarizing microscope

Utilization of chrome sludge in cement manufacturing

Chrome sludge is a hazardous waste generated by industries producing chromium based chemicals. Studies included chemico-mineralogical evaluation of chrome sludge along with other conventional raw materials. Leachability studies of chrome sludge as per TCLP was also carried out. Preliminary investigation was performed for suitability of hazardous waste for co-processing as per CPCB guidelines of 2017. Raw mix design studies using the byproducts of the chromium industry revealed that development of clinker phases in terms of granulometry, distribution and quantity in the clinker samples prepared from raw mixes with chrome sludge up to 3.0% was found to be comparable with that of control clinker sample at temperatures of 1400 & 1450oC. OPC prepared from the bulk clinker met all the requirements of OPC 53 Grade, as per IS 269-2015.

Independent Testing

Independent Testing Laboratories of NCB undertake complete physical, chemical, mineralogical, micro-structural thermal analysis of various types of raw materials, cement, clinker, pozzolana, aggregate, concrete, admixtures, water, refractory, bricks, coal, lignite etc. as per National and International Standards. The labs also perform testing of internal samples for CRM and BND preparation, PT sample preparation, R&D and industry sponsored projects. Established in 1977 on a Test House pattern the laboratories undertake testing jobs for cement, construction and allied industries and achieved a landmark when NABL accredited them in 1997 as per ISO 17025, continued since then. These labs are also recognized by BIS for testing of 19 cement and related products. The laboratories are equipped with state-of-art instruments and competent staff regularly trained to carry out the testing activities as per National and some International Standards. During the year, assignments were carried out for samples from neighboring countries also. The number of samples tested during the year 2023 were 7,890.

CONSTRUCTION DEVELOPMENT AND RESEARCH

Carbonation induced corrosion study for composite cement

Studies conducted by NCB and reported in various research literatures indicate that composite cement behavior is quite similar to PPC and found to be beneficial in chloride rich environment. However, like in PPC, problem of carbonation induced corrosion persists. Similar phenomenon has been observed with composite cement. Initial investigations done by NCB indicates that concrete made with existing composite cement composition shows less resistance to carbonation in comparison to OPC. Therefore, the present specification, i.e. IS 16415 requires modification to cater the effect of carbonation w.r.t higher clinker substitution in composite cement. A comprehensive study has been conducted by NCB using various combinations of OPC, fly ash and slag. The following combinations have been used:

Combinations of composite cements

Sl.No	Possible Specification	Type of cement	Clinker +Gypsum (%)	Fly ash (%)	Slag (%)
1	SP1	Composite Cement	35	15	50
2		Composite Cement	35	25	40
3	SP2	Composite Cement	40	10	50
4		Composite Cement	40	25	35
5	SP3	Composite Cement	45	10	45
6		Composite Cement	45	25	30
7	SP4	Composite Cement	50	10	40
8		Composite Cement	50	25	25
9	SP5	Composite Cement	55	10	35
10		Composite Cement	55	25	20

The study was carried out at two different set of materials. About 20 mortar samples and 72 concrete mixes were studied. The study envisages the effect of various combinations as specified above on the cement mortar and concrete properties. Based on the mechanical as well as durability test results, especially carbonation as well as carbonation induced reinforcement corrosion, it was recommended to keep OPC content at least 50% or clinker content at least 45%, fly ash in the range of 10-25% and GGBS in the range of 25-40% to achieve performance equivalent or better than PPC. Based upon the study conducted by NCB, IS 16415 has been revised and final outcome of the study has been included as referred to in the following table.

Table: Material Proportion to be used in Composite Cement

Material	Proportion (Percent by Weight)
Portland Cement Clinker or Ordinary Portland Cement	Minimum 45 (in case of clinker is used) Minimum 50 (in case of OPC is used)
Fly ash	10-25
Granulated slag	25-40

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

The study investigates role of new cementitious systems or low carbon cement on mechanical and durability properties especially carbonation, progress of carbonation front and corrosion rate. It also investigates effect of environmental parameters like relative humidity, temperature and alternative wetting & drying phenomenon over the progress of carbonation front and corrosion rate. The studies are done in both lab and field environment with aim to develop relationship between durability results in accelerated and normal environment.

The study has been carried out on two w/c ratios of 0.40 and 0.60. Experiments were carried out in laboratory as well as in field conditions. Laboratory study (under accelerated environment) involves quantifying the effect of CO_2 concentration, relative humidity and temperature on carbonation front whereas field study (under normal environment) involves determination of various parameters like CO_2 concentration, no. of rainy days / sunshine days, relative humidity and temperature that can influence carbonation front and corrosion rate.

In this study, new cementitious systems that are under investigation are:

Composite Cement	OPC+ Fly Ash + GGBS
Portland Limestone Cement	OPC+ L imestone
Portland Composite Cement	OPC+ Fly Ash + L imestone
High Volume Fly Ash Cementitious System	OPC+ Fly ash
Portland Slag Composite	OPC + GGBS+ L imestone

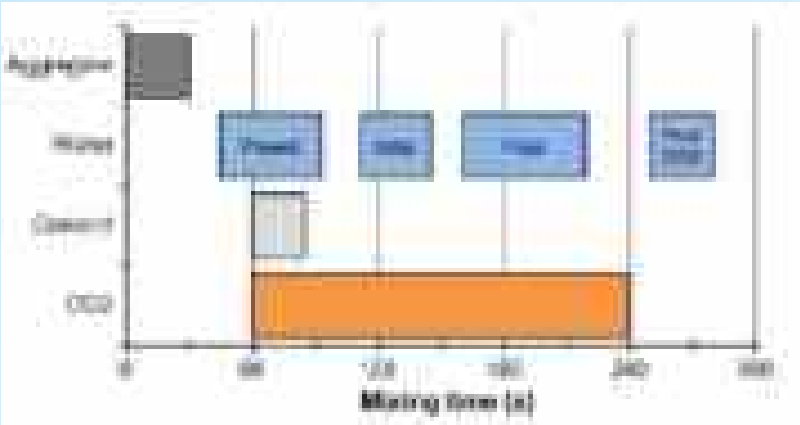
Study on Portland limestone cement (PLC) has been completed. In the present research work, PLC has been designed at 10 % and 15 % limestone content. The findings of the PLC study are (a) minimum requirement of fineness of the limestone = 600 m^2/kg and (b) overall fineness of PLC blends ≥ 425 m^2/kg. If these criteria are met, performance of the concrete designed with PLC blends (limestone content up to 15 %) will be at par to that of concrete made with OPC.

The study conducted on high volume fly ash cement (HVFAC) where it has been designed at 40 % and 45 %, fly ash content shows that fineness of cement blend has a significant effect on mechanical and durability properties of concrete. Concrete made with HVFAC blends (designed at a Blaine's fineness in the range of 400-410 m^2/kg) containing 40 % fly ash content shows performance at par to the concrete made with fly ash blend that contains 35 % fly ash designed at a Blaine's fineness of the order of 300 m^2/kg. Higher fineness leads to some better microstructural properties that is quite evident from the test data. Therefore, it is suggested to have a Blaine's fineness in the range of 400-410 m^2/kg and fly ash content 40 %, while using HVFAC for structural works. Out of 124 concrete mixes, casting of all concrete mixes for different cementitious system such as composite cement, PLC and HVFAC has been completed while study on remaining cementitious systems is under progress. For the field study, based upon climatic zones of India, exposure classes for structures exposed to carbonation is being categorized into 4 zones (as proposed for revision of IS 456) and different locations have been selected accordingly as referred in the following table.

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

Utilisation of CO_2 in Fresh Concrete and Study on Fresh and Hardened Properties of CO_2 induced Concrete

Five Levers of De-carbonization of Cement Industry are (a) Substitution of Clinker (b) Alternate Fuel and Raw Materials (c) Waste Heat Recovery (d) Improving Energy Efficiency and (e) Newer technologies like Renewable Energy, Novel Cements, Carbon Capture, Utilization & Storage (CCUS) Therefore, cement sector in India has an important role to achieve the committed climate targets. Global Cement and Concrete Association (GCCA), CEMBUREAU and Portland Cement Association (PCA) have announced roadmap to achieve Carbon Neutrality across the cement and concrete value chain by 2050 with major contribution from Carbon Capture and Utilization (CCU). Indian Cement Industry has already taken steps on four levers out of five identified in low carbon technology roadmap. However, to achieve the target of Net Zero, cement industry will have to go for implementation of CCU technologies. In this area, NCB took up this R&D project currently under progress and scheduled to be completed in 2025. The aim of the project is to study the potential of CO_2 utilisation in concrete and its effect on fresh and hardened properties of concrete. Accelerated carbonation of the cementitious phases of concrete is much more viable to contribute on a short term to mitigation of climate change than natural carbonation.



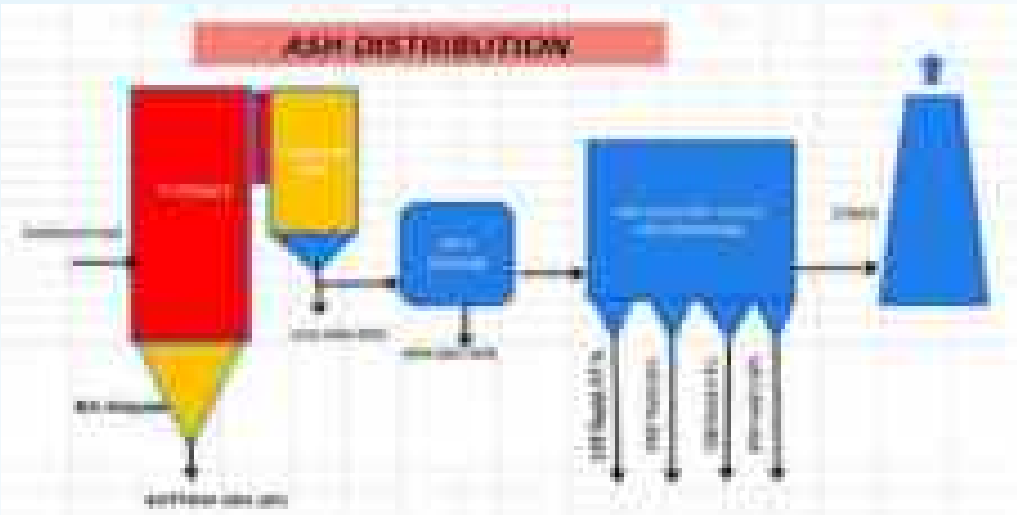
Schematic representation of batching and CO_2 injection sequence

A limited reaction time and effects on workability have been identified as challenges to overcome. It has been seen that a small dose of CO_2 could feasibly be used to provide performance benefits in concrete. Research includes not only the carbonation processes but also the properties in terms of hydration /carbonation mechanisms, concrete mix design, mixing sequence, mechanical properties and durability.

Utilization of coarser fly ash (having fineness between 250 m^2/kg to 320 m^2/kg) in concrete as a cementitious material.

IS 3812 Part-I gives the specification of pulverized fuel ash to use in the production of cement concrete, where it is mentioned that the minimum required fineness of fly ash should be 320 m^2/kg or more. However, it is noticed that in India there is large amount of coarser fly ash (having fineness 250 to 320 m^2/kg) available. As this coarser fly ash is not satisfying the minimum requirement of fineness as per IS 3812 Part-I, it is not being utilized in the production of cement and concrete. In order to address this concern, the utilization of coarser fly ash seems to be an appropriate step to utilize a large quantity of fly ash and also yield significant environmental benefits. Therefore, NCB carried out this study and collected fly ash from various locations (i.e., field wise samples & sample collection from ash dyke) of six different thermal power plants located across the country. Collected fly ash has been characterized under different categories on the basis of chemical, physical, mineralogical and morphological properties. In order to study the hardened properties of concrete all samples have been cast and results obtained. Based on the fineness of fly ash, the test results of hardened concrete samples were analysed in following five categories:

Category-I (Concrete sample cast using fly ash Fineness < 250 m^2/kg)
Category-II (Concrete sample cast using fly ash Fineness Between 251 to 300 m^2/kg)
Category-III (Concrete cast with Fly ash having fineness 325 m^2/kg)
Category-IV (Concrete cast with Fly ash having fineness 387 m^2/kg)
Category-V (Concrete sample cast with OPC only)



Based on the results obtained, it is concluded that coarseness and fineness of fly ash is not affecting the fresh properties in all categories of concrete in terms of workability loss of concrete. Properties of hardened concrete such as 28 days and 56 days compressive strength, flexural strength, Poisson's ratio and water absorption for Category-I concrete were found to be comparable to concrete of categories II to IV. Based on this study recommendation for the modification / amendment in the specification of fly ash has been given to BIS (IS 3812 Part-1, 2013). The study also indicated need for revision of BIS code on sampling of fly ash & bottom (IS 6491 -1972).

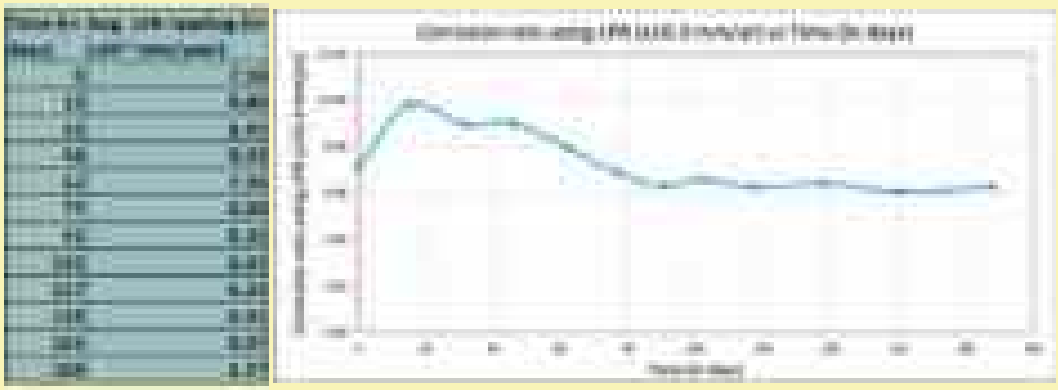
Cathodic Protection to Enhance Service Life of New and Existing Concrete Structures

The objective of the project is to (a) evaluate the performance of discrete sacrificial anodes in enhancing the service life of reinforced concrete, (b) evaluate the effectiveness of discrete sacrificial anodes in different cementitious systems (c) To come out with guidelines on the design, use and monitoring of sacrificial anodes in reinforced concrete. Both laboratory based and field-based studies have been carried out to study and monitor the performance of these anodes. Commercially available zinc based discrete sacrificial anodes from two different manufacturers were used for the laboratory experiments. Concrete slab specimens were cast with different cementitious systems using varying proportions of OPC, fly ash and GGBS. One set of laboratory experiments were done to study the effectiveness of these anodes in corrosion control in these specimens in which corrosion has already initiated under carbonation induced corrosion as well as chloride induced corrosion due to external chloride ingress. Another set of laboratory experiment involved usage of these anodes in newly cast chloride contaminated concrete slab specimens and study the effectiveness of the anodes in preventing corrosion.

Field study involved monitoring anodes installed at an actual project site under a sponsored project involving supervision of ongoing repair work. The anodes have been instrumented and monitored through monitoring junction boxes installed at site and the current output of instrumented anodes have been recorded to judge the compliance of the anodes with performance criteria established in international standards. The research literature surveyed in the course of this project has also been used in designing the CP system to decide the distribution and spacing of the anodes for execution at site. Linear Polarization Resistance (LPR) technique has been used to measure the corrosion rate in the specimens prior to and post installation of anodes for the laboratory studies. Based on the experiments performed, the effectiveness of the anodes in reducing the corrosion rate and enhancing the service life has been evaluated. Experimental results obtained have shown reduction in corrosion rate in the specimens in which anodes have been installed as compared to control specimens. Based on reduction in corrosion rate, probable enhancement in service life has been calculated.

Sacrificial anodes used in experiments

Measurement of corrosion rate using LPR



PAPERS PUBLISHED AND PUBLICATIONS IN WORKSHOPS, SEMINARS AND CONFERENCES

Publications in Journals by Centre for Construction Development and Research

- P N Ojha, Pranay Singh, Brijesh Singh, Abhishek Singh, Amit Sagar and Ravi Yadav, Statistical Characteristics of compressive strength of Normal & High strength concrete and concrete made with recycled aggregate, Revista Ingeniería de Construcción RIC Chillee, December 2022
- P.N. Ojha, Brijesh Singh, Amit Trivedi, Pranay Singh, Chirag Pede, Abhishek Singh, Short term mechanical performance and flexural behavior of reinforced slag-flyash based geopolymer concrete beams in comparison to OPC based concrete beams, Research on Engineering Structures and Materials, January 2023
- P N Ojha, Pranay Singh, Brijesh Singh, Empirical Equations for Prediction of Split Tensile and Flexural Strength of High Strength Concrete Including Effect of Steel Fiber, Research on Engineering Structures and Materials, February 2023
- P N Ojha, Abhishek Singh, Brijesh Singh, Subhadra Sen, Studies on PSC made with composite slag (mix of BF and LD slag), ACI Materials Journal, February 2023
- Pranay Singh, P N Ojha, Brijesh Singh, Abhishek Singh, Crack Detection and Crack segmentation in concrete beams undergoing mode I fracture using computer vision and Convolutional Neural Network, Canadian Journal of Civil Engineering, February 2023
- P N Ojha, Pranay Singh, Brijesh Singh, Abhishek Singh, Ajay, Amit Sagar, Experimental and FEM analysis for Fracture performance evaluation of Concrete made with recycled construction and demolition waste aggregates, Periodica Polytechnica Journal, March 2023
- P.N. Ojha, Abhishek Singh, Amit Trivedi, Brijesh Singh, N. Chowdhury, Evaluation of coal based bottom ash as an alternative to fine aggregate in concrete: recommendations for specifications of bottom ash and its concrete mix design, Research on Engineering Structures & Materials, May 2023
- B N Mohapatra, Puneet Kaura, P N Ojha, Brijesh Singh, Sumit Kumar, Versha Liju, Fresh, hardened and durability properties of concrete made with Fly ash and limestone based Portland composite cement, Journal of Asian Concrete Federation, June 2023
- Pranay Singh, Brijesh Singh, P N Ojha, A. Singh & Amit Trivedi, Fracture behavior of slag & flyash-based geopolymer concrete in comparison with OPC-based conventional concrete including the effect of steel and hybrid fibers, Revista Ingeniería de Construcción RIC, Chillee, August 2023
- Brijesh Singh, Pranay Singh, P N Ojha and Abhishek Singh, Experimental study on stress-strain characteristics of very high strength concrete and its effect on stress block parameters for flexural design of building, Research on Engineering Structures and Materials, September 2023
- P.N. Ojha, Puneet Kaura, Brijesh Singh, Studies on mechanical performance of treated and non-treated coarse recycled concrete aggregate and its performance in concrete-an Indian case study, Research on Engineering Structures and Materials, October 2023

Publications in Workshops, Seminars and Conferences by Centre for Construction Development and Research

- P N Ojha, Brijesh Singh, Abhishek Singh, Puneet Kaura, B N Mohapatra, Valorization Strategy For Utilisation Of Ash Generated From Thermal Power Plants In India, "Valorization of Fly Ash and Steel Slag: Challenges, Innovations, and Future Trends"22-23 Sept 2022, Jamshedpur, India
- P N Ojha, A. Singh, Brijesh Singh, P. Kaura, B N Mohapatra, Current Trends and future utilization potential of iron and steel slag in cement and construction industry, "Valorization of Fly Ash and Steel Slag: Challenges, Innovations, and Future Trends"22-23 Sept 2022 at, Jamshedpur, India
- P N Ojha, Brijesh Singh, Abhishek Singh & Suresh Kumar, Material Selection & Quality Requirements for Repair of Abrasion and Erosion Damaged Hydraulic Structure, International Conference on Dam Safety being organized by INCOLD at Jaipur, 10-12 October, 2022 Jaipur, India
- P N Ojha, Brijesh Singh, Abhishek Singh, Amit Sagar, Amit Prakash & Ravi Yadav, Comparison Of Creep Coefficient Of Normal, High And Ultra-High Performance Concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Brijesh Singh, P N Ojha, Amit Sagar, Abhishek Singh, Pranay Singh & Ravi Yadav, Effect Of Curing Regime On Compressive Strength Of Ultra-High Strength Concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India

- Manish Mandre, Brijesh Singh, Amit Trivedi, P N Ojha, B N Mohapatra, Mix Optimization for Development Of 3D Printed Concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Amit Trivedi, Brijesh Singh, Abhishek Singh, P N Ojha, Dinesh Kumar, Shear Behaviour of Reinforced Alkali Activated Slag and Fly ash Concrete under Ambient Curing: Comparison with OPC based concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Rizwan Anwar, P N Ojha, Nitin Chowdhary, Brijesh Singh, Adarsh Kumar NS, Condition Assessment of Reinforced Concrete Members of a Fire Damaged Structure – A Case Study, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- P N Ojha, Abhishek Singh, Brijesh Singh, Amit Trivedi & Puneet Kaura, Recent Research On Iron, Steel, Copper And Ferrochrome Slag For Utilization In Construction Industry, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Puneet Kaura, P N Ojha & Hardik Jain, Mechanical and Durability Performance of Portland Limestone Cement (PLC) Made with Intergrinding Having High Fineness Limestone in Concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Arup Ghatak, P N Ojha, Sanjay Mundra & Rizwan Anwar, Review of Design Considerations for Cathodic Protection & Case Study of Design of CP with Galvanic Anodes for Reinforced Concrete, 17th NCB International Conference on Cement, Concrete and Building Materials, 06-09 December 2022, Manekshaw Centre, New Delhi, India
- Brijesh Singh, P N Ojha & Puneet Kaura, Assessment of Mechanical Properties and Microstructural Investigation of Concrete for Aged Dams, CSIR-CBRI: National Workshop and Exhibition on Innovative & Sustainable Construction Materials & Technologies, New Delhi, 06 January 2023, India
- Brijesh Singh, P N Ojha, Amit Sagar & Abhishek Singh, Influence of Mixing Procedure and Curing Regime on Compressive Strength of Normal Strength and Reactive Powder Concrete, CSIR-CBRI: National Workshop and Exhibition on Innovative & Sustainable Construction Materials & Technologies (ISCMT2023), New Delhi, 06 January 2023, India
- Puneet Kaura, P N Ojha & Brijesh Singh, Impact of mechanical treatment on properties and performance of coarse recycled aggregate, CSIR-CBRI: National Workshop and Exhibition on Innovative & Sustainable Construction Materials & Technologies, New Delhi, 06 January 2023, India

Achievements meriting Special Recognition

Brijesh Singh, Group Manager at NCB has been **conferred** in year 2023 as **Outstanding Concrete Technologist-2023** by Indian Concrete Institute-Delhi & Ultratech Cement Ltd. for his contribution in Revision of code clauses of IS: 456-2000 on material properties and fire resistant design aspects, effect of aggregate type on MOE of concrete and flexural strength of concrete, flexural design parameters of reinforced high strength concrete, Revision of IS: 1786-2008 & IS: 16712, Revision of Standards on tests such as ultrasonic pulse velocity, rebound hammer and concrete core test, Formulation of standards on GFRP bars, Condition assessment of two major dams of India (Idduki & Bhakra Dam), Quality audit of Indian International Convention Centres at Pragati Maidan and at Dwarka in Delhi, MP Flats, President Estate, MP Hostel, Central Vista project constructed by CPWD in Delhi.

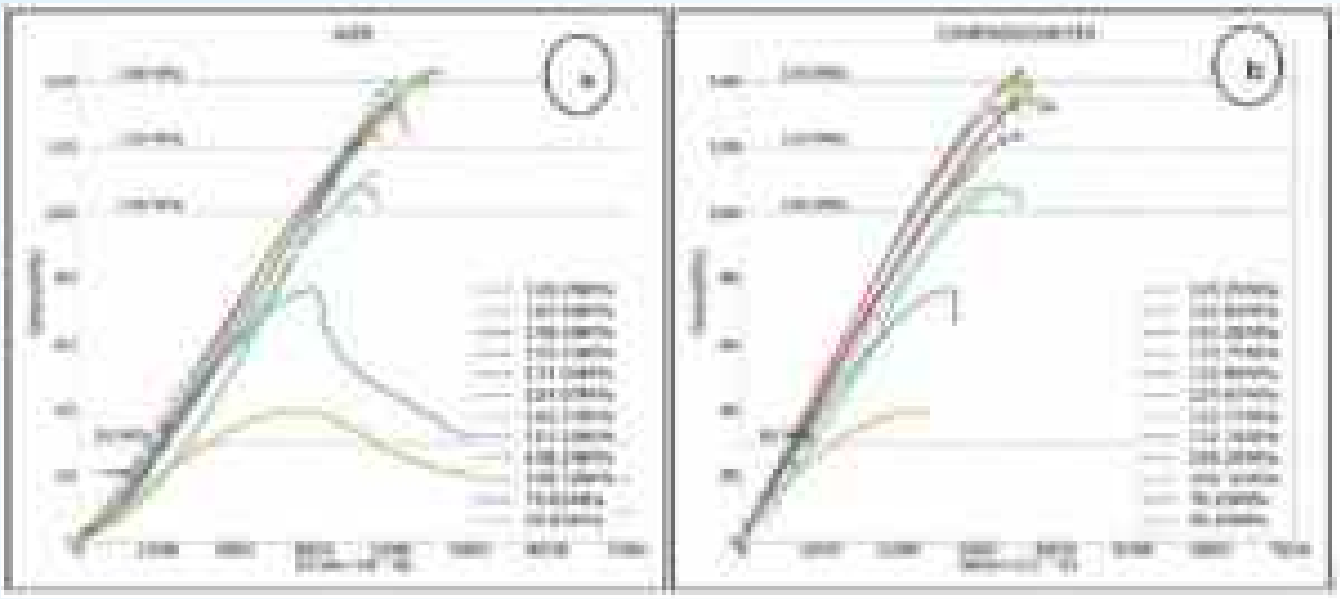
Evaluation of Concrete Surface Coatings for their effectiveness in service life enhancement of RCC elements under: Carbonation & Chloride Induced Corrosion

A number of surface coatings for concrete are marketed and used on a large scale in the repair and rehabilitation of reinforced concrete structures. There are numerous formulations available for such products in the market, each based on a particular group of compounds. Based on the literature survey, it has been envisaged to carry out the experimental study on five types of coatings. The identified five coatings are (a) epoxy resin (b) polyurethane resin (c) acrylic resin (d) polymer solution (e) polymer modified cement composition. The aim of the study is to evaluate performance of coating in delaying corrosion in the embedded reinforcement under (a) carbonation induced corrosion environment and (b) chloride induced corrosion environment. The expected modification in Tutti service life model for corrosion in RCC members by application of protective coating is shown in the Fig.

Each set of coatings belonging to a particular principal group will first be tested for their material properties. Subsequently these coatings will be applied on cast specimens to study their efficacy. Tests such as accelerated carbonation, measurement of half-cell potential values and corrosion rate measurement using Linear polarization Resistance technique in specimens with embedded reinforcement, measurement of resistance to chloride ion ingress using Rapid Chloride Permeability Test, evaluation of transport properties using water vapour permeability/diffusion test, air permeability test and water absorption test will be done. With the data generated from these tests, the effectiveness of these coatings will be evaluated.

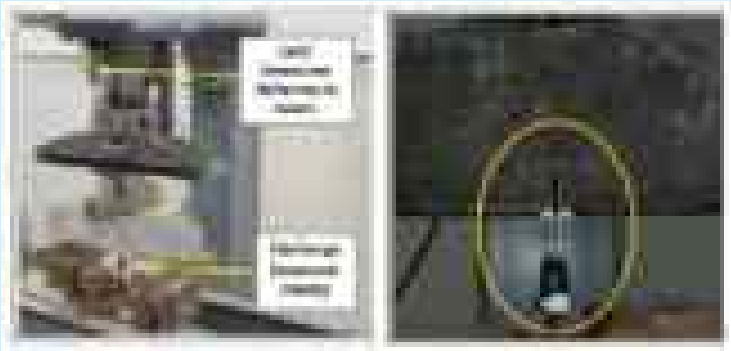
Studies on mechanical and time-dependent properties of Ultra-High Strength Concrete (UHSC)

NCB conducted studies in past on Normal and High Strength Concrete (HSC) using different indigenous aggregates for concrete grades from M35 to M100. NCB had also completed an R&D project for development of Ultra High-Performance Concrete (UHPC) with compressive strength in excess of 150 MPa. Currently, IS:456 under revision covers concrete grade up to M100 and outcome of study will provide data for up-gradation of IS of design for higher-grade concrete above M100. This study includes (a) Optimization of different mix design parameters for UHSC. (b) studies on mechanical properties such as compressive strength and its statistical analysis, modulus of elasticity, Stress-Strain behaviour and its effect on stress block parameters, split tensile strength, flexural strength and fracture behaviour. (c) creep and shrinkage behavior (d) effect of fiber on mechanical properties of HSC.



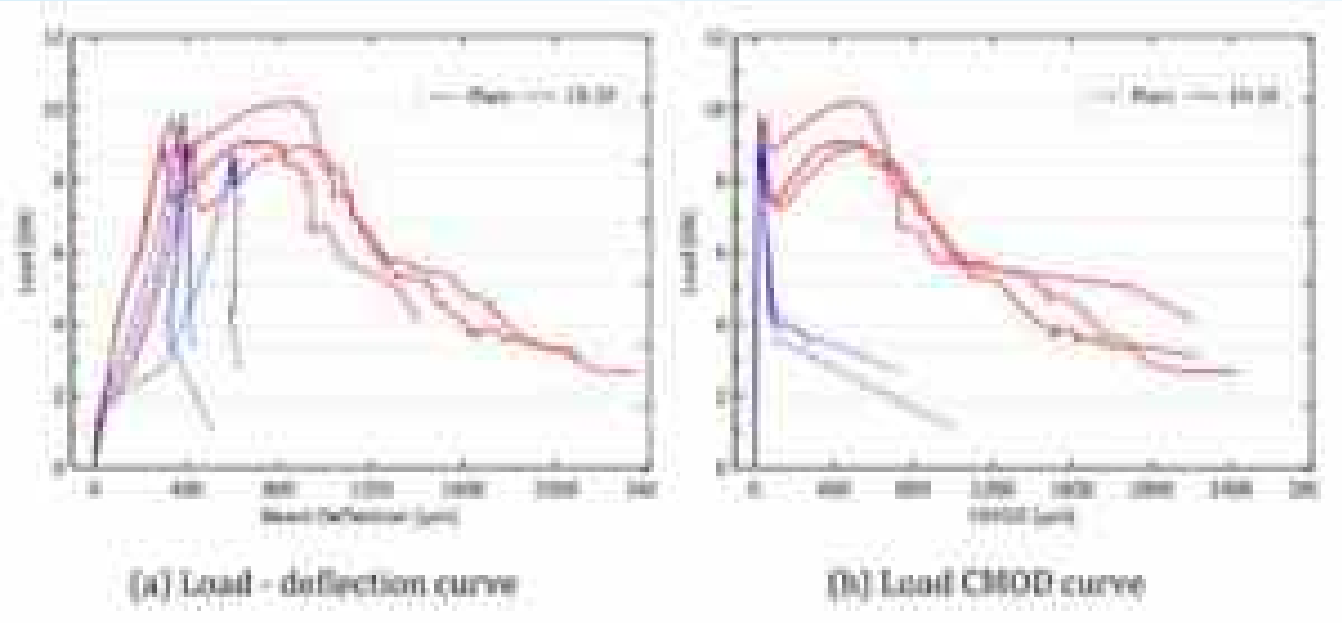
Graphs for Strain (LVDT) vs stress and combined graphs for strain (Compressometer) vs stress

The stress-strain curves obtained gets steeper with an increase in strength of concrete. At a higher strength, curves follow a straight-line path contrary to the parabolic path for normal and to some extent for HSC. With increase in strength of concrete, post-peak behavior shrinks and finally coincides with very HSC. The decrease in ultimate strain and increase in strain at peak stress of high to very high strength concrete will have a direct impact on depth of neutral axis for a balanced section which is directly related to maximum capacity of member.



Experimental setup for evaluation of fracture parameters

In terms of fracture behaviour, hybrid fiber reinforced concrete performed much better than plain concrete without any fiber addition. Also, for normal and normal to HSC fracture parameters improved marginally by hybrid fibers compared to steel fiber only. This can be attributed to an improvement in paste-aggregate matrix in concrete mixes due to filling up of voids by hybrid fibers. On the contrary, already optimized mix for HSC gets disturbed by addition of hybrid fiber. The findings of the study were disseminated through research papers published in journals and key findings were submitted & presented to BIS code committees for revision of existing Indian Standards in field of concrete and construction.



Load-Deflection and Load-CMOD curves

Development and evaluation of Reinforced Geopolymer Concrete for its mechanical and durability properties

Geopolymer concrete is seen as an alternative to the conventional OPC based concrete. The geopolymer concrete uses industrial mineral waste like fly ash and Ground Granulated Blast Furnace (GGBS) as a binder material in concrete. In the present study, around 60 mix trials were conducted for development of normal and high strength geopolymer concrete mix with varying proportion of GGBS and fly ash (GGBS: fly ash as 70:30, 50:50 and 30:70), by varying the total Na_2O (% by weight of total cementitious binder) from 5% to 9% and keeping activator modulus (ratio of SiO_2 and Na_2O) as 1 and varying water to binder ratio to achieve mixes of required strength and desired level of workability. In present study, Sodium Hydroxide (NaOH) and Sodium Silicate (Na_2SiO_3) were used as chemical activators for development of

normal and high strength geopolymer concrete mixes. The finalized geopolymer concrete mixes were evaluated for fresh properties of concrete (slump and air content) along with mechanical properties of hardened concrete such as compressive strength, flexural strength, split tensile strength, Modulus of elasticity, drying shrinkage, etc. Performance of geopolymeric concrete mixes was also evaluated for their long-term durability behaviour in terms of accelerated carbonation, rapid chloride penetration test, chloride diffusion, water permeability, abrasion resistance, sorptivity, etc. Reinforced geopolymer concrete beams (both normal and high strength) were cast to study their behaviour in flexure and shear. The flexural performance of conventional and geopolymer concrete was observed to be comparable in 4-point bend test. The strength characteristics in terms of yield load and yield moment capacities were also comparable. This suggests that reinforced conventional and geopolymer concrete of equivalent compressive strength behave similarly in flexure.

Testing of reinforced geopolymer concrete beam to study its behaviour in flexure

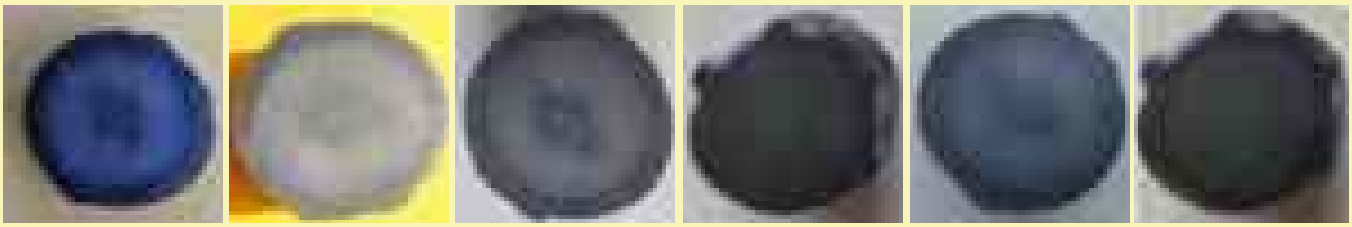
The load deflection curves of both the conventional and geopolymer concrete are similar suggesting no significant variation in the shear capacity of different concrete systems for same structural design and comparable compressive strength. The cracks patterns, crack width and number of cracks are more or less similar for both conventional as well as geopolymer reinforced concrete beams. Load deflection relationship and shear strength of geopolymer concrete beams were comparable with conventional concrete beams, but the cracking load corresponding to allowable maximum crack width decreases in geopolymer concrete beams. The measured experimental ultimate shear strength of tested beams for both conventional and geopolymer RC beams is higher than that of design code equations of IS:456-200 and EuroCode EC-2: 2004.

Crack patterns in flexure for M40 RCC and RGC beams & M70 RCC and RGC beams

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

Spalling of concrete can initiate at the temperatures as low as 250–300°C as a function of concrete porosity due to high water vapour pressure, in the form of a sudden detachment of concrete. As concrete spalling occurs, the reinforcement bars are exposed directly to fire conditions, which may lead to significant loss in member strength. Currently there is limited data on indigenously made reinforcing bars. In the present research work, the effect of temperature on mechanical performance of reinforcing bars is being studied on different brands of steel and different commonly used diameters. The selection of reinforcing bars consists of bars from both primary and secondary manufacturers. TM-ring test method has been performed to check the Cross-Sectional Phase Distribution (CSPD) of TMT/QST steel rebars.

Cross sections of different brands of TMT bars obtained from Ring TestThe residual mechanical properties of reinforcing bars of different brands has been evaluated at 500°C, 750°C and 1000°C. The tensile strength, yield strength, percentage elongation, tensile strength to yield strength ratio is being compared with codal values and models available in literature for reinforcing bars exposed to elevated temperature. Effect of temperature on micro-structure of reinforcing bars is being studied for different brands. Microstructure of samples heated to beyond 750°C revealed that outer martensitic rim completely disappears and microstructure throughout cross section gets transformed into ferrite and austenite. Further studies on different brands of steel at elevated temperature and its performance on flexure and shear behaviour have been planned.



Brand A **Brand B** **Brand C** **Brand D** **Brand E** **Brand F**

The residual mechanical properties of reinforcing bars of different brands has been evaluated at 500°C, 750°C and 1000°C. The tensile strength, yield strength, percentage elongation, tensile strength to yield strength ratio is being compared with codal values and models available in literature for reinforcing bars exposed to elevated temperature. Effect of temperature on micro-structure of reinforcing bars is being studied for different brands. Microstructure of samples heated to beyond 750°C revealed that outer martensitic rim completely disappears and microstructure throughout cross section gets transformed into ferrite and austenite. Further studies on different brands of steel at elevated temperature and its performance on flexure and shear behaviour have been planned.

MINING, ENVIRONMENT, PLANT ENGINEERING & OPERATION

Development of Transfer Chute for Handling Solid Alternative Fuels

The Indian Cement Industry is actively working towards achieving net-zero CO_2 emissions by 2070, with a focus on integrating Alternative Fuels (AFs). However, challenges have emerged in handling AFs, particularly in transfer chute operations, posing environmental, quality, logistical and safety concerns. A survey conducted in 2019-20 across the industry revealed that 78.7% of respondents faced transfer chute issues, mainly jamming. Reasons included unsuitable chute designs, insufficient knowledge about material flow and unexpected introduction of new materials. These issues led to significant maintenance efforts and operational disruptions. Based on the survey result, NCB initiated an R&D project addressing chute jamming, employing site visits, discussions, and Discrete Element Modelling (DEM) simulations based on material properties and operational parameters.

Ensuring the accuracy of the DEM model involved calibration through CAD calibration models aligning it with real-world conditions. Post-calibration, the existing transfer chute design underwent DEM simulations for 14 scenarios involving AFs. Results identified significant concerns with the traditional design, forming the basis for an improved model. Subsequent DEM simulations evaluated various designs, and adjustments were made to enhance performance and address identified issues.

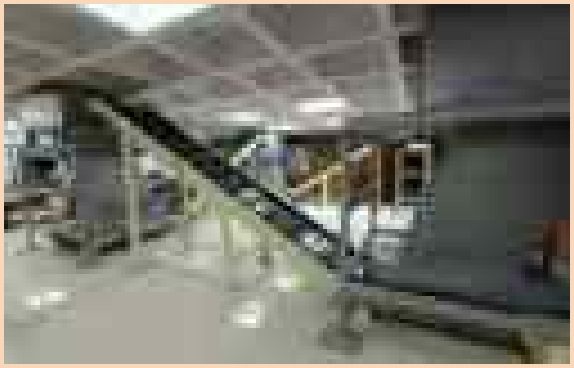
Fine-tuning DEM parameters aimed at achieving model accuracy. The final design parameters, obtained after adjustments and simulations include a chute valley angle of 70°, minimum chute width of 4.3 to 4.5 times the lump size, minimum chute hood height at the entrance (0.6 times belt width) and a transfer chute cross-sectional area 10 to 11 times the material stream's cross-sectional area. Selected liners for the chute were UHMWPE.

Simulation results & development of Meta-Particles

Based on the above parameters obtained, an experimental setup with four transfer chutes and belt conveyors was established at NCB's Ballabgarh premises. Nineteen (19) AF samples from various cement plants were tested at different mass flow rates (3, 5, 8, 10, and 15 tph) and moisture content levels (0.18% to 45%). After a total of 261 operational hours, the experimental setup demonstrated no instances of jamming in the transfer chute, validating the effectiveness of the improved design.

In the event of a jamming incident, the inventive flexible arrangement implemented in the transfer chute design (patent filed by NCB) has proven highly efficient in rapidly resolving blockages caused by solid AFs. This innovative approach clears blockages in just 6-8 minutes, a remarkable improvement compared to the conventional method that typically requires a lengthy 85 to 105 minutes to resume operations.

Pictures below show the general arrangement of the experimental setup and glimpses of experiments:



General Arrangement of experimental setup

Experiments conducted using the experimental setup

Process Integration of high ash Refuse Derived Fuel gasification in cement manufacturing process

65 million tonnes of waste are generated annually in India of which over 62 million tonne is the share of Municipal Solid Waste (MSW). Only about 75-80% of the municipal waste gets collected and out of this only 22- 28% is processed and treated. The remaining MSW is deposited at dump yards. With population explosion and urbanization, this trajectory is expected to reach 165 million tonnes by 2031, and further add up to 436 million tonnes by 2045.

RDF is a form of MSW that has been sorted and subject to basic processing treatment. RDF roughly comprises of 15-20% of MSW. As per the current scenario, the availability of RDF, considering the proximity of cement plants in India, is estimated to be around 13600 tonnes of RDF per day, equivalent to 4.96 million tonnes per annum. Indian cement industry has improved to around 7 % thermal substitution rate (TSR) and is targeting to achieve 30 % TSR by 2030. Currently, all high TSR plants (14-30%) are using RDF & plastics as major fuel with 69 % share in quantity.

The maximum thermal substitution rate (TSR) achieved through RDF is 80-100 % in the calciner, while it is limited to 50-60% in the kiln burner. Different AF pre-combustion technologies, advancements in multi-channel burners and new satellite burners have supported high TSR worldwide. However, the cement industry still faces fundamental operational issues such as high CO and incomplete combustion, increased specific heat consumption, reduced flame temperature, jamming and buildups. Improper segregation, low calorific value, high chloride content, cost fluctuations and poor characterization facilities leads to an inconsistent quality altogether affecting the production and quality. Higher RDF utilization sometimes require kiln bypass system which along with pre-processing also adds up as an additional cost.

RDF gasification can pose as a promising solution to eliminate operational issues. Gasification is the thermal conversion of carbonaceous matter into a syngas by partial oxidation. This reaction has two products: a combustible gas called syngas and inert ash or char. Syngas can be directly burned in the calciner/kiln with minimal prior cleaning. Syngas has better combustion properties in the calciner than even small size solid waste directly fed to the calciner. Moisture will participate in gasification reactions to a certain extent and increase the NCV of syngas by contributing to H2 production through water gas shift reaction. NCV variations of the input fuel mix (coal and syngas) are reduced substantially due to consistent syngas composition. Moreover, it offers better clinker quality due to no additional ash in the clinker. No ash absorption by clinker can also facilitate the usage of marginal and low-grade limestone. Thus, a hard-to-burn fuel can be made easily combustible. Gasification integration with the cement industry will help achieve the target of 25% TSR within the timeframe. The GOI has set a target of 100 million tonnes of coal gasification by the year 2030. This will also facilitate co-gasification of coal and waste, having the advantage of improved syngas quality.

There can be different configurations for integrating the gasifier with the pyroprocessing system. A way of ash utilization can be an alternative raw material. The syngas can also prove to be very helpful in white cement manufacturing. As per IS 8042, the iron content in white cement should be less than 1% and the degree of whiteness should be greater than 70%. As syngas has no residual ash, the whiteness index and iron content can be easily maintained.

National Council for Cement and Building Materials (NCCBM) in collaboration with the Birla Institute of Technology (BITS) Pilani-Pilani campus carried out experimental runs in a downward draft gasifier for RDF gasification and RDF-biomass mix cogasification. RDF contains ash in the range of 30-50%. A multizone gasifier model was developed for RDF gasification having four zones, i.e., drying, pyrolysis, oxidation/combustion and reduction/gasification. A stoichiometric approach was followed for modelling the drying, pyrolysis and combustion zone. The reduction zone was modelled as a cylindrical fixed bed reactor with a uniform cross-sectional area. The developed differential equations were solved using simulation software to predict the producer gas properties. Further, to study the integration of gasifier with calciner, a stoichiometric based model has been developed for calciner along with material and energy balance which predicted calciner outlet temperatures, gas composition, SO_2 and CO_2 for coprocessing of producer gas as an alternative fuel in white cement plant replacing petcoke at 15% TSR.

Gasification experiments were performed with RDF fluff and RDF pellets as feedstock and air as gasifying agents. The gas yield ranges from 2.43-3.65 Nm/kg RDF with LHV of 1.87-2.24 MJ/Nm3 RDF and cold gas efficiency of 44-60%. It was observed that RDF containing high ash content in the range of ~31-51% is quite challenging to gasify in a downdraft-type gasifier with operational bridging and clinker formation issues. Upon adding O2 to air as a gasifying agent, LHV and CGE increased by 78% and 30%, respectively further, more experimental runs were carried out using RDF and biomass mix in different ratios using air as a gasifying agent. RDF-biomass mix co-gasification results are better than RDF gasification in terms of LHV and CGE. Upon adding O2 to air as a gasifying agent for a 50:50 RDF-biomass mix, LHV and CGE increased by 35.5% and 8.35%, respectively.

The proposed multizone gasifier model can predict the output of each zone satisfactorily since the model assumptions are more realistic and cater to the heterogeneous nature of RDF. The impact of equivalence ratio (ER), moisture content and reduction zone length on the performance of the gasifier are evaluated. For calciner modelling at 15% TSR, the model predicted the calciner outlet temperature accurately compared to the baseline scenario (100% petcoke firing). Considering the biogenic content in RDF, CO_2 mitigation potential due to RDF utilization as producer gas is estimated to be 10.5% of the baseline scenario at 15% TSR.

RDF gasification stands out as a transformative approach to address operational challenges encountered in maximizing RDF utilization. By converting RDF into a syngas, this method provides several advantages apart from overcoming the current operational challenges during co-processing of RDF in cement

production. The experimental runs and modeling efforts conducted in this research explore the viability of RDF gasification as a game-changing solution. This aligns well with India's broader environmental, energy and waste utilization objectives, positioning RDF gasification as a sustainable and efficient means of addressing the growing issue of solid waste while contributing to the country's sustainability goals.

Solar thermal treatment of phosphogypsum and its impact on the mineralogical modification for effective utilization in cement production

Gypsum is a key component in cement because it plays vital role in controlling the setting behavior of the cement. PG is a chemical gypsum, contains substantial amount of SO_3 and has the potential to replace mineral gypsum in cement. PG acts as super retarder by extending cement setting process. The retardation property of PG calcinated at 250–550 ◦C was investigated by taking around 5% of resultant PG in cement. All the samples were characterized by chemical analysis, X-ray diffraction and isothermal calorimetry. No significant variation of phosphate content was observed in untreated and thermally treated samples. Mineralogical characterization showed that the phosphate was converted into inert form at and above 350◦C. The retardation behavior of PG in cement was studied by using isothermal calorimetry and observed that it was reduced in treated samples than untreated sample. Solar thermal treatment at optimized temperature of PG was performed and the resultant PG exhibited shorten setting time than the untreated PG in cement.

A homogeneous clinker sample was collected from a cement plant in India, after ensuring the proper process and quality control conditions of the plant. Phosphogypsum was collected from a typical phosphoric acid plant in India. Chemical composition of clinker and PG samples was determined as per Indian Standard procedures, IS 4032–1985 and IS 1288–1982 respectively. Mineralogy of the collected samples was evaluated by Rigaku smart lab XE X-ray diffractometer. X-ray tube of copper target with Nickel filter, i.e., Cu-Kα radiation of wavelength 1.5406 Å was used as source. X-ray tube was operated at 40 kV and 50 mA. Samples were scanned in the 2θ range of 10–80◦, with step size (2θ) of 0.02◦ and scan step time of 0.15 s. Samples were ground to pass through 45 µm sieve and taken up for XRD analysis. Initial thermal treatment of PG was carried out in a laboratory muffle furnace in the temperature range of 250 ◦C up to 550 ◦C with a step of 50 ◦C and 20 min retention time. These samples were termed as PG-250, PG- 300, PG-350, PG-400, PG-450, PG-500 and PG-550. Loss of ignition (LOI) of the PG was tested at 950±25 ◦C and combined water of the same was evaluated at 230 ◦C. Phosphorous content was estimated as per IS 12423-1988 by taking 0.2 g of sample in a platinum crucible. 1 mL of water and 5 mL of HF solution were added to the crucible. It was placed on hot plate till the solution became dry and then 2 mL of concentrated nitric acid & 5 mL of picric acid were added. Again, it was kept on hot plate till white fumes evolved. Then the resultant mixture was cooled. It was filtered into a 100 mL volumetric flask along with 3–4 times of washing with distilled water. 5 mL of citric acid and 2.5 mL of ammonium vanadomolybdanate were added to filtrate and made up the final solution to 100 mL. A blank sample was also prepared by following same procedure without adding sample. Optical density was measured at 426 nm using UV–Vis spectrophotometer. The net value of optical density of the solution was calculated by subtracting the value of blank and then percentage of phosphorus calculated as follows.

$$\text{Phosphorus\%} = (\text{concentration in ppm} \times 1^{-6} \times D \times 100 \times 100)/\text{weight of sample.}$$

The mechanical properties such as normal consistency, setting time, compressive strength at 1, 3, 7 and 28 days of cement samples were carried out as per IS 4031.

The thermal treatment of phosphogypsum from the conventional energy sources like electric heating, combustion of fossil fuels etc. can lead to emission of direct or in-direct Green House Gases (GHG). In order to avoid additional GHG emission from thermal treatment of PG, a novel approach of using solar radiation was adopted for generation of thermal energy. The objective of the experiment is to supply thermal energy for PG calcination through non-concentrated solar thermal technology. Scheffler dish was chosen for the purpose which maintains a fixed focus with single axis tracking mechanism. The average solar radiation (DNI) during the test period was 800 W/m^2. 350 g of phosphogypsum sample was placed inside a cylinder having an agitator for proper mixing and uniform heating. The cylinder was placed in front of the Scheffler reflector to allow solar radiation to directly fall onto it as shown in Fig. 1a and b. Thermocouples were inserted to monitor the temperature. The experiment was conducted for about 90 min to reach a temperature of 350 ◦C inside the cylinder. The impurities in PG behave as super retarder and bring retardation in the setting process of cement. XRD investigations of PG sample shows that the phosphate is in the form of calcium hydrogen orthophosphate/brushite. PG-250 shows the conversion of calcium hydrogen orthophosphate to brushite. PG-300 samples show the conversion of brushite to phosphorous pentaoxide. PG-350 shows further conversion of phosphorous pentaoxide into pyrophosphate.

Scheffler reflector

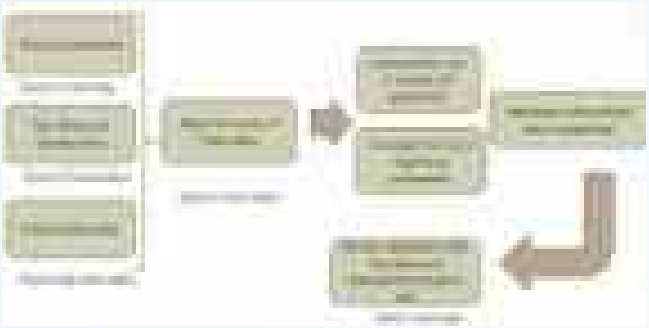
Experimental setup

The similar form of pyrophosphate mineral is observed in PG-400 to PG-550. Hence, the thermal treatment of PG samples at and above 350°C forms an inert form i.e., pyrophosphate. Isothermal calorimetry investigations of OPC-PG-350 to OPC-PG-550 shows less retardation (induction period duration equal or lower than 3 h 30 min) and increases rate of acceleration reaction than OPC-PG. XRD and Isothermal data correlated with each other in the reduction of retarding characteristics of OPC with PG-350 to PG-550. Hence, the reduction of retardation is due to the conversion of soluble form of phosphate such as calcium ortho phosphate/brushite/P2O5 into inert form (pyrophosphate). The minimum required temperature for utilization of PG as a retarder is confirmed by above studies as 350°C. Mineralogy and retardation properties of solar treated PG sample and OPC-SPG performance results are in line with the laboratory furnace results. OPC-SPG sample shows reduction of retardation properties against the OPC-PG. The utilization of phosphogypsum (PG) as a retarder in place of mineral gypsum is an economic and ecological for cement industry. This study will be the basis for future research to develop large industrial scale solar thermal set up in cement plants or phosphoric acid plants to utilize the PG as a retarder. However, the radioactive behavior of PG should be considered during its utilization.

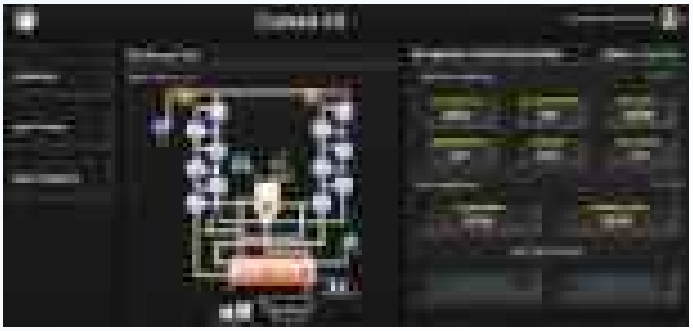
Improvement in clinker quality and increase in % TSR by the application of Artificial Intelligence

The Centre through its program of Advanced Fuel Technology (AFT) signed a tripartite agreement was signed with M/s Livnsense Technologies Pvt. Ltd. and M/s J K Lakshmi Cement to develop forecasting models to enhance TSR through liquid alternative fuel in the cement plant. JKLC is using 1-2 m^3/hr of liquid hazardous waste from different sources and looking to enhance its utilization by 20-25%. The objective is to forecast the average cyclone 6 temperature (old & new) & new cyclone 6 outlet CO at every 5 min interval which will support CCR operator to increase the liquid AF flow rate. Accordingly, 5 months historical kiln and quality data was collected on kiln operation for Line-2. M/s Livnsense Technologies Pvt. Ltd. developed a prediction model and NCB as a domain expert supported in data cleaning and feature engineering to select the features that are mostly correlated to TSR. Various supervised machine learning techniques were used to forecast the process parameters to assist CCR operator. Main coal tph, kiln feed, PH fan rpm, kiln speed, PC coal tph are some of the key identified input parameters for model development.

The forecasting model was developed and validated with real time data. The accuracy of developed model for temperature forecasting with 5 minutes' interval is ~95%. However, for outliers i.e. 5% values above +/- 9 deg C, the accuracy with 5 minutes' interval is around 50%. The model shall assist the CCR operator to do the necessary process changes (to take action immediately by changing the temperature set point within the PID loop) and ultimately support in decreasing the variations in process parameters and increased % TSR. A dashboard was developed for the forecasting model and deployed in plant CCR for continuous monitoring.



Model approach



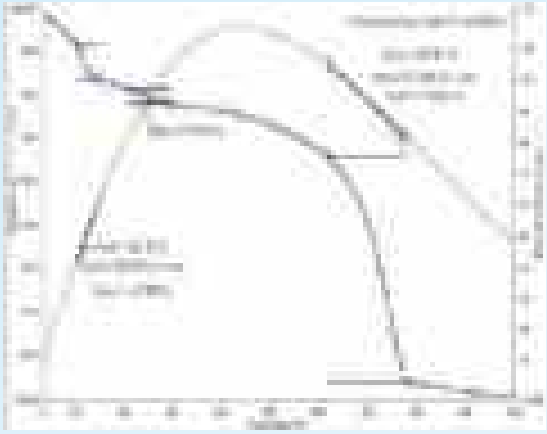
Dashboard for forecasting model

CEMENT RESEARCH AND TESTING

The Centre is involved in testing building materials samples, development of plant specific standards for calibration of XRF, assisting plants in designing Raw Mix to improve clinker productivity and in establishing Limestone Consumption Factor (LCF). The Centre provides its services through its NABL accredited laboratories located in Ballabgarh, Hyderabad and the latest one in Bhubneswar.

Investigation of Lump Formation in Cement Bags

NCB has successfully carried out investigations on lumps in cement bags for cement plant which approached for study of the same. The plant was facing the problem of lump formation in cement bags within 10 to 15 days of dispatch. NCB carried out complete chemico-mineralogical analysis starting from the raw materials, intermediate products and the finished product. All the process parameters along with the packing plant, transportation and the warehouse were thoroughly investigated. Based on the above studies recommendations were given and remedial measures and action plan was suggested. These recommendations and action plans have resulted in successfully solving the problem of lump formation in cement bags of the cement plant.

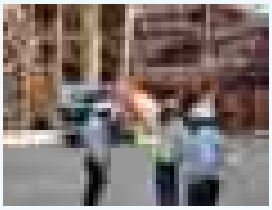


Thermal analysis of Cement Lump sample in OPC

Cement Bags (14Nos) stacked in warehouse

Establishing Limestone Consumption Factor (LCF)

The LCF establishes the limestone utilized from the captive limestone mines in production of cement. Also it estimates royalty payable to state for the limestone mined from their respective captive mines and 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 257 cement plants. During the year, LCF studies were completed for 17 cement plants from Madhya Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu, Assam, Meghalaya and Telangana.



Discussion with plant officials for LCF studies

Raw mix design

In this study, raw mix design was performed with 86-90.2 % of limestone, 5.4-6.0% of clay, 0-2.5% of laterite and 2-2.9% of AFR slag as a raw mix components. The potential C_3S percentage of above raw mix design was between 48-51% and the resultant actual mineralogy of lab fired clinker samples showed similar percentage of C_3S through XRD. The lab fired clinker samples shows less than 1.5% of free lime at 1450°C and thus the bulk clinker were prepared with the mix proportions of 90.2 % of limestone, 5.40 % of clay, 2.4% of laterite and 2.0% of AFR slag. The mineralogical investigations of bulk clinker shows < 1.5% of free lime and 55% of C_3S. The bulk clinker was used to prepare PSC, OPC and CC cement samples in laboratory ball mill at 300 m^2/kg fineness with around 3.0% SO_3. PSC sample was prepared with clinker, gypsum and GGBFS with 35% and 65% respectively. The composite cement sample was prepared with 55% of clinker and gypsum along with 20% of fly ash and 25% of GGBFS. All the prepared cements passed the limits BIS comfortably.

Discussion with plant officials during lab visit at NCB, Ballabgarh

Development of plant specific secondary standards for XRF calibration

Chemical analysis plays an essential role in controlling the manufacturing of cement, from the full analysis of raw materials to testing each stage of the process. In cement plants, all plant operations starting from mining to cement grinding are dependent on XRF analysis. Control of the basic reaction requires accurate analysis of calcium, silicon, aluminum, iron, magnesium and other constituents in the cementitious materials. Therefore, accuracy of XRF is very crucial for process as well as product quality control. Accuracy of XRF depends on the standards used for calibration. Standard Reference Materials are used for this purpose. Secondary standard is a compound/ chemical that has been standardized against a primary standard. Secondary standards are commonly used to calibrate analytical methods. Secondary standards are required as only limited primary standards are available (one to four) and range of the primary standards is not adequate, matrix and mineralogy may be different, evenly spaced samples across the calibration curve are not achieved. NCB has taken up studies for development of plant specific secondary standard materials.

The methodology followed by NCB for developing the plant specific secondary reference standards of XRF include technical support for collection of samples, preparation of representative sample, homogeneity confirmation, accurate chemical analysis by different standard methods, review of results & planning, technical support of calibration at plant and providing fusion bead samples. The study has been carried out so far for 16 cement plants covering 40 matrix. This year the study has been carried out for 8 cement plants from Karnataka, Uttar Pradesh, Madhya Pradesh, Chattisgarh, Maharashtra and Andhra Pradesh.

Assessment of Quality Control Laboratories of Cement Plant

Laboratory assessment studies, which include the visit to the laboratories, assessment of infrastructure & equipment, calibration of equipment, skill level assessment, providing necessary training & assisting the plant laboratories in getting the NABL accreditation was carried out by the Centre. These assessments have been provided for the cement plants in India and abroad. Till now these studies have been conducted for 6 cement plants.

Laboratory Assessment at Indian Cement Plants

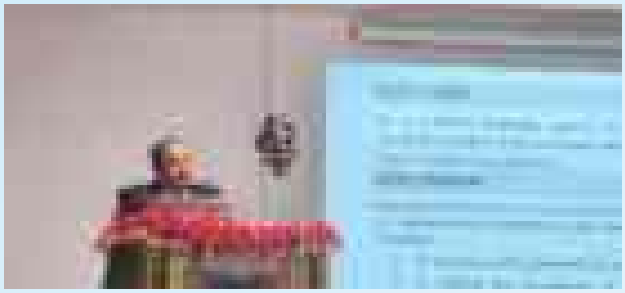
NCB, BIS & CMA joint visit to Sand Mines

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

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

BARC and UCIL jointly organised Theme meeting

A two member NCB team comprising of Sh Suresh Vaguri and Dr Toney Moses Rajan visited Jaduguda uranium mines, Jharkhand from 03rd to 06th Dec 2023 and also attended a Theme meeting organised jointly by BARC (Bhabha Atomic Research Center) and UCIL (Uranium Corporation of India Ltd). Jaduguda mines are the first uranium mines of India. These mines generate 7500 tons of tailing and seeks to have a solution. UCIL has similar sites in other states like Karnataka, Rajasthan, Telengana, etc. Dr Rajan presented a proposal for novel solution for utilization of mine tailings in cement and building materials which was appreciated by BARC and UCIL and have shown interest in working with NCB on this important socio-economic theme.



Presentation during the BARC-UCIL Theme meeting in Jaduguda, Jharkhand

International Training on X-ray Diffractometer

A 10-day training on X-ray diffractometer was organized by Rigaku Corporation Limited, Tokyo, Japan. A two-member team consisting of Sh Suresh Vanguri & Sh Gaurav Bhatnagar visited the training facility Centre of Rigaku at Tokyo from Oct 14 2023 to Oct 29, 2023. The training was co-ordinated by Akira Hachihama and imparted by Mr Miki Kasari. Introduction to powder X-Ray diffraction & Instrumentation, methodology of sample preparation of different matrices, operating procedures of XRD software (SMARTLAB Studio II), Search/ Match strategies & peak identification for quantitative phase analysis were discussed. Experiments with optimization of different measuring conditions viz. scan speed, step size, scan rate, incident slit size were performed with & without knife edge & filters.Impact of optimizing the said parameters on XRD results was also discussed. A hands-on training session was organized on sample preparation, equipment handling & software operations and working with different libraries such as ICDD, PDF 4+ and the Rigaku database for cement phase identification.

XRD trainers with NCB official in Rigaku, Japan

CONSTRUCTION DEVELOPMENT AND RESEARCH

Evaluation of activated GGBFS as an alternative to hydraulic binder for Tata Steel Limited

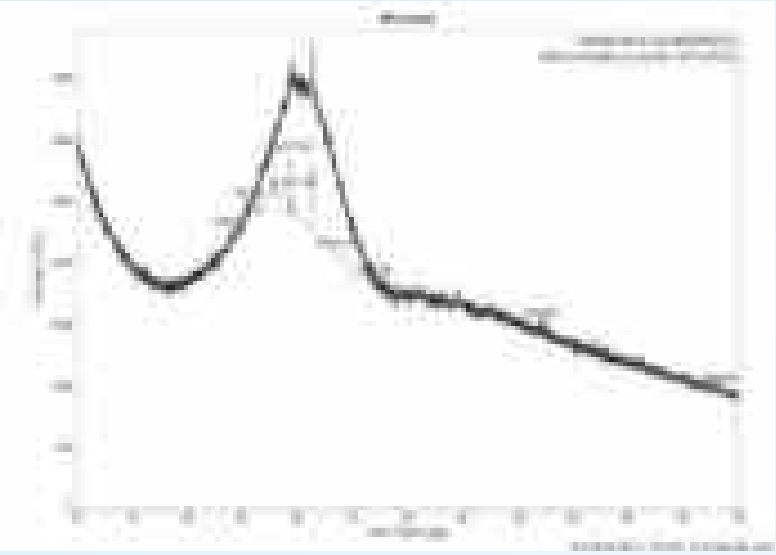
In line to the approach towards sustainability and net zero CO_2 emission, Tata Steel is working on improving the properties of GGBFS to enhance its application in cement and concrete applications. In that pursuit, Tata Steel Limited has developed an activated binder which is a combination of GGBFS and alkalis. GGBFS is activated through a proprietary blend of alkaline chemicals developed at their indigenous laboratory. To assess the performance of their alkali activated GGBFS as a cementitious binder in concrete, Tata Steel Limited approached NCB to carry out a sponsored R&D study on evaluation of activated GGBFS as an alternative to hydraulic binder. In this study, activated GGBFS binder was evaluated for its different physical and chemical characteristics as applicable for a hydraulic binder. Further, to assess its performance as a binder in concrete, concrete mixes were prepared at two water to binder ratios (i.e. 0.60 and 0.40) using activated GGBFS binder. The concrete mixes were evaluated for various fresh, hardened and durability properties of concrete and comparison was carried out with conventional concrete mixes, i.e., concrete made with OPC and concrete made with PSC. Preliminary investigation shows that compressive strength of activated GGBFS sample is lower than that of OPC 43 and PSC at all ages when tested in accordance to IS 4031. Compressive strength of concrete mixes at both water to binder ratios (i.e. w/c of 0.40 and 0.60) made using activated GGBFS binder are lower in comparison to compressive strength of mixes made using OPC 43 and PSC at all the ages.

This can be attributed to the lower compressive strength of activated GGBFS as a cementitious binder itself in comparison to OPC 43 and PSC. Durability aspect of concrete made with activated GGBFS is under progress.

Study on the use of Ferrochrome Slag as a coarse aggregate in concrete for Ferro Alloys Corporation Limited, a Vedanta Group Company

M/s Ferro Alloys Corporation Limited, requested NCB to take up the study which includes characterization of the coarse aggregate made from ferrochrome slag for various physical and chemical parameters in accordance to IS 383 requirements. In addition, ferrochrome slag was also characterized for mineralogical as well as microstructural parameters through optical microscopy. Toxicity study was also carried out. Fresh, hardened and durability properties of the concrete made with ferrochrome slag based coarse aggregate at replacement level of 30%, 60 % and 100 % (by volume) was compared with concrete made with conventional aggregates. From the study, it can be concluded that ferrochrome slag based coarse aggregates can be used as a replacement to natural aggregates. Mechanical behaviour of concrete made with ferrochrome slag based coarse aggregates was found to be either equivalent or better than that of concrete made with natural coarse aggregates. Durability results shows equivalent or better performance of concrete made with ferrochrome slag based coarse aggregate than the concrete made with natural coarse aggregates.

Evaluation of Granulated Blast Furnace Slag sand and study of its suitability to be used as fine aggregate for JSW Cement Limited



X-Ray Diffractogramme of powdered sample of GBFS sand

Presently, the use of Granulated Blast Furnace slag (GBFS) based aggregate as replacement of both coarse and fine aggregate is limited to 50% in plain concrete, 25% in reinforced concrete and 100% in lean concrete. Taking this into consideration, the possibility of increasing the current permissible limit of using GBFS sand by replacing conventional fine aggregate in concrete as specified in IS 383: 2016, NCB had conducted an experimental R&D study titled "Evaluation of Granulated Blast Furnace Slag sand as per IS 383: 2016 and study of its suitability to be used as fine aggregate" sponsored by JSW Cement Limited. In this study, GBFS sand was evaluated for physical and chemical parameters as specified in IS 383: 2016. Optical microscopy and X-Ray Diffraction (XRD) technique were used for the study of Petrographic and mineralogical analysis of GBFS sand respectively. To study the alkali aggregate reactivity of GBFS sand, accelerated mortar bar test as per ASTM C1260 and long term mortar bar test as per IS 2386: Part-VII was performed. Thereafter, the concrete mixes were cast at three different water to cement ratio (i.e. 0.60, 0.40 and 0.30) by replacing conventional fine aggregate at replacement levels of 0, 25%, 50%, 75% and 100% using GBFS sand and the concrete mixes were then evaluated for various fresh, hardened and durability properties of concrete.

The physical and chemical properties of GBFS sand meets the various requirements specified in IS: 383-2016 except alkali content which was found to be slightly higher than the permissible value. However, in particular, it did not have any adverse effect on volumetric change occurring in GBFS sand due to alkali aggregate reactivity as the expansion value was found to be less than 0.1 %. The hardened properties of concrete mixes containing different proportions of GBFS sand fine aggregates as replacement of conventional fine aggregates are either better or at least comparable to corresponding hardened properties of concrete mix made with conventional fine aggregates. Replacement of conventional fine aggregates with GBFS sand as fine aggregate with up to 100% replacement in a concrete mix does not have any negative or detrimental effect on the durability properties of concrete and the behavior of both control mixes and experimental mixes (containing GBFS sand as fine aggregate) are either better or comparable.

Study on the use of Electric Arc Furnace Slag (EAF slag) as a fine aggregate and coarse aggregate in concrete for Arcelor Mittal Nippon Steel (AMNS) Limited

In order to study the effect of EAF slag based coarse and fine aggregate on concrete properties, a detailed experimental study was conducted at various replacement levels of natural aggregates with EAF slag based coarse and fine aggregate. The study covered a broader spectrum that includes various fresh, hardened and durability aspects of the concrete made with EAF slag based coarse and fine aggregate. The properties of concrete made with EAF slag based coarse and fine aggregate was compared with conventional concrete, i.e., concrete made with natural aggregate. From the study that it was seen that EAF slag aggregates did not show adverse impact on the durability behaviour of the concrete. Durability performance of concrete made with EAF slag aggregates evaluated in terms of sulphate resistance, chloride resistance, carbonation and water penetration was found to be either equivalent or better than that of concrete made with natural aggregates. Based on the mechanical property as well as durability test results, EAF slag aggregates (coarse as well as fine) has the potential to replace natural aggregates. From the study, it can be concluded that it is possible to use 100 % coarse as well as fine aggregate made from EAF slag as a replacement to natural aggregate in concrete.

EAF slag and Conrac slag – coarse as well as fine

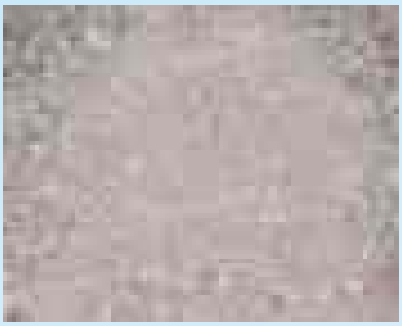
A comparative study between EAF slag and Conarc slag was also carried out. This mainly includes physical, chemical and mineralogical characterization of EAF slag and Conarc slag sourced from 2-3 steel plants located in different parts of the country. From the study, it was found that physical characteristics of aggregate made from EAF slag and Conarc slag are quite similar whereas chemical & mineralogical characteristics of EAF slag and Conarc slag are slightly different from each other. A draft specifications were also formulated that includes certain recommendation in terms of physical and chemical parameters for aggregate made from EAF and Conarc slag for its application in concrete that can be used for the revision of IS 383:2016.

Evaluation of processed LD Slag as per IS 383: 2016 and study its suitability to be used as fine aggregate for M/s JSW Steel Limited

To explore the feasibility of LD slag to be used as an alternative to conventional fine aggregate this study, processed LD slag utilized as fine aggregate in concrete production. The processed LD slag based fine aggregate was evaluated for physical and chemical parameters as specified in IS 386: 2016 for fine aggregate. Other studies such as petrographic and mineralogical analysis using optical microscopy and X-Ray Diffraction (XRD) Technique, evaluation of alkali aggregate reactivity using accelerated mortar bar test, evaluation of free lime and magnesia content using XRD was done. Volumetric expansion study was also carried out to understand the potential expansion which may occur due presence of free lime and magnesia content in LD slag based fine aggregate. The procedure described in Annexure E of IS 383: 2016 is suitable for coarse aggregate and cannot be directly applied to fine aggregate. Therefore, a suitable testing methodology was developed based upon maximum packing fraction in the sample. The study was carried out at two w/c ratio (i.e. 0.65 and 0.40). Conventional fine aggregate was replaced by LD slag based fine aggregate at a replacement levels of 0, 25%, 50%, 75% and 100%. The concrete mixes were studied for different fresh, hardened and durability properties.

The physical and chemical properties of processed LD slag fine aggregate meet the various requirements specified in IS: 383-2016 except soundness (volumetric expansion due to free lime and magnesia). The hardened properties of concrete mixes containing different proportions of processed LD slag fine aggregates as replacement of conventional fine aggregates are either better or at least comparable to corresponding hardened properties of concrete mix made with conventional fine aggregates. The durability properties of such mixes are also almost comparable and similar. Volumetric expansion studies for evaluation of potential expansion occurring due to presence of free lime and magnesia in LD slag fine aggregates showed that expansion in case of LD slag fine aggregate is in excess of 3% and is significantly higher than that of standard sand and commercially available crushed sand. Based on studies conducted on fresh, hardened and durability properties of concrete mixes (by replacing conventional fine aggregates with processed LD slag fine aggregates), LD slag fine aggregate has been found suitable for its use as

fine aggregate in reinforced cement concrete. However, suitable weathering techniques (for example: LD slag fine aggregate sample can be passed through a chamber of hot water for a certain duration of time) shall be adopted to bring down the free lime and magnesia content in processed LD slag fine aggregate for its wide application as fine aggregate in reinforced concrete structures.



Processed LD slag as fine aggregate

XRD diffractogramme of powdered sample of processed LD slag

Structural Assessment and Rehabilitation (SAR)

SAR group routinely undertakes sponsored projects on condition assessment of concrete structures, Non-Destructive Testing of concrete, consultancy and supervision works for repair and rehabilitation of concrete structures. In the last year, a number of important projects were undertaken for prestigious clients both from the government and private sector. Some key projects are briefly discussed hereunder:

- NCB carried out detailed condition assessment of residential multi-storied towers for NHAI and submitted a detailed report on condition assessment with recommendations on repair and rehabilitation. This included design of the cathodic protection system for the RCC elements of the residential towers and preparing a detailed cost estimate and bill of quantities for the same. NCB is currently providing consultancy services for the repair and rehabilitation work for NHAI and also providing consultancy services for implementation of cathodic protection at the site for corrosion mitigation.

NCB Team carrying out Pull-off test on repaired columns and checking electrical continuity of installed anodes at NHAI site

- NCB has investigated fire damaged building structure at AIIMS and has provided consultancy services for repair and rehabilitation of the structure. Techniques such as TG - DTA, XRD analysis were made use of in investigating the structure.

NCB Team carrying out investigation at a fire damaged structure at AIIMS

- NCB is carrying out condition assessment of RCC structures of power plants at NTPC Korba and NTPC Singrauli and many more such projects are in the pipeline.

NCB Team carrying out Non-Destructive Testing at FD fan foundation structure at NTPC Singrauli

Construction Technology and Management

NCB provides Third Party Quality Assurance services for a wide range of construction projects such as buildings, convention centres, flyovers, dam, barrage, roads, bridges & tunnels, construction utility projects, special construction activities like pre-engineered steel structures, etc. built by various central / state / autonomous organizations across India through its units located at Ballabgarh, Hyderabad, Ahmedabad and Bhubaneswar. NCB uses state-of-the-art techniques / methods to perform inspections that reduces risk and ensures quality of construction. The scope of TPQA includes inspections, lifting & testing of samples, witness of field & laboratory testing done at site / fabrication yard, review of quality system and documents including Non-Destructive Testing (NDT) wherever applicable.

Two most prestigious projects of national importance looked after by NCB are "**Bharat Mandapam**" an international exhibition and convention centre under Indian Trade Promotion Organization (ITPO) and "**Yashobhoomi**" an international convention centre under India International Convention Centre (IICC).

Bharat Mandapam, an international exhibition and convention centre under Indian Trade Promotion Organization (ITPO) Delhi

Yashobhoomi, an international convention centre under India International Convention Centre (IICC), Delhi

TPQA Team of NCCBM carrying out inspection at Yashobhoomi Convention Centre Site, IICC, Dwarka

Development of Geopolymer Reinforced Concrete (GRC) and its evaluation including durability study and development of basic design parameters including construction of a demonstration structure for M/s JSW Cement Limited.

This is an experimental work which involves the development and evaluation of RGC (Reinforced Geopolymer Concrete) mixes for their mechanical and durability properties along with quality inspection, quality assurance and health monitoring of a demonstration structure. This project was taken up based on the earlier R&D project on development and evaluation of Reinforced Geopolymer Concrete and its evaluation carried out by NCB.

In the 1st part of the project, development and evaluation of RGC was carried out. The 2nd part of the project involved durability studies on the developed reinforced geopolymer concrete specimens. The 3rd and final part of the project is currently underway and covers design and development of experimentation scheme, Quality inspection and assurance, load testing of structural element and further health monitoring. The design, development and experimentation scheme has already been worked out and a single storied demonstration structure made of reinforced geopolymer concrete with the developed mixes has been cast at site. Load testing on the slab has been carried out.

In the next stage, non-destructive testing will be done on the structure for its health monitoring and the results of load testing and non-destructive testing (NDT) will be compared with that of load test testing and

NDT carried out on a similar structure made of conventional concrete of the same grade.

Batching plant setup for production of geopolymer concrete

Reinforced slab structure with embedded strain gauges before concreting

Load testing with sand-filled bags in progress on the RGC slab structure

Construction Development and Research at NCB Hyderabad

Structures were investigated for various clients viz., NTPC & NSPCL plants, PGCIL, NMDC, BDL, NRSC, Bank of Baroda, Singareni Collieries Company etc. TPQA services have been provided to enhance the program's effectiveness and opportunities for innovation in construction industry for construction projects such as institutional buildings, residential buildings, skill development centers, hostel blocks, Exhibition halls etc. in southern & central states viz., Telangana, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. The Centre is associated with various Central/ State/ Autonomous Organizations in delivering durable buildings and structures to meet specified quality standards by ensuring quality workmanship, good construction practices, use of quality materials etc. and inspections are done in accordance with ISO/IEC 17020:2012 Type 'A' Accreditation Standards. TPQA services have been provided for various clients Tamil Nadu Trade Promotion Organization (TNTPO), IISc Bangalore, CPWD (Chennai, Bangalore & Pune) projects. Testing & evaluation of concrete making materials and conducting various grades of concrete mix proportions, using different types of cements like OPC, PPC, PSC and different kinds of aggregates to enhance durability including analysis and interpretation of test results for Civil works for various central/state/PSUs/Private organizations was taken up.

Construction Development and Research at NCB Ahmedabad

The unit has essential facilities for testing cement, concrete, steel and soil and provides Quality Assurance and Quality Control (QA-QC) and TPQA services to the construction industry. Facilities include Universal Testing Machine (UTM), Automatic Compression Testing Machine (ACTM), Physical Testing Laboratory, Soil Testing Machine and Non-Destructive Testing (NDT) equipment such as Concrete Core Drilling Machine, Rebound hammer, Ferroscan & Ultrasonic Pulse Velocity Test (UPV) etc. The 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 and Nagar Haveli. The unit is ISO 9001: 2015 certified and has ISO 17025:

2017 accredited testing laboratories providing testing facilities & services.

Testing Facilities & Services

- Tests on Cement and Cementitious Materials.
- Aggregates – Complete physical analysis.
- Concrete Mix Design for standard concrete, self-compacting concrete and high strength concrete.
- Physical properties of reinforcement steel.
- Testing for uniformity properties of chemical admixtures.

Structural Assessment & Rehabilitation Services Offered

- In-situ quality assessment and durability investigation of concrete structures.
- Non-Destructive Testing of concrete structures.
- Distress investigations of buildings, bridges, dams, power plants, chimney, etc. deteriorated due to aggressive environment or fire damaged structure.
- Consultancy for repairs/rehabilitation & retrofitting.
- Testing for uniformity properties of chemical admixtures.

Construction Technology & Management Services Offered

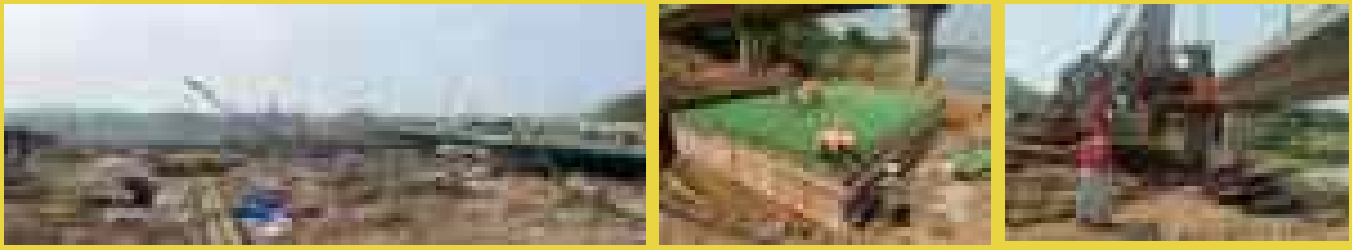
Technical Audit (TA), Quality Assurance & Quality Control (QA/QC) and Third Party Quality Audit (TPQA) of new constructions- residential, commercial & institutional buildings; flyovers, concrete roads, bridges etc.

Some important sponsored projects taken up by NCB-A recently include:

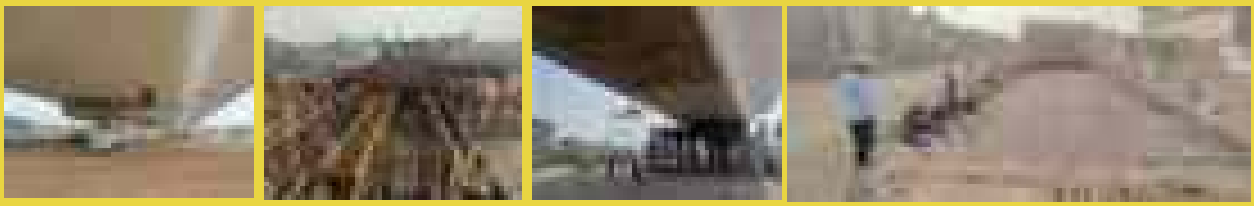
- Third Party Inspection and Monitoring (TPIM) for the work of Construction of High Level Bridge across river Damanganga at Athal on Silvassa Naroli Road (EPC Mode) in the District of UT of Dadra & Nagar Haveli (D&NH), Silvassa.
- Third Party Inspection and Monitoring (TPI-M) for Quality Assurance and inspection of materials for construction of fly over bridges at two major junctions of ring road stretches forming at Dokmardi (Point f) on Silvassa Kilvani road and at Point C crossing Silvassa Sayli road in UT of Dadra & Nagar Haveli.
- Condition Assessment using Non-Destructive Evaluation Technique for various Load Bearing Building structures of Bank's Residential Colony at Navrangpura, RBI, Ahmedabad

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

Honorable Minister Shri Praful Patel administrator of the Union Territory of Dadra and Nagar Haveli and Daman and Diu and the Union Territory of Lakshadweep visited at site.



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



Third Party Inspection and Monitoring (TPI-M) for Quality Assurance and Inspection of Materials for Construction of fly over bridges at two major junctions of ring road stretches forming at Dokmardi (point f) on Silvassa Kilvani road and at point c crossing Silvassa Sayli road in UT of Dadra & Nagar Haveli

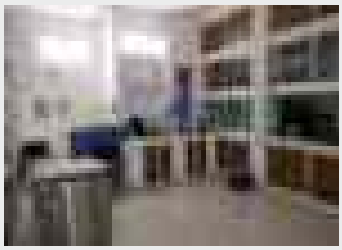
Construction Development and Research at NCB Bhubaneswar

NCB Bhubaneswar- site office cum laboratory was established in 2016 in the State of Odisha and was set up on in a space provided by IDCO at Mancheswar Industrial Estate as per the MoU signed between NCB and IDCO. Accordingly, NCB has established material testing laboratory in the above space referred as Independent Testing Laboratory (ITL) NCB Bhubaneswar and the same has been accredited by NABL for both Mechanical & Chemical parameters in testing of building materials during 2020-21.

The Chemical Laboratory has been established to provide technical support to cement industries in Odisha and its neighbouring states i.e. West Bengal, Jharkhand, Bihar, Chhattisgarh and States of North-East India. ITL services currently opted by organisations like IDCO, H&UD, OBCC, CPWD, NTPC, RITES, NBCC, Paradip Port Authority, Bridge & Roof etc. & cement manufacturing plants in Odisha and neighbouring states.

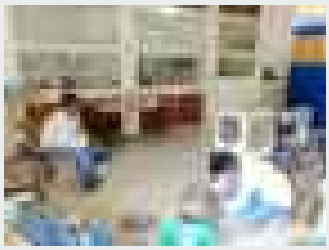
Mechanical Testing Laboratory is available for hydraulic cement, hardened concrete, building bricks (burnt clay & lime pulverized fuel ash), coarse aggregate, fine aggregate, soil, bituminous mix, tiles, granite, kota stone, marble, paver blocks, AAC blocks, etc.

NABL Accreditation for the laboratory was obtained during September 2020 and accreditation is renewed continuously current accreditation valid up to 27.03.2025.

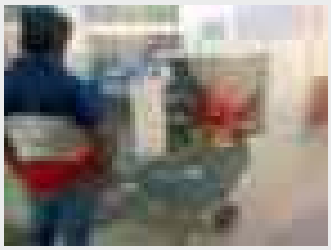


View of Cement Testing Laboratory

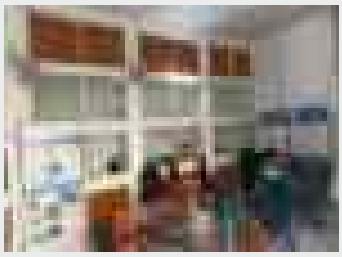
View of Concrete Mix Design Laboratory

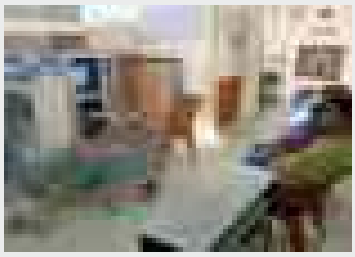


View of Soil Testing Area

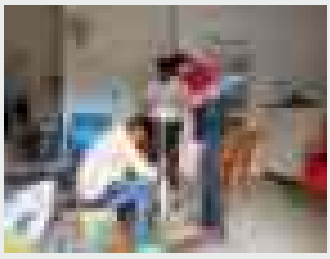


View of Concrete Testing Laboratory





View of Building Materials Testing Laboratory



MDD & OMC Testing of Soil

Competency enhancement through training

Third Party Quality Assurance (TPQA)

TPQA Services, on sponsored project basis, are currently provided to various clients like M/s NBCC, M/s OSRTC, M/s PPA etc. The TPQA inspection is being carried out by NCB Team at OSRTC site under "AMA BUS STAND" Scheme.

Department of Civil Engineering
Indian Institute of Technology Delhi

National Council for Cement
and Building Materials

Department of Civil Engineering
Indian Institute of Technology Madras

National Council for Cement and Building Materials (NCB) along with IIT Delhi and IIT Madras, has successfully won the bid to host the 17th edition of prestigious International Congress on the Chemistry of Cement (ICCC) in India in the year 2027 for the second time after 1992. India's leading research and academic institutes, NCB along with IIT Delhi successfully presented the India's bid before the Steering Committee members of the Conference during the ongoing 16th ICCC at Bangkok, Thailand. Besides India, other bidders were from Switzerland and UAE. The decision was announced on 20th September 2023 at Bangkok, Thailand during the 16th ICCC. The Indian bid was presented by Dr L P Singh, Director General, NCB, Dr S K Chaturvedi, Joint Director, NCB and Dr Shashank Bishnoi, Professor (Civil Engg.), IIT Delhi.

The International Congress on the Chemistry of Cement is the largest and most prestigious event of its kind which reviews the progress of research in the area of Cement and Concrete. The congresses have been held generally at intervals of four to six years since 1918, providing a strong and fruitful link between the academic world and the cement industry. The 9th Congress was organized at New Delhi in 1992 by NCB and the 16th ICCC was recently held at Bangkok, Thailand in September 2023.

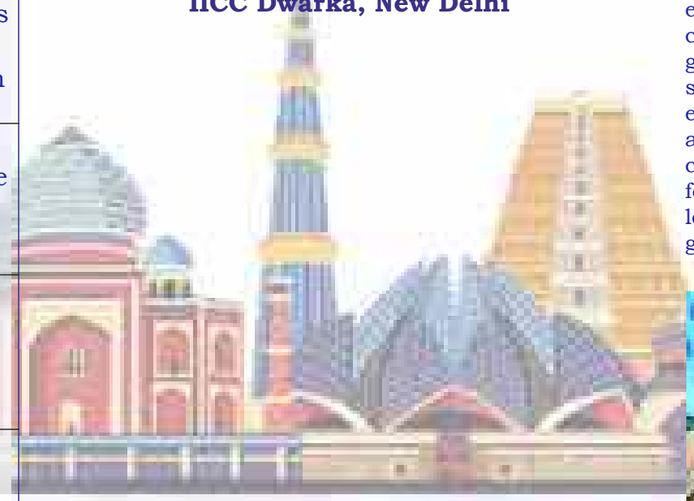
Hosting this esteemed event in India provides us with a unique opportunity to bring together the leading leaders, experts, and innovators in cement sector from around the world. This event is not only a testament to our research and academic organization's capabilities but also a chance to showcase our vibrant city New Delhi to the global cement and concrete industry. New Delhi, as a host city, will be poised to offer an unforgettable experience to all attendees of 17th ICCC in 2027 with its world-class conference facilities like Bharat Mandapam and Yashobhoomi, rich cultural heritage, and exceptional hospitality.

The proposed theme of 17th ICCC 2027 is "Achieving Sustainability and Carbon Neutrality in Cement and concrete" and is expected to be organized in the month of November 2027 at Yashoo Bhumi, India International Convention and Expo Centre (IICC), Dwarka, New Delhi. The congress will be focussed on cement chemistry and various topics related to cement and concrete will be covered like:

Advances in Clinker Chemistry	New Developments in Chemical Admixtures and Rheological Studies
Advances in Cement Process Technology	Durability and Service life of Concrete Structures
Circular economy and alternate raw materials	Concrete Deterioration Mechanisms and Reinforcement Corrosion
Emerging Trends in Low Carbon Cements	Advanced Characterization Methods
Supplementary Cementitious Materials	New Approaches in Standardization
Hydration Chemistry of Portland Cements	Advanced cement concrete composites
Hydration Chemistry of Non-Portland Binders	Environment and Sustainability
Emerging approaches in carbon capture and utilisation in cement and concrete	Latest Innovation Trends

Achieving Sustainability and Carbon Neutrality in Cement and Concrete

29th November to 03rd December 2027
Yashobhoomi Convention Centre,
IICC Dwarka, New Delhi



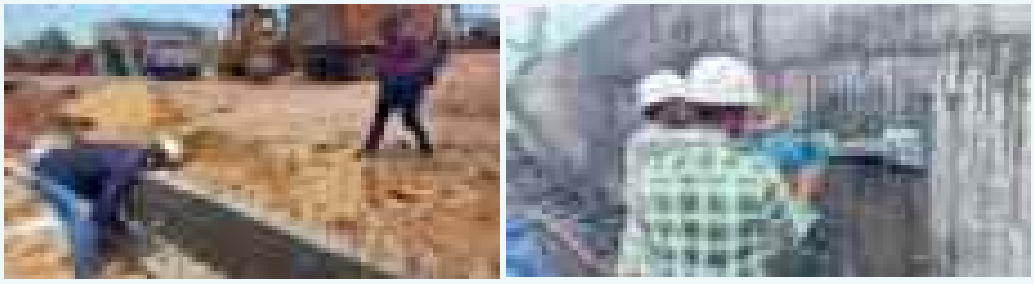
ICCC 17TH 2027

International Congress on the Chemistry of Cement

National Council for Cement and Building Materials (NCB) is an apex Research and Development organization under the administrative control of DPIIT, Ministry of Commerce & Industry, Government of India. NCB is dedicated to research, technology development & transfer, education & industrial services for cement, allied building materials & construction industries. NCB has a proven track record of executing biennial NCB International Seminars / Conferences of similar magnitude, ensuring a seamless and memorable experience for all participants from across the globe.

India is the fifth largest economy today and is likely to become third largest by the next five years and its cement industry is second largest in the world with installed cement capacity of 600 million tonnes. The cement industry in India plays a key role in circular economy framework in the country by utilizing various industrial wastes and is having one of the lowest CO_2 footprints and most energy efficient in the world. The booming infrastructure development, resources, and expertise available within India make it a perfect backdrop to bring together thought leaders, academics, cement and concrete professionals, and enthusiasts to exchange ideas and drive progress. The experience and framework of Indian cement industry for addressing local and global issues such as decarbonisation, sustainable development, circular economy in operation, energy security, alternate energy sources, low carbon cements and so on provide an ideal modal for deliberations and showcasing to global leaders and technocrats for the benefits of global society at large.

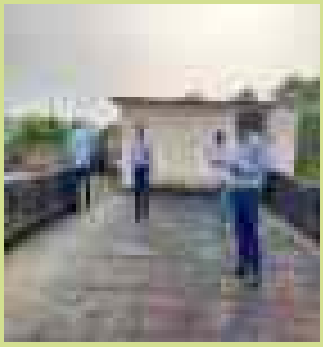
TPQA Inspection carried by NCB Team at Paradip Port Authority [PPA]



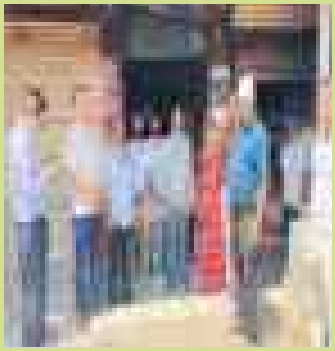
TPQA Inspection carried by NCB Team at Paradip Port Authority [PPA]

Structural Assessment and Rehabilitation (SAR)

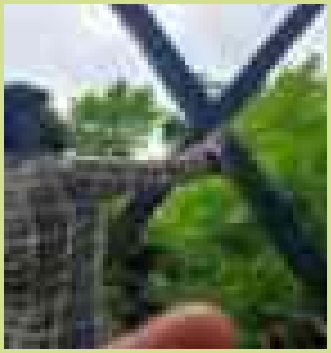
SAR Services, on sponsored project basis ,are currently provided to various clients like M/s NBCC,M/s OSRTC,M/s OWD etc



TPQA Visit at M/s. OSRTC Site: Kakatpur



TPQA Visit at M/s. SBG-NBCC (I) Ltd., Odisha



TPQA Visit at M/s. Paradip Port Authority, Odisha

TPQA Visit at CPWD Pune Site

R & D of industrial wastes as prospective building materials

The unit is carrying out R&D project on Stress–Strain Behavior of High Performance Geo Polymer self compacting concrete mix and its performance evaluation since April 2023. The duration of the project is 2 years. This projects aims to proportion Geopolymer self-compacting concrete with GGBFS and flyash ,duly maintaining rheological properties for 90 minutes ,at ambient curing conditions, and to evaluate mechanical, micro structure, durability characteristics.

Materials for Geopolymer Concrete-Sample procurement, Mechanical, Chemical and Microstructure Characterisation

MINING, ENVIRONMENT, PLANT ENGINEERING & OPERATION

Fully automated system for efficient tyre chips utilization

The Centre through its Process Optimization and Productivity program provided consultancy services to establish a fully automated system for storing, handling and feeding tyre chips into the calciner at a cement plant with a kiln production capacity of ~5000 clinker per day. The cement plant, with a daily kiln production capacity of ~5000 tonnes, set a target TSR of 21%. The project exceeded expectations by achieving a TSR of 23%. NCB played a pivotal role in the project, spanning from the initial feasibility study to the commissioning of the plant.

The cement plant made a significant commitment to utilizing tyres as a valuable fuel source in their cement rotary kiln. The decision to utilize tyres as a valuable fuel source in the cement rotary kiln serves a dual purpose. Firstly, it reduces the plant's dependence on fossil fuels, addressing concerns related to availability and cost. Secondly, it tackles the critical issue of waste disposal, leading to substantial resource savings that would have otherwise been allocated to waste management. NCB conducted an in-depth tyre characterization study within NCB-Ballabgarh laboratory, including ultimate and proximate analyses. The results provided crucial insights into the composition and properties of tyres, essential for their effective utilization as a fuel source.

The project's scope included the construction of a covered storage shed, an automated Grab Crane, Hoppers, Apron weigh feeders, Conveyor systems and an electrical double flap valve with a pneumatic shut off gate—all connected to the calciner. The design, based on a Computational Fluid Dynamics (CFD) study, ensures efficient tyre chip utilization with the system capable of handling other fuels independently. The system's operation involves receiving and unloading tyre chips, automated handling and storage using a Grab Crane, feeding through apron weigh feeders and controlled injection into the calciner. The entire process is designed to operate continuously, providing a seamless supply of tyre chips to the calciner. To ensure environmental quality, the system incorporates a comprehensive CCTV system, a deodorization system for managing odours, and a fire control system to swiftly suppress potential fires. These measures enhance the efficiency and safety of the entire system.

The project's success contributes to sustainability, waste management, and reduced fossil fuel consumption. NCB's consultancy services played a pivotal role in the successful implementation of a fully automated tyre chip utilization system and also showcases responsible industrial practices in cement production, effective waste disposal and a commitment to sustainable development.

Commissioned system at site for storing, handling, and feeding tyre chips into the calciner

Successful completion of project (Phase-I) in the Republic of Congo

Visualizing growing demand for cement and improvement in social lives of local population, the Government of the Republic of Congo (Go-RoC) with financial aid in form of a soft loan of US$ 55 million from Government of India (GoI) under the Lines of Credit, set upon endeavor of constructing a greenfield 600 tpd rotary kiln-based cement plant on turnkey basis in its department of Niari. From the very beginning, NCB's advice through its program of Project Engineering and System Design in the form of technical feasibility report and recommendations at crucial decision making moments, impressed the Go-RoC such that it entrusted NCB as its Project Management Consultant (PMC) for the upcoming plant. NCB as PMC for the entire cement plant where it has prepared EPC tender, evaluated offers received, participated in bid opening and presently monitoring & controlling the project implementation & providing support for inspection and supervision.

The project carried out on turn-key basis covers Geological Prospecting Work, Mine Planning, Mine Development and Mining Equipment Supply in Package-I and Engineering, Construction and Supply of Machineries to set up the cement plant in Package-II. NCB, as PMC, has successfully completed Package-I for the project in first week of November 2023 and gauging at the present progress of the Package-II, this project, is well and truly on its way to completion before end of 2025.

NCB has earlier provided its technical consultancy services in multidisciplinary domains to cement plants of Kenya, Mozambique, Nigeria, South Africa, Tanzania and post completion, this cement plant shall be the first in the RoC set up with Indian collaboration.

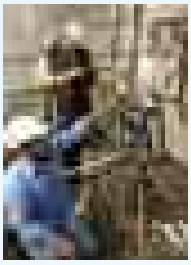
Cement plant erection team at the Republic of Congo

Energy Management in cement plants

The Centre through its program of Energy Management is regularly providing its services to the cement plants and institutions like BEE in the form of Mandatory Energy Audits, compressed air audits, WHRS potential assessment study, Detailed Energy Audits, Walk through energy assessments etc. and has executed energy audit projects outside country in Bhutan, Sultanate of Oman, Kenya, Nepal, Malaysia etc. This year also, audits are conducted in cement plants located in Himachal Pradesh, Madhya Pradesh, Maharashtra and Andhra Pradesh.

Environmental Monitoring in cement plants

The Centre through its Environment Sustainability and Climate Change program is regularly carrying out Performance Assessment of Existing Air Pollution Control Equipment in cement plants of Assam and Himachal Pradesh under which the major APCE attached with Kiln/Raw Mill, Coal Mill, Cement Mill, Cooler are monitored. Dust monitoring of inlet and outlet of APCE is carried out to evaluate the performance of APCE. Process Dust Measurement in Process Ducts, Moisture Measurement in Process Ducts, Pollution Load Assessment, Life Cycle Assessment (LCA) studies, Environment Monitoring (Point Source & Ambient Air), CO_2 Auditing, Water Footprint Assessment Environment Audit, NABL accredited air monitoring lab, Noise & Ground Vibration studies.

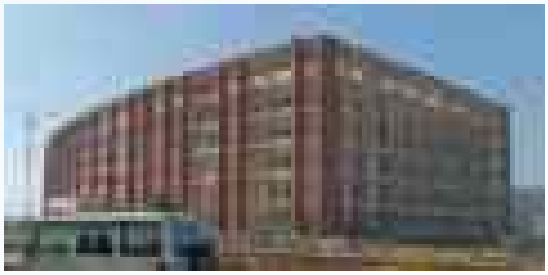


Third Party Quality Assurance of infrastructure projects

The Quality Assurance Group (QAG) comprising of pool of Electrical, Mechanical and Instrumentation engineers are primarily involved in Third Party Quality Assurance of Electrical & Mechanical services of various types of infrastructure and nation building projects such as Hospitals, Schools, Convention centers, Street lighting works, Sewage Treatment Plant, Effluent treatment plant etc. TPQA services are carried through pre-dispatch inspections, in process/ stage inspections and conformity assessments through review of testing methodology. The group has been on the path of steady progression in terms of projects executed for reputed clients like ITPO, NICDC, CPWD, DDA, MCD, AIIMS, PWD and DTC to name a few.

General Pool Residential Accommodation at Thyagraj Nagar, Delhi

Type V staff quarter at Indian Agriculture Research Institute, Pusa, Delhi



College of Dairy Sciences and Technology at Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana

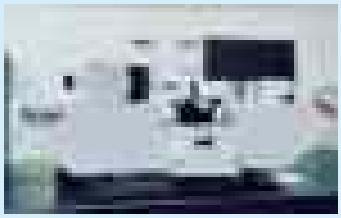
Quality Management, Standards and Calibration Services

The Centre serves the quality control and quality assurance needs of the cement & construction industry, Quality Control Testing Laboratories of various Govt., PSUs and Private organizations and Industries. It provides quality control and quality assurance services through various programs.

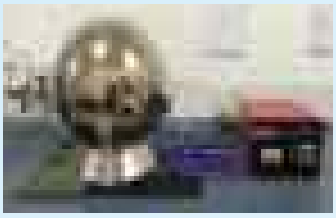
Calibration Services

The calibration laboratories of the center are state of the art, equipped with the sophisticated equipment and facilities. The laboratories constantly strive to improve accuracies and uncertainties of measurement of existing calibration facilities and also expand the scope of calibration activities. The calibration laboratories are accredited as per ISO/IEC 17025:2017 in the fields of force, pressure, temperature & humidity, dimension, mass & volume and RPM.

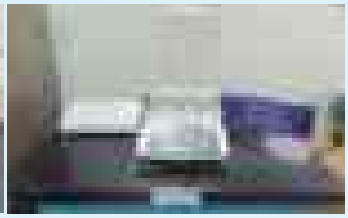
The laboratories have acquired equipment like Dry Block Calibrator, Liquid Temperature Bath, Thermocouple Calibration System, Mass Comparators, Temperature and Humidity Calibrator, Force Proving Instruments and Universal Length Machines.



Universal Length Machine



Thermocouple Calibrator



Semi Micro Balance Readability: 0.01mg, Range:200g

Micro Balance Readability: 0.001mg, Range:30g

Standard Reference Materials

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

In addition, 19 Bhartiya Nirdeshak Dravyas (BNDs), the Indian Certified Reference Materials (CRMs) were developed in collaboration with CSIR-National Physical Laboratory (NPL), NMI of India. It is intended to be used for calibration of equipment, evaluating proficiency of analysts and evaluating/comparing various test methods.

BNDs would play key role in maintaining the quality infrastructure of the economy through testing and calibration with precise measurements which are traceable to SI units. These BNDs will give a boost to "Make in India" programme & harmonize the quality infrastructure of the country and fulfilling the mission of "Atmanirbhar Bharat". The details of CRMs are

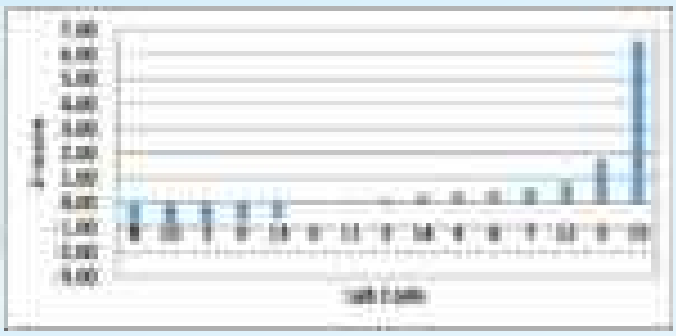
Field	Material
Physical	OPC, PPC, PSC, Fly ash, Composite Cement, WPC, Granulated Blast Furnace Slag, CCP, OPC residue on 45µm sieve (Wet Sieving), OPC residue on 90µm (Dry Sieving), Fly ash for ROS 45µm (Wet Sieving)
Chemical	OPC, PPC, PSC, Fly ash, Composite, Limestone, Raw Meal, Clinker, Granulated Blast Furnace Slag, Coal, Hydrated Lime Powder, Pet Coke, Red Ochre, Laterite, Silica Fume, Gypsum, WPC, Clay, Iron Ore, Bauxite

Interlaboratory Services

Interlaboratory Services (ILS) Programme is accredited under ISO/IEC 17043:2010. NCB is first accredited Proficiency Testing (PT) provider in India. So far, NCB has completed more than 100 PT schemes in the areas of cement and building materials. The participants were mainly from reputed private laboratories, cement plants, govt. laboratories, public sector laboratories, participant laboratories from outside India are also enrolled in PT schemes. PT schemes such as NDT in mechanical field and gypsum, hydrated lime and iron ore in chemical field are launched as ILC. These parameters will be considered for scope in next accreditation cycle. The details of PT scope are shared on the next page.

Field	PT Item
Chemical	Cement, Limestone, Clinker, Coal/Coke/Pet coke, Concrete admixture, fly ash, Water for concrete,
Mechanical	Cement, Aggregate, Burnt clay building brick, Fly ash, Steel bar, Mortar/Concrete cube, Tile (Ceramic)

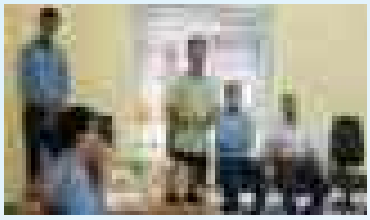
Scatter Plot of Test Results – Volatile Matter (%) (PT Scheme on Coal-Chemical (ILS/PT/94)



Bar Chart of Laboratory Performance for Sample – Volatile Matter, % (PT Scheme on Coal-Chemical (ILS/PT/94)

Total Quality Management

Total Quality Management programme is providing various consultancy services on Quality Management to cement plants, academic institutions laboratories, R&D organizations. This programme also provides consultancy services for accreditation as per ISO 17025, ISO 17034, and ISO 17043 Quality Management System standards.



4-day Training Programme on QMS as per ISO/IEC 17025:2017 at J K Lakshmi Cement (C.G.)

Training Session on ISO 17034 at CSIR-NPL, New Delhi

Release of Bharatiya Nirdeshak Dravya (BND)

The Centre has developed BNDs for cement material i.e. OPC 45 micron standard in association with CSIR-NPL, Delhi. BND was released in the presence of Prof (Dr.) Ajay Kumar Sharma, Director, NIT, Delhi, Prof. Venugopal Achanta (Director, CSIR-NPL), Dr. L P Singh (DG-NCB) and NCB team at a glittering function on 82nd CSIR Foundation Day in CSIR-NPL on 04th October 2023. During the event, Dr. L P Singh, was felicitated by Director, CSIR-NPL.

BNDs are Indian Certified Reference Materials which are being used for evaluating proficiency of analysts, evaluating various test methods and calibration of equipment. These BNDs will substitute the import of international standard product and give a boost to "Make in India" & "Atmanirbhar Bharat" programme and harmonize the quality infrastructure of the country.

Continuing Education Services

The Centre 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. A number of Govt./Semi-govt./Private organizations both from India and abroad have availed the training services of NCB. During the year 2023, 19 training programmes were successfully organized with a total of 320 participants attending the programmes.

Post-Graduate Diploma in Cement Technology

In its efforts to develop technological talent for the cement industry, the Centre 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. In the session 2023, nine students were admitted in the course out of which eight students successfully completed the course and most of them are retained in the Indian Cement Industry.

Short Term Refresher Courses

During the year, 08 Short Term Refresher Training Courses were organized wherein 73 professionals from cement and construction industries participated.

Training Programme	Duration
Repair and Rehabilitation of Concrete Structures	18-20 Jan 2023
Sampling and Testing of Cement as per BIS Standards	10-12 May 2023
Optimization of Cement Grinding System to Improve Productivity and Energy Conservation	15-16 June 2023
Quality Control and Quality Assurance in Concrete Construction including Extreme Weather Concreting	17-21 July 2023
Diagnostic Studies on Process and Refractory Related Problems in Cement Rotary Kiln	26-28 July 2023
Advanced Preprocessing Techniques for improved Productivity and Clinker Quality	14-15 Sep 2023
Concrete Mix Design and Acceptance Criteria of Concrete	09-11 Oct 2023
Best Practices for Quality & Productivity in Cement Plant	23-24 Nov 2023

Contact Training Programmes

The programme is related to practice on the specialized equipment like XRF/XRD/PSD/SCEM/Optical-microscopy/ or testing procedures of cement & concrete which improves skills and knowledge of employees. Contact training programme on Optical Microscopy was organized for Shree Cement Ltd.

Special Group Training Courses

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

Organization	Topics of the Courses Organized
M/s Dalmia Cement Bharat Ltd.	Cement Manufacturing Technology for GETs of Integrated plant
M/s Ultratech Cement	Training -cum-Workshop on PAT Schemes
M/s Power Grid Corporation Ltd.	Concrete technology
M/s Hindustan Petroleum Corporation Ltd., Mumbai	Quality Control and Quality Assurance in Concrete Structure
National Thermal Power Corporation Ltd. (NTPC)	Quality Control and Quality Assurance in Concrete Structure (2 batches)
IMTI,TN	Quality Control and Quality Assurance in Concrete Structure (2 batches)

The Centre in Hyderabad unit organised Cluster based training programmes on “Pragmatic approaches using advanced instruments for improving clinker productivity” and Special Group Training Programmes on “Concrete Mix Proportions and Acceptance Criteria” for the officials of M/s. ICL and 3 Weeks Special Training Programme on “Cement Manufacturing Technology” for M/s. Bharathi Cement & M/s. Kalburgi Cement. The centre has a well established training complex with excellent infrastructure with residential facility in both Ballabgarh and Hyderabad unit.

Participants of Dalmia Cement (Bharat) Ltd. during Special Group Training Programme for GETs at NCB-Ballabgarh Unit

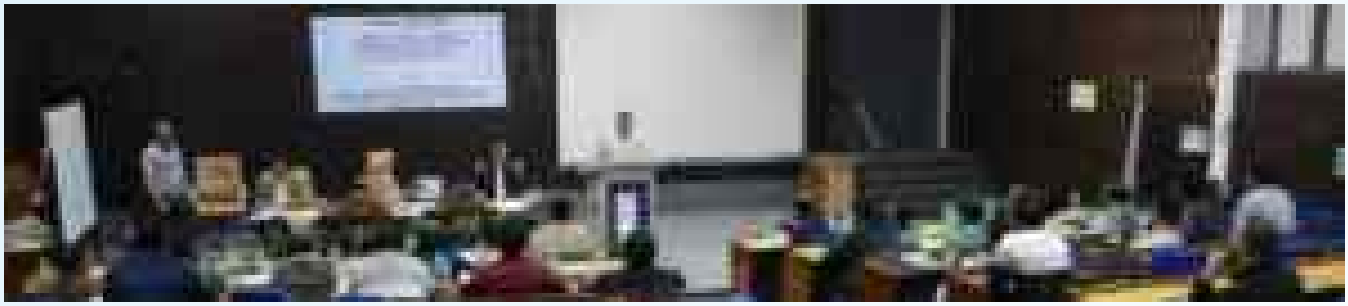
Training programme on Sampling and Testing of Cement as per BIS standard

Training programme on Concrete Mix Design as per IS 456 at NCB-B

Special Group Training Programme for the engineers of Irrigational Department of Tamil Nadu Government, PWD organised for IMTI at NCB-Ballabgarh Unit

Training programme on Optimization of Cement Grinding System at NCB-B

Laboratory Demonstration for the participants of a training programme at NCB-B

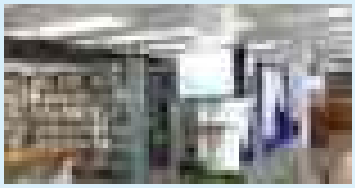


Interaction with the participants of NTPC

Lectures conducted in training halls of NCB Hyderabad Unit

Industrial Information Services

Library


NCB Ballabgarh Library

Library at Ballabgarh Unit serves as National Information Centre for cement, building materials and construction industries. Holdings of library have grown to 46,970 documents. It has a bibliographic data base consisting of about 44,260 entries derived from the journals received. NCB's scientists, cement plants and other user industries utilize it for interactive searches. A library automation system called 'LIBSYS' is being used for maintaining the library operations. The system is user-friendly and compatible to network communication. Memberships of Indian and Overseas professional institutions were served.

MEMBERSHIP	
Indian	**Overseas**
Indian Roads Congress (IRC), New Delhi	Precast/ Pre-stressed Concrete Institute (PCI), USA

eOffice Implementation at NCB

One of the agendas of the Minimum Government Maximum Governance is to adopt eOffice in all government offices for achieving the goal of Governance with Accountability, Transparency and Innovation which is the sine-qua-non for achieving Hon'ble Prime Minister's mission of Pro-Active Governance and Timely Implementation (PRAGATI).

The Department of Administrative Reforms & Public Grievances (DARPG) has been assigned the important task of guiding and monitoring of implementation of eOffice in Attached offices, Subordinate offices and Autonomous bodies of Central Government Ministries/Departments. It is noteworthy that eOffice has been implemented in almost all the Central Government Ministries/Departments and more than 40 Central Government Ministries/Departments have been completely moved on eOffice Platform.

DPIIT directed NCB to implement eOffice as per the OM No. 2201 1/1/2019-ARC-DARPG (e6136) dated 20 January 2020, received from the Department of Administrative Reforms & Public Grievances, Government of India. Activities undertaken for eOffice implementation at NCB are:

- Instance (Wrapper) of NCB has been created on DPIIT eOffice Cloud.
- VPN of NCB eOffice Users have been created to access eOffice.
- Organization Structure of NCB's all Centres / Service and Units (Ahmedabad, Hyderabad and Bhubaneshwar) has been created on eOffice Platform.
- 74 Users have been created on eOffice Platform and assigned on their respective posts
- User Credentials verification on eOffice Platform
- Training provided by DPIIT's eOffice Team
- File Codes created for NCB
- eSign is generated by most of the NCB Officials
- eOffice is ready to use

Memorandum of Understanding (MoU) signed by NCB

In recent years gone by, NCB has entered into MoUs with educational and scientific institutions like Birla Institute of Technology and Science, Pilani, GLA University, IIT-Hyderabad, Bhubaneswar, Roorkee, Bombay, Jodhpur, Mandi, Guwahati, Kalinga Institute of Industrial Technology (KIIT), Madhav Institute of Technology & Science, Manav Rachna University (MRU), NIT-Andhra Pradesh, Rourkela, Silchar, Warangal and Surathkal, Meghalaya, Jalandhar, Calicut, NTPC Ltd., Ravenshaw University, Sambalpur University and Thapar University. In 2023, NCB has also entered into MoU with CSIR-CBRI , J C Bose University of Science and Technology (YMCA) and NTPC.

18th NCB International Conference on Cement, Concrete and Building Materials

For updates Visit www.ncbindia.com

27-29 November 2024

Yashobhoomi, IICC Dwarka, New Delhi

ISO 9001 : 2015

THEMES FOR TECHNICAL DELIBERATIONS

Cement Manufacturing

- Low Carbon Cements
- Energy Conservation Systems
- Alternate / Waste Fuels and Raw Materials
- Cement Plant Machinery & Project Engineering
- Carbon Capture, Utilization and Storage (CCUS)
- Productivity Enhancement and Process Optimization
- Marketing and Consumer Protection
- Emerging Trends

Concrete & Construction

- Performance and Durability of Concrete
- Performance-based Design of Concrete Structures
- Concrete Deterioration Mechanisms and Reinforced Corrosion
- Distress Investigation, Repair / Strengthening / Retrofitting of Concrete Structures
- Energy Efficient Materials
- Sustainable Materials for Green Building
- Environmental Management and Sustainable Development

Opportunities as Delegate

- **Policy Makers / Top Management Personnel :**
  Sustainability, Modernization, Upgradation
  Retrofitting & Plant Rejuvenation, Service Life Design
- **Senior & Middle Level Executives :**
  Energy Efficiency, Productivity Enhancement & Environmental Management, Quality Assurance, Alternate Aggregates Deterioration Mechanism, Distress Investigation
- **Entry Level Engineers / Chemists :**
  Design Practices, State-of-the-art, Knowledge about Equipment Process & Technologies, Performance and Durability
- **Engineers, Technologists, Scientists, Economists, Academicians & Research Scholars :**
  Propagate your Expertise, Innovations, Futuristic Research through Presentations

Highlights of
17th NCB International Seminar
(06-09 December 2022)

- 1100 Delegates Including 48 Delegates from 11 Countries
- 160 Technical Papers Presented in 20 Sessions
- 120 Stalls by 83 Exhibitors in the Technical Exhibition

ORGANIZED CONCURRENTLY

Technical Exhibition

- Cement Plant Machinery Manufacturers, Suppliers, Designers, Automation & Control and Construction Equipment Manufacturers and all Other Allied Industries may take part in the Exhibition.
- Stalls shall be booked on first-pay-first-served basis.

National Council for Cement and Building Materials

Ballabgarh: 34 Km Stone, Delhi-Mathura Road (NH-2)
Ballabgarh-121004, Haryana, India
Phone: +91-129-2666600
Website: www.ncbindia.com
E-mail: seminar@ncbindia.com

Kindly block your dates

Swachhata Pakhwada 2023

S.NO.	Activity	Date	Action Taken
1.	Banners to displayed at NCB Main Entry Gate informing about observance of the Swachhata Pakhwada and creating awareness at all NCB units	01st November 2023	Banners displayed at all NCB units
2.	Swachhata Pledge for cleanliness to be undertaken by NCB officials / staff at all NCB units	01st November 2023	Swachhata Pledge taken by all NCB officials
3.	Sensitization of all concerned personnel about their crucial role in maintaining cleanliness to be undertaken.	02nd November 2023	Sensitization done by Senior Officials to personnel involved in cleanliness.
4.	Disposal of old files and Waste papers / boxes etc. in NCB	03rd to 8th November 2023	Paper Shredding Machines Procured and old files being shredded
5.	Cleaning & dusting of office equipment in laboratories to be undertaken.	03rd to 8th November 2023	Cleaning of office equipment undertaken
6.	Cleaning of Library / Record Rooms etc. to be undertaken.	09th to 15th November 2023	Cleaning of Library & Basement cleaning undertaken
7.	Cleanliness & maintenance in all the washrooms at regular intervals to be undertaken.	01st to 15th November 2023	Cleanliness of all washrooms undertaken
8.	Cleaning of the corridors of NCB premises to be undertaken.	01st to 15th November 2023	Cleanliness of Corridors undertaken
9.	Cleaning of Office Premises, and parking areas.	09th -15th November 2023	Cleaning of Office Premises being undertaken
10.	Moping of Glass partitions / wooden portion etc.	08th - 10th November 2023	Moping of Glass being undertaken
11.	White washing work in rooms / corridors of NCB building, wherever required	01st to 15th November 2023	Whitewashing of roadside kerbs, boundary wall and parapet walls undertaken
12.	Cleaning of drains and sewer lines to be undertaken.	11th – 12th November 2023	Cleaning of drains carried out
13.	Maintenance of the lawn, removal of weeds etc. in NCB premises and in NCB Colony to be undertaken.	01st to 8th November 2023	Removal of weeds and maintenance of lawns undertaken
14.	Maintenance of green belt around NCB premises to be undertaken.	09th to 15th November 2023	Maintenance of green belt undertaken
15.	Proper Pest control to avoid spreading of Mosquitoes, bad odour in the NCB Premises to be undertaken	13th – 15th November 2023	Pest Control undertaken on 13th November 2023
16.	Recognition of Horticulturist/House Keeping Staff	15th November 2023	Recognition will be given to best performing staff on NCB Day

Cleanliness drive of office premises, campus, library and residential colony of NCB undertaken along with Swachhata Pledge

Special Swachhata Campaign 3.0

Best Practices for Cleanliness adopted in NCCBM

- Display of Swachhata Banners and Awareness Posters all over campus
- Usage of tested samples/C&D waste for development of Parking space.
- Area ownership to Horticulturist for maintaining/ developing gardens
- Management By Walking Around (MBWA) – Every day top management goes to any of the section in morning & monitor the digitization, cleanliness status etc.
- Display of names outside rooms in Hindi & English
- Suggestion Box for bringing out innovative ideas from staff
- Segregation of waste in campus by putting up separate dust bins for wet waste & dry waste.
- Recognition/ Award to best gardener and housekeeping staff every month

Impact Assessment of the Special Campaign

- The special campaign has resulted in formation of Record Retention Schedule in our organization.
- The campaign has helped in:
- Proper file management
- Improved traceability of important documents/files due to digitization,
- removal of unnecessary papers
- Initiation of Scrap Disposal activity
- Awareness on Swachhata

Glimpses of activities carried out during Swacchata Campaign 3.0

Observing Rashtriya Ekta Diwas at NCB

NCB pays tribute to the Iron Man of India Sardar Vallabh bhai Patel on National Unity Day

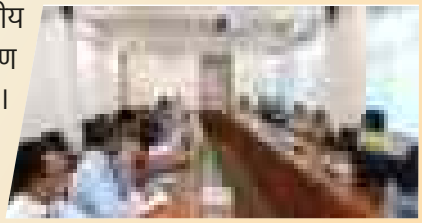
एनसीबी में हिन्दी पखवाड़ा का आयोजन

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद्, बल्लभगढ़, में हिन्दी पखवाड़े का आयोजन 18 सितंबर से 04 अक्तूबर 2023 के बीच बड़े उत्साह के साथ मनाया गया। राजभाषा विभाग गृह मंत्रालय, भारत सरकार के निर्देशानुसार कार्यालय के राजभाषा कार्यान्वयन समिति के सदस्यों श्रीमती पूनम कनौजिया एवं श्रीमती रश्मि गुप्ता ने तृतीय अखिल भारतीय राजभाषा सम्मेलन, छत्रपति शिवाजी स्टेडियम, बालेवाड़ी, पुणे (महाराष्ट्र) में भाग लिया। संस्थान के माननीय संयुक्त निदेशक श्री पी एन ओझा जी द्वारा पखवाड़े का शुभारंभ किया गया। उन्होने सभी अधिकारियों / कर्मचारियों को कार्यालय में राजभाषा के प्रचार – प्रसार को बढ़ावा देने के लिए अधिक से अधिक कार्य हिंदी में करने के लिए प्रोत्साहित किया तथा उन्होने कहा कि राजभाषा में कार्य करते समय हमें गौरान्वित महसूस करना चाहिये। हिन्दी पखवाड़ा 2023 के दौरान संस्थान में हिन्दी आदर्श वाक्य (salogan), हिन्दी निबंध एवं टिप्पणी लेखन प्रतियोगिताओं का आयोजन किया गया।

हिन्दी शिक्षण योजना

राजभाषा विभाग, गृह मंत्रालय, भारत सरकार के अंतर्गत प्रथम सत्र जुलाई से नवम्बर 2022 में पारंगत शिक्षण की कक्षा आयोजित की गई। जिसमें कार्यालय के 19 प्रशिक्षाथियों ने पारंगत परीक्षा में विशेष रुचि लेते हुए उत्कृष्ट प्रदर्शन किया।

द्वितीय सत्र जनवरी से मई 2023 में पारंगत शिक्षण की कक्षा आयोजित की गई। जिसमें कार्यालय के 17 प्रशिक्षाथियों ने पारंगत परीक्षा अच्छे अंको से हिन्दी की परीक्षा उतीर्ण की।



कार्यालय में राजभाषा विभाग, गृह मंत्रालय, भारत सरकार के हिन्दी शिक्षण योजना के अंतर्गत तृतीय सत्र जुलाई से नवम्बर 2023 में प्रबोध शिक्षण कक्षा कार्यालय में आयोजित की जा रही है। प्रबोध शिक्षण की कक्षाओं का शुभारंभ माननीय डॉ लोक प्रताप सिंह, महानिदेशक, एनसीबी द्वारा किया गया। जिसमें कार्यालय के 13 अधिकारियों / कर्मचारियों भाग ले रहे है।

हिंदी शिक्षण योजना का मुख्य उद्देश्य कार्मिकों को हिन्दी में दक्ष बनाकर अधिकाधिक कार्यालयीन कार्य हिन्दी में करने के लिये प्रेरित करना है।

Strategic Solutions and Opportunities for Cement Industry at NCB-Hyderabad

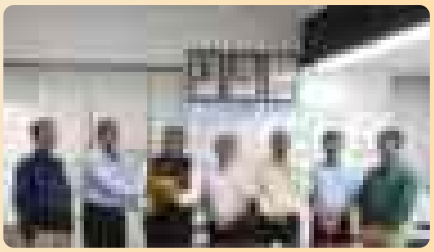
NCB and IIT-Hyderabad jointly organized a National Conference on "Strategic Solutions and Opportunities for Cement Industry" on 24 & 25 August 2023 at NCB Hyderabad. More than 130 delegates from prominent cement and allied industries attended the conference. Technical exhibition was arranged to showcase the advanced and modern technologies and machinery. Conference was inaugurated by Shri Sunil Sharma, Special Chief Secretary (Energy), Government of Telangana.

77th Independence Day 2023

77th Independence Day celebrated at NCB and its units. At NCB-Ballabgarh, Director General hoisted the National Flag, distributed sweets, flags and addressed the NCB staff & their family members.

NCB family welcomes Dr. L P Singh as Director General

Dr. L P Singh, FRSC, is a profound scientist/researcher with a distinguished career in Research & Development. With a strong track record, he is committed towards advancing scientific knowledge and translating research into practical applications. Dr. Singh earned his Ph.D. degree (1996) in Physical Chemistry from the University of Roorkee (now IIT Roorkee). For his exemplary contribution in research and development, he was awarded with two of most prestigious awards; the 'First Khosla Research Award' (Gold Medal) and 'Second Khosla Research Award' (Silver Medal). Dr. Singh is also known for his knowledge as Centre of Excellence Fellow at the National Institute of Materials and Chemical Research, Japan and as Scientist at CSIR-Central Building Research Institute, Roorkee. He has shared his insights in more than 100 substantial research articles in international publications, also authored seven book chapters, three registered patents and last but not the least, he transferred several know-how/technologies to different MSMEs. His contribution in the field of Cement and Building Materials is widely acknowledged and well implemented across the globe, honouring more than 6700 citations with a h-index of 40. Dr. Singh has supervised more than 08 doctoral theses and 06 are in process, more than 50 post graduate dissertation. Dr. Singh has made a number of foreign visits under different bilateral programmes, invited talks, conference/symposium and fellowship calls, to establish international collaborations with recognized institutes in USA, Scotland, UK, Russia, China and Hong Kong. He has been conferred as the Fellow of Royal Society of Chemistry, London (UK) and listed in rank 2% or above Scientist in the world according to Stanford University ranking in Aug. 2021. Also awarded "Outstanding Concrete Technologist Award" 2015 by Indian Concrete Institute (ICI) and UltraTech, Cement.



World Environment Day 2023

NCB observed World Environment Day with the theme of Beat Plastic Pollution. Cement Plants are considered as best co-incinerators. Co-processing in cement kilns is considered as a technically feasible and economically viable option not only for treatment of wastes having combustible value, but also a better and a cost effective option for co-processing other hazardous wastes too. Cement Industry has high potential to dispose single use plastic waste as alternate fuel, replacing the conventional fuels. The high flame temperature up to 2000°C, material temperatures up to 1450°C and residence time of 4 – 5 seconds in oxygen rich atmosphere ensures complete destruction of plastic waste and the biggest advantage of the complete absorption of the ash in the cement complex compounds. With this wide range of temperature and residence times almost all types of hazardous, non-hazardous, combustible wastes can be co-processed in the cement kilns. Indian cement industry has achieved 6% Thermal Substitution Ratio (TSR) by co-processing of wastes. Many cement plants all over India are co-processing plastic waste collected by the municipal corporations of the nearby cities and industries generating single use plastic waste, helping in management of Municipal Solid Waste.

Hon'ble Prime Minister launched Swachhata Hi Seva (SHS) 2019, a massive countrywide awareness and mobilization campaign on plastic waste management. SHS 2019, with special focus on 'plastic waste awareness and management' was organized from 11th September to October 02nd 2019.

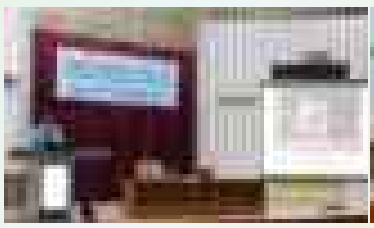
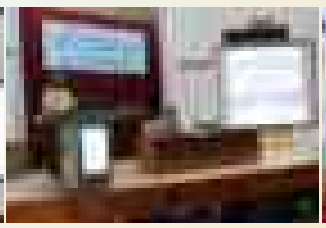
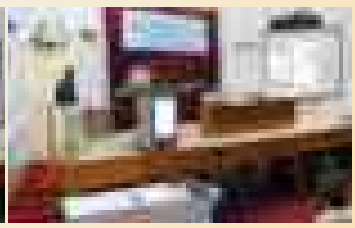
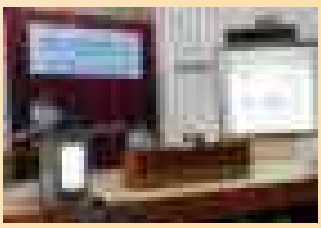
During Swachhata Hi Sewa campaign from September 11 till October 27, 2019, Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Jal Shakti, Ministry of Housing and Urban Affairs (MoHUA), Government of India partnered with the Cement Manufacturers' Association and Indian Cement Industry in utilization of single use plastics in Cement Kilns. Over the period of October 02 to October 27, 2019 Cement Companies helped dispose of 7.6 lakh tonnes of plastic waste in cement kilns.

This year the focus of World Environment Day celebrations in India is on Mission LiFE. LiFE (Lifestyle For Environment) mission was introduced by Hon'ble Prime Minister at COP26 in Glasgow on 01 November 2021 as a mass movement for mindful and deliberate utilization, instead of mindless and destructive consumption, to protect and preserve the environment.

DG-NCB urged all NCB officials to make action plans on **Saving energy, Saving Water, Saying No To Single Use Plastic, Adopting Sustainable Food Systems, Reducing Waste, Adopting Healthy Lifestyles, Reducing E-waste**. He requested all the NCB Scientists, Engineers and staff to work towards phasing out single use plastics from our daily lives and adopting sustainable practices and way of life.

National Technology Day

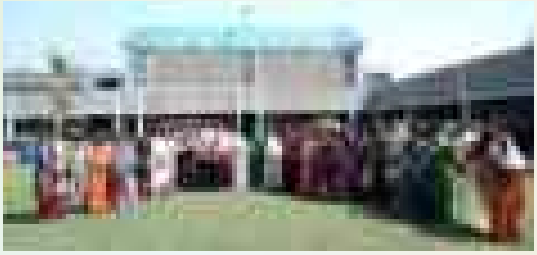
The National Technology Day was observed at NCB with great enthusiam. The theme of National Technology Day was "**Atal Tinkering Labs**", a path breaking initiative undertaken in 2016 under the leadership of Hon'ble Prime Minister Shri Narendra Modi. The vision behind "Atal Tinkering Labs" is to create and promote innovation StartUps and entrepreneurship via intervention at the level of school and teaching institution, in a bid to ignite the young minds. NCB is also directed by DPIIT to launch start up scheme in Gypsum based materials. DG-NCB highlighted the priority areas for research to be carried out at NCB which are Circular Economy, Development of Technology Roadmap for decarbonization, Green Labelling & Benchmarking of Cement Plants,Carbon Audit in Cement Plants and Logistics. He also discussed various in-house initiatives taken by NCB's Management towards employee welfare after the presentation.

IMPORTANT EVENTS, ACTIVITIES AND DAYS OBSERVED AT NCB AND ITS UNITS

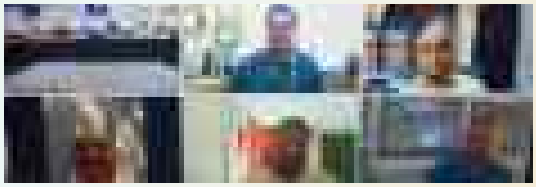
International Women's Day 2023

NCB celebrated International Women's Day 2023 on 07th March 2023. DG-NCB highlighted the social, political and economic achievements of women & their contribution in various fields. Ms Satbeer Chabbra, Deputy Director, National Institute of Public Cooperation and Child Development (NIPCCD) was the Guest of Honour and Ms Ruchika Drall, Deputy Secretary (Environment Policy), Ministry of Environment, Forest and Climate Change was the Chief Guest on the occasion.



Advisory Committee for NCB-Hyderabad & NCB-Bhubaneswar

Meeting of "Advisory Committee for NCB-Hyderabad & NCB-Bhubaneswar" was conducted on 25th February 2023 in physical mode. Sh Rakesh Singh, Executive President, M/s. ICL, chaired the meeting. Apex level officials of various cement plants, construction sectors, Government bodies & Educational Institutes actively participated in the meeting.



74th Republic Day 2023

NCB celebrated 74th Republic Day. DG, NCB hoisted the National Flag, distributed sweets and addressed the staff present on the occasion.

60th NCB Day celebration

NCB - IN SERVICE FOR CEMENT AND CONCRETE FOR THE PAST SIX DECADES

NCB is an apex research and development institution dedicated to carry out frontline research in the field of cement, concrete and building materials. Through its various Centres and their programmes, NCB is carries out various programmed and industry sponsored projects in the field of cement and building materials. The institution has embarked upon the journey of getting itself benchmarked with the top R&D institutes all over the world in the field of cement, concrete and building materials research. Its present vision is to be within Top 4 R&D organizations of the world. The present studies undertaken at NCB are on reducing carbon footprint and improving sustainability of cement industry like Portland Composite Cements based on Fly Ash & Limestone, Portland Limestone Cement (PLC), Portland Dolomite Cement (PDC), Development of Low Carbon Clinker (Belite Calcium Sulphoaluminate Clinker), Composite Cements based on Fly Ash & Slag, Investigation for Standardization of High Magnesia (MgO) Clinker for the Manufacture of PPC & PSC, Investigations on Utilization of Coarse Fly Ash (200-250 m^2/kg) in Cement Manufacturing and Multi Component Blended Cement.

NCB's Services	NCB's Centres	NCB's Stakeholders
Programmed R&D Projects	Cement Research and Independent Testing (CRT)	Govt of India (MoCI , MEA, MoEF&CC, Niti Aayog etc)
Sponsored R&D Projects		
Independent Testing Lab		
Optimization of Raw Mix Design	Construction Development and Research (CDR)	Central Govt. Regulatory bodies like BIS, CPCB, CWC etc.
Alternate Fuels and Waste Utilization		
Limestone Consumption Factor		
Non-Destructive Testing / Diagnostic studies for Distressed Structures	Quality Mgmnt, Standards & Calibration (CQC)	Central and State Govt. Organizations/Bodies like Mines Deptt, ITPO, Delhi Metro, PWD, MCD, IDCO etc
Durability Studies		
Concrete Mix Design		
Third Party Quality Assurance		
Independent Calibration		
Proficiency Testing	Continuing Education Services (CCE)	Cement Industry
BNDs and CRMs		
Process Optimization		Construction industry
Project Management Consultancy		
Energy Audits	Mining, Environment, Plant Engineering & Operations (CME)	Other Building Materials industry
Life Cycle Assessment Studies		
Techno-Economic Feasibility studies		PSUs like NTPC, NHPC, IOC, SAIL etc
Performance Evaluation of APCEs		
PG Diploma in Cement Technology	Industrial Information Services (CIS)	Laboratories
Training and Skill Development		
Seminars / Workshops		Overseas Cement Industry

एन.सी.बी. दर्पण अंक 3 का विमोचन

राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद् की वार्षिक हिंदी पुस्तक एन.सी.बी. दर्पण के तृतीय अंक का विमोचन माननीय श्री अनिल अग्रवाल, अपर सचिव, आन्तरिक व्यापार और उद्योग संवर्धन विभाग, वाणिज्य और उद्योग मंत्रालय, भारत सरकार के द्वारा 24 दिसम्बर 2022 को एन.सी.बी. बल्लभगढ़ में किया गया।

17TH NCB INTERNATIONAL CONFERENCE ON CEMENT, CONCRETE AND BUILDING MATERIALS

NCB has been organizing International Seminars on Cement and Building materials every alternate year since 1987. These Seminars have emerged as singular biennial event in this part of the globe where experts of cement and concrete sector, policy makers, engineers and scientists, academicians / students, consultants, professionals and machinery manufacturers come under one roof and discuss future action plans aimed towards clean and green production and responsible consumption of the resources utilized in cement sector to ensure its long term sustainability. Cement and Construction industries of the world look forward for participation in the Seminar/ Conference.

NCB organized the 17th NCB International Conference on Cement, Concrete and Building Materials as a follow-up of the sixteen NCB International Seminars organized earlier. Henceforth this biennial event will be known as "NCB International Conference on Cement, Concrete and Building Materials".

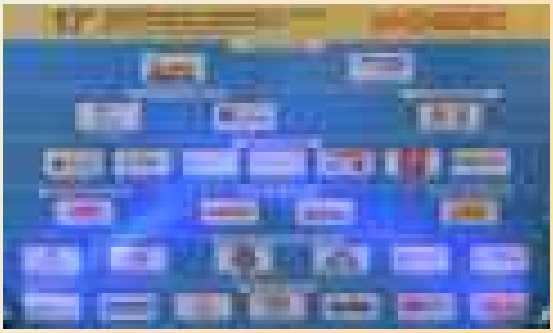
The 17th Conference was held from 06 - 09 December 2022 at Manekshaw Centre, Parade Road, New Delhi and saw participation of around 1100 delegates including 48 overseas participants from 11 countries. The theme of the conference was "**Moving Towards Net Zero Carbon Emissions**". During the span of the 4-day event, 160 presentations were made in 20 technical sessions; 4 panel discussions were held, covering key topics of concerns for the industry and speeches were delivered by keynote speakers.

Sponsors of 17th NCB International Conference

Sl. No.	Name of Sponsors	Category
1.	UltraTech Cement Ltd.	Chief Patron
2.	Dalmia Cement (Bharat) Ltd.	
3.	JSW Cement Ltd.	Platinum Sponsor
4.	IKN India	
5.	Saurashtra Cement Ltd. & Gujarat Sidhee Cement Ltd.	Kit Bag Sponsor
6.	Shree Cement Ltd.	Gold Sponsor
7.	Nuvoco Vistas Corp Ltd.	
8.	J.K. Cement Ltd.	
9.	HeidelbergCement India Ltd.	
10.	Star Cement Ltd.	
11.	Prism Johnson Ltd.	
12.	KHD Humboldt Wedag India Pvt. Ltd.	
13.	DCL Bulk Technologies Pvt. Ltd.	High Tea Sponsor
14.	JK Lakshmi Cement Ltd.	Silver Sponsor
15.	TRL Krosaki Refractories Ltd.	
16.	My Home Industries Pvt. Ltd.	Bronze Sponsor

Supporting Organizations / Departments

- Department of Promotion of Industry and Internal Trade (DPIIT), Govt. of India
- Ministry of Environment, Forest, and Climate Change (MoEF&CC), Govt. of India
- Council for Scientific and Industrial Research (CSIR)
- Bureau of Indian Standards (BIS)
- Bureau of Energy Efficiency (BEE)
- Cement Manufacturers' Association (CMA)



Media Partners

Industrial Angles | Indian Cement Review | Construction World
International Cement Review | World Cement | ZKG International
Civil Engineering & Construction Review (CE&CR)

The conference was inaugurated by Chief Guest Shri Anurag Jain, Secretary, Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce & Industry, Govt. of India. Shri Anil Agrawal, Additional Secretary, DPIIT, Guest of Honour shared the outlook of Indian Cement Industry. Shri K C Jhanwar, Chairman-NCB, President-Cement Manufacturers' Association & MD, UltraTech Cement Ltd. deliberated his views on "Indian Cement Industry-Future Outlook, Challenges & Opportunities". Shri Mahendra Singhi, MD & CEO, Dalmia Cement (Bharat) Ltd shared his views on "Cement Industry Global Perspective".

Release of Publications during the 17th NCB International Conference

Chief Guest Shri Anurag Jain, Secretary-DPIIT, Ministry of Commerce and Industry released four NCB publications during the inaugural session of 17th NCB International Conference on 06th December 2022. These publications were:

- Conference Proceedings with Abstracts of 150 Technical papers, Background of Panel Discussions and Special Technical Sessions.
- 3rd edition of the compendium titled "**The Cement Industry-India 2022**".
- AFR Book titled "**Alternate Fuels – A Green Solution for Indian Cement Industry**".
- 6th edition of "**Guide Norms for the Cement Industry**".

Panel discussions and Keynote Sessions

Four panel discussions with distinguished panellists were organized on important topics viz.

- Moving towards Net Zero Carbon Emissions in Indian Cement Industry.
- Sustainability and Circular Economy in Cement & Construction Sector.
- Enhancing AF & ARM utilization in Indian Cement Industry.
- National Mission on Sustainable Habitat -2030.

Keynote presentations

- Promise of Energy Efficiency for addressing Climate Change by Dr Ashok Kumar, Dy. Director General, Bureau of Energy Efficiency
- Durability Design of Concrete Structures by Prof. Manu Santhanam, Professor, Department of Civil Engineering, IIT Madras
- From Pollution to Solution – Bringing Cement and SCM to Net-Zero by Dr Sada Sahu, Solidia Technologies, USA

Keynote presentation during 17th NCB International Conference

National Awards for Indian Cement Industry

Emanating from a suggestion at the first NCB International Conference in 1987 and at the instance of the Ministry of Industry, the scheme of National Awards for Energy Efficiency was started from the year 1986-87 and since then these Awards are being given regularly to the best performing cement plants.

The scheme of these awards was designed in consultation with various experts and organizations including Ministry of Power, Advisory Board on Energy (ABE), Bureau of Industrial Costs & Prices (BICP), Cement Manufacturers' Association (CMA), National Productivity Council (NPC) and Chief Executives of Cement Plants. Keeping in view, the prevalent scenario of the Indian cement industry, the scheme is revised and updated periodically, in consultation with experts from industry and consultants as well as based on suggestions from Technical Committee members.

The Technical Committee is constituted of Director General- National Council for Cement and Building Materials (NCB), Chairman and members from DPIIT, Bureau of Indian Standards (BIS), The Ministry of Environment, Forest and Climate Change (MOEF&CC), Quality Council of India (QCI), National Productivity Council (NPC) and Bureau of Energy Efficiency (BEE).

The objective of these awards is to create motivation in the industry for competitive improvement in the thrust areas of Energy, Environment & Total Quality. Total Quality Excellence Award is aimed to give special recognition to organizations that contribute significantly towards the quality movement of India. This award is in line with other prestigious quality awards like Rajiv Gandhi National Quality Award of India, Malcolm Baldrige National Quality Award of the United States, European Quality Award of the European Union and the Deming Prize of Japan. The scheme of awards for energy excellence and environment excellence awards were revised and two new award categories (Achieving Circular Economy in Cement Plant Operation and Energy & Environment Excellence in Grinding Unit Operation) were added.

The Government of India has been actively formulating policies and promoting projects to drive the country towards a circular economy. As cement industry is at the heart of any circular economy initiative, , a new award on Achieving Circular Economy in Cement Plant Operation was introduced to motivate sustainable development of cement industry and utilization of industrial waste in cement plant operation.

As there are about 115 grinding units in India and increasing every year, two new awards on Energy and Environment Excellence in Grinding Units have been introduced. The objective of these awards is to motivate competitive improvement in the energy performance and creation of better environment in and around grinding units.

The National Awards for the Indian Cement Industry for the years 2019-22 were distributed by Shri Som Parkash, Hon'ble Minister of State for Commerce & Industry, Govt. of India and Shri Shashank Priya, Special Secretary & Financial Advisor, DPIIT in the Concluding Session of 17th NCB International Conference on 09 December 2022 at Manekshaw Centre, New Delhi.

Distribution of National Awards by Shri Som Parkash, Hon'ble MoS for Commerce & Industry, Govt. of India and Shri Shashank Priya, Special Secretary & Financial Advisor, DPIIT

Awards for papers of High Merit

During each technical session of 17th NCB International Conference, the chairman and co-chairman evaluated each technical paper in terms on four different parameters:

- Innovativeness/Originality of the paper.
- Significance, impact and relevance to industrial application.
- Presentation quality and skill.
- Timeliness of the presentation.

Based on evaluation done by the respective Chairman and Co-chairman of the technical session, one paper from each technical session has been selected as paper of high merit out of the 160 papers presented in the 17th NCB International Conference in 20 technical sessions.

Awards for papers of High Merit

Technical Exhibition

The Conference also had a Technical Exhibition, which was held concurrently at the venue. The exhibition gave additional exposure to the latest in available technologies and services for efficient operation of cement plants, making of concrete and construction activities.

Technical Exhibition during the 17th NCB International Conference

Awards for Energy, Environment, Total Quality Excellence, Achieving Circular Economy and Energy Excellence in Grinding Units

S.NO.	AWARDS	Plant Name
I.	**Awards for Energy Excellence in Integrated Cement Plants**	
1.	Best Award for Energy Excellence in Integrated Cement Plants	RCCPL Pvt. Ltd., Maihar, Madhya Pradesh
2.	Second Best Award for Energy Excellence in Integrated Cement Plants	Sree Jayajothi Cements Pvt. Ltd., My Home Group Industries, Nandyal, Andhra Pradesh
3.	Third Best Award for Energy Excellence in Integrated Cement Plants	J K Cement Works, Muddapur, Karnataka
4.	First Consolation Prize for Energy Excellence in Integrated Cement Plants	UltraTech Cement Ltd., Unit: Kotputli Cement Works, Rajasthan
5.	Second Consolation Prize for Energy Excellence in Integrated Cement Plants	J K Lakshmi Cement Ltd., Sirohi, Rajasthan
II.	**Awards for Environment Excellence in Integrated Cement Plants**	
1.	Best Award for Environment Excellence in Integrated Cement Plants	Dalmia Cement (Bharat) Ltd., Belagavi Unit, Karnataka
2.	Second Best Award for Environment Excellence in Integrated Cement Plants	Dalmia Cement (Bharat) Ltd., Dalmiapuram, Tamil Nadu
3.	Third Best Award for Environment Excellence in Integrated Cement Plants	J K Cement Works, Muddapur, Karnataka
4.	First Consolation Prize for Environment Excellence in Integrated Cement Plants	Shree Beawer Cement Plant, Ajmer, Rajasthan
5.	Second Consolation Prize for Environment Excellence in Integrated Cement Plants	Dalmia Cement (Bharat) Ltd., Ariyalur, Tamil Nadu
III.	**Awards for Total Quality Excellence in Integrated Cement Plants**	
1.	Best Award for Total Quality Excellence in Integrated Cement Plants	Shree Cement Ltd. (RAS), Pali, Rajasthan
2.	Second Best Award for Total Quality Excellence in Integrated Cement Plants	Birla Corporation Ltd. Unit: Birla Cement Works & Chanderia Cement Works, Chittorgarh, Rajasthan
3.	Third Best Award for Total Quality Excellence in Integrated Cement Plants	UltraTech Cement Ltd., Unit: Aditya Cement Works, Chittorgarh, Rajasthan
4.	First Consolation Prize for Total Quality Excellence in Integrated Cement Plants	Shree Raipur Cement Plant, Shree Cement Ltd., Baloda Bazar, Chhattisgarh

5.	Second Consolation Prize for Total Quality Excellence in Integrated Cement Plants	J K Cement Works, Muddapur, Karnataka
IV.	**Awards for Achieving Circular Economy in Integrated Cement Plants**	
1.	Best Award for Achieving Circular Economy in Integrated Cement Plants	UltraTech Cement Ltd., Unit: Reddipalayam Cement Works, Ariyalur, Tamil Nadu
2.	Second Best Award for Achieving Circular Economy in Integrated Cement Plants	J K Cement Works, Muddapur, Karnataka
3.	Third Best Award for Achieving Circular Economy in Integrated Cement Plants	Shree Beawer Cement Plant, Ajmer, Rajasthan
4.	First Consolation Prize for Achieving Circular Economy in Integrated Cement Plants	Dalmia Cement (Bharat) Ltd., Ariyalur, Tamil Nadu
5.	Second Consolation Prize for Achieving Circular Economy in Integrated Cement Plants	Nuvoco Vistas Corp. Ltd., Chittor Cement Plant, Chittorgarh, Rajasthan
V.	**Awards for Energy Excellence in Grinding Units**	
1.	Best Award for Energy Excellence in Grinding Units	UltraTech Cement Ltd., Unit: Jharsuguda Cement Works, Odisha
2.	Second Best Award for Energy Excellence in Grinding Units	J K Lakshmi Cement Ltd., Kalol, Gujarat
3.	Third Best Award for Energy Excellence in Grinding Units	J K Cement Works, Jharli, Haryana
4.	First Consolation Prize for Energy Excellence in Grinding Units	Ambuja Cement Ltd. –Adani Group, Roorkee Grinding Unit, Uttarakhand
5.	Second Consolation Prize for Energy Excellence in Grinding Units	Calcom Cement India Ltd., Dalmia Cement (Bharat) Ltd., Lanka, Assam
VI.	**Awards for Environment Excellence in Grinding Units**	
1.	Best Award for Environment Excellence in Grinding Units	My Home Industries Pvt. Ltd., Mulakalapalli, Anakappali, Andhra Pradesh
2.	Second Best Award for Environment Excellence in Grinding Units	Star Cement Ltd., Guwahati, Assam
3.	Third Best Award for Environment Excellence in Grinding Units	Dalmia Cement (Bharat) Ltd., Bokaro, Jharkhand
4.	First Consolation Prize for Environment Excellence in Grinding Units	J K Lakshmi Cement Ltd., Kalol, Gujarat
5.	Second Consolation Prize for Environment Excellence in Grinding Units	J K Cement Works, Jharli, Haryana

Celebration of Constitution Day

NCB celebrated Constitution Day (Samvidhan Diwas) on 26th November 2022 to commemorate the adoption of the Constitution of India on the same day in 1949 in the Constituent Assembly of India. The preamble of the Constitution was read out by entire officials of NCB & their units.

Vigilance Awareness Week

NCB and its units observed Vigilance Awareness Week in October 2022. Pledge was taken by all NCB officials during the week.

World Standards day

NCB and its units observed World Standards Day with the theme of 'Shared Vision for a Better World.' The theme was part of the IEC, ISO and ITU multi-year campaign to increase understanding about how standardization is important to achieve the United Nations' Sustainable Development Goals. NCB is also playing a key role in validating variety of industrial wastes as mineral component in cement manufacturing and it is incorporated in number of BIS specifications at right time.

Foundation stone laying for NCB Unit at Bhubaneswar by Chief Secretary of Odisha, Sh Suresh Chandra Mohapatra

There are mainly four activities /services provided at the unit which are:

- Independent Testing Laboratory (ITL).
- Third Party Quality Assurance (TPQA).
- Structural Assessment and Rehabilitation(SAR).
- R & D of industrial wastes as prospective building materials.

NCB shall be investing funds in near future for the development of this unit, enhancing its laboratory facilities for testing of cement and concrete, thereby catering to the industry in the eastern part of the country.

Foundation stone laid for NCCBM unit in Bhubaneswar

Exhibition and Dissemination of Technologies in Waste Heat Recovery Systems (WHRS) in Indian Cement Plants

Indian Industries have the highest contribution target of 312 million tonnes of CO_2 reduction and amongst the PAT Industries, Cement has a significant contribution of 32.0 million tonnes of CO_2 from energy reduction. Similar to other PAT Sectors, the Indian Cement Sector has the potential of Waste Heat Recovery System (WHRS) as an important technological intervention in mitigating CO_2. Additional Secretary-DPIIT, Ministry of Commerce and Industry, Govt. of India asked NCB & BEE during foundation

day event of BEE on 01st March 2022 to disseminate the waste heat recovery technologies among cement plants.

To promote Low Carbon Technologies in cement sector, BEE and NCB organized a one-day Seminar on Dissemination and Exhibition of Waste Heat Recovery Technologies in Indian Cement Plants at NCB Ballabgarh on 29th July 2022.

The seminar was inaugurated by Chief Guest Shri Anil Agrawal, Additional Secretary-DPIIT (connected online), Shri Abhay Bakre (connected online), DG- BEE, Guest of Honour Shri Arun Shukla, President & CEO, J K Lakshmi Cement Ltd., Dr B N Mohapatra, DG-NCB and Dr Ashok Kumar, DDG-BEE. Seminar was attended by 100 + delegates including 02 exhibitors.

Shri Abhay Bakre, DG- BEE during his inaugural address informed about progress of PAT scheme as well as project financing facility available for cement plants. This financing scheme can be utilized for implementation of energy efficient projects and waste heat recovery system installations at the plant site. He also informed that carbon market will be launched by the end of this year. He informed that to reduce the carbon intensity by 45% by the year 2030, all stakeholders including cement industry need to take steps for CO_2 reduction.

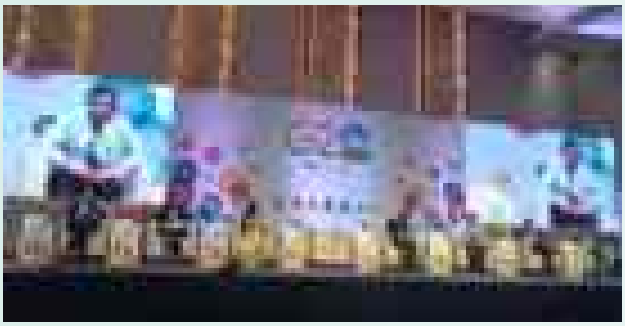
Chief Guest Shri Anil Agrawal, Additional Secretary-DPIIT during his address emphasised that cement industry should proactively try to reduce the CO_2 emissions to meet the target of reduction of 1 billion tonnes of CO_2 emissions by the year 2030 given by Hon'ble PM. He directed NCB to estimate the potential contribution of each of the five levers for decarbonization. Shri Agrawal congratulated NCB and BEE for organizing the event on the relevant topic of waste heat recovery and asked them to organize more seminars on other levers of decarbonization.

DG-NCB in his welcome address highlighted the ongoing initiatives taken by NCB on each of the five levers for decarbonization of Indian cement industry viz. Substitution of Clinker, Alternate Fuel and Raw Materials, Waste Heat Recovery, Improving Energy Efficiency and Newer technologies like Renewable Energy, Novel Cements, Carbon Capture and Storage/Utilization. He informed that three more seminars on the same topic will be organized in the coming months to spread awareness amongst the Indian cement industry on the latest developments of waste heat recovery in cement plants.

Guest of Honour Shri Arun Shukla, CEO & President, J K Lakshmi Cement Ltd. highlighted the initiatives taken by cement industry for reducing the carbon footprint. He called up cement industry representatives to fully utilize the WHR potential in their plants.

During the three technical sessions, total 13 nos. presentations were presented by industry experts including IKN, Thermax Global, Siemens Energy, ThyssenKrupp, KHD India, SRS M Engineering Solution, Holtec, Triple I Engineers. BEE also guided on financing of Waste Heat Recovery projects followed by case studies presentation by M/s J K cement, M/s Ambuja Cement, M/s J K Lakshmi Cement & NCB. The seminar program covered the current scenario and opportunities ahead for promoting WHRS in Indian cement industry, technology development and future advances for WHRS efficiency, barriers, and possible mitigations in WHRS adoption by cement plants, showcased case studies of cement plants for WHRS efficiency improvements and highlighted selection concepts of technology and equipment for WHRS installations and impact of process and system design over WHRS outputs. A technical exhibition of technologies on Waste Heat Recovery Systems from Original Equipment Manufacturers (OEMs) was organized in parallel in the seminar.

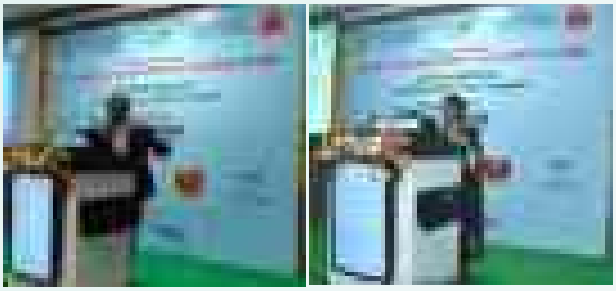
Participation in the G20 India Presidency



Discussions during the G20 India Presidency Meeting, Mumbai

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

National conference on Strategic Solutions & Opportunities for Cement Industry



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

FSAET 2023

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

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

Sectional Committee of BIS (CED-54)

NCB team is currently working for BIS Committee CED-54 (Reinforcement Sectional Committee) along with IIT Chennai, Bombay, Hyderabad & GFRP bar manufacturers for developing new standards on test method and specification of Glass Fiber Reinforced Bars for application in RC structures. The new IS code (IS:18256-2023) on specification of GFRP bars has already been published in Nov' 23 and new IS code on test method is under print stage.

Round Table Interaction at FICCI

NCB attended the round table interaction on Indian Cement Industry of 2030 and 2047:Opportunities, Challenges and Way forward.

Participation in Make in Odisha Conclave'22

DG-NCB delivered the theme address for the topic of Circular Economy on "**Making Odisha a Harbinger of Cradle to Cradle' Economy**" in the Make in Odisha Conclave 2022.

Visit of Ambassador of the RoC

Delegation from the Embassy of Republic of Congo (RoC) H.E. Mr Raymond Serge BALÉ, Ambassador, Mr Gabriel ITOUA, Economic Counsellor & Mrs Smriti Malhotra, Secretary In-charge, Project Monitoring visited NCB Ballabgarh in September 2022 and met DG-NCB & other officials of NCB. The RoC delegation was briefed about the activities carried out by NCB for cement industry and discussion was held on cement plant project in Republic of Congo.

Interaction with Scientists of BARC

Tripartite Agreement with JK Lakshmi Cement Ltd. and Livnsense Technologies Ltd.

Under this agreement, a pilot project on "Improvement in Process Stabilization and Increase in % TSR by the Application of Artificial Intelligence" is being undertaken for the first time in cement industry.

Interaction with Expert Appraisal Committee (Industry-1) at MoEF&CC

Interaction with J K Cement Ltd. at Gurugram

INTERACTION WITH INDUSTRY, ACADEMIA AND GOVERNMENT INSTITUTIONS

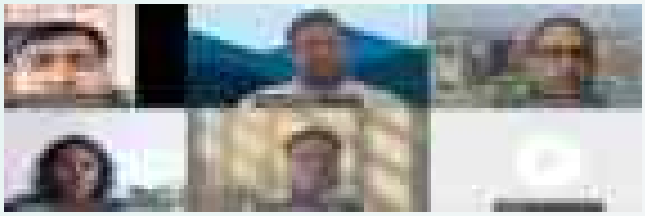
Interaction with UTCL, Roorkee

Interaction with Scientists from Bridge & Rigid Pavement Division, CBRI-CSIR

Stakeholders Meet of CSIR's One Week One Lab - CSIR CBRI program

NCB- H interaction with Cement Industry & Public Sector Units in South India

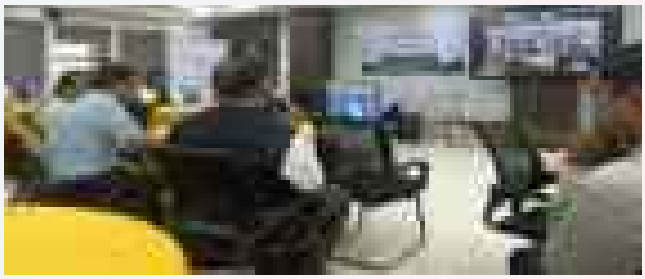
Coordination meeting for R&D projects b/w NCB-H and IIT-H



Meeting with KIIT-DU for UK-India collaborative project

Participation in event organised by NTPC Kaniha on Ash Based Building Products Users

NCB-Bhubaneswar participation in Working Group Consultation on Transforming the Built Environment Through Sustainable Building Materials



Interaction with M/s JSL, Jaipur

Latest MoU with Bureau of Energy Efficiency (BEE)

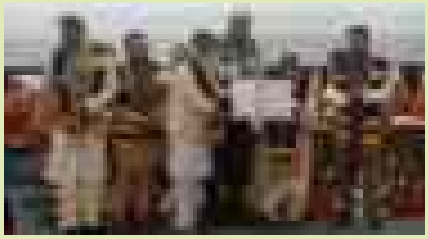
NCB signed (MoU) with (BEE) on 18th December 2023 at NPTI Badarpur to promote intellectual capacity building activities and technical activities targeted towards the cement sector. The MoU was signed & exchanged by Dr. L P Singh, DG-NCB and Sh. Sunil Khandare, Director, BEE in presence of Sh. Raju Goyal, CTO, UltraTech Cement Ltd.; Sh. K N Rao, Advisor, My Home Industries Pvt Ltd; Sh. Sameer Bharadwaj, J K Cement Ltd; Sh. Sanjay Singh, Shree Cement Ltd; Ms Rachna Sharma, CMA; Sh. J S Kalra, BEE; Sh. Vivek Negi, BEE.

EMPLOYEE CORNER

Academic Achievements of NCB employees

Sh. Kapil Kukreja, Group Manager-NCB was successfully awarded Ph.D from BITS-Pilani on the topic of "**Design and Development of Transfer Chute to Handle Alternate Fuels and their Mix in Indian Cement Plants**". For his Ph.D. work, he has solved one of the major challenges faced by the cement industry, i.e., jamming of transfer chute because of handling of various alternative fuels and their mix having a high moisture content of up to 40 %.

Sh. Prateek Sharma, Manager-NCB was successfully awarded Ph.D from BITS-Pilani on the topic of "**Process Design and Integration of Refuse Derived Fuel (RDF) Gasification in Cement Manufacturing Process**". He studied RDF characterization, gasification experiments, and gasifier and calciner model building. He proposed integrating Refuse Derived Fuel (RDF) Gasification in Cement Manufacturing to overcome significant operational, environmental, and sustainability concerns in waste utilization for the cement sector.



Doctorate degree was conferred to **Sh. Sandeep Gupta** on the topic of "**Chemico Mechanical Study of Portland Limestone Cement (PLC) Developed in Indian Scenario**" in April 2023. He completed his doctoral studies from Manav Rachna University, Faridabad. The study highlighted preparation and analysis of PLC blends prepared from raw materials from different regions of India. The performance characteristics of PLC blends depicted its equivalence with other cementitious material.

Adieu

NCB bids farewell to Dr. B N Mohapatra (Former Director General), Sh AV Subramanian (Joint Director), Sh. Suresh Kumar (Manager), Sh. Srinivas Palagummi (Manager) and Sh. C K P Sharma (Deputy Manager) who superannuated in the year 2023. NCB thanks them for their service and wishes them a happy and healthy post retired life.

Welcome

NCB family welcomes new joinees Sh. Amit Kumar Mehta (General Manager), Sh. Gudisa Linga Reddy (General Manager), Sh. Dheerendra Singh (Deputy Manager), Sh. Anwar Salim (Deputy Manager) and Sh. Dhirendra Pratap Singh (Senior Assistant).

ABOUT THE COUNCIL

The six corporate Centres of the Council guide the activities at the different units. The Centres and their main areas of activity are:

Centre for Cement Research and Independent Testing (CRT) - Fundamental and Basic Research, Cement and Other Binders, Wastes Utilisation, Refractories & Ceramics and Testing Services.

Centre for Mining, Environment, Plant Engineering and Operations (CME) - Geology, Mining & Raw Materials, Process Optimisation & Productivity Enhancement, Energy Management, Plant Maintenance, Project Engineering & System Design, Environmental Management.

Centre for Construction Development and Research (CDR) - Structural Optimisation & Design, Structural Assessment & Rehabilitation, Concrete Technology, Construction Technology and Management.

Centre for Industrial Information Services (CIS) - Industrial Information and Data Bank, Integrated IT Solution, Publication, Seminars & Conferences, International & National Linkages, Image Building.

Centre for Continuing Education Services (CCE) - Long Term & Short Term Courses, Special Group Training Programmes, Simulator Based Courses, Distance Learning Correspondence Courses, Workers' Development Programmes.

Centre for Quality Management, Standards & Calibration Services (CQC) - Total Quality Management, Calibration Services, Standard Reference Materials, Inter laboratory Services.

National Council for Cement and Building Materials
34km stone, Delhi-Mathura Road (NH-2), Ballabgarh-121004, Haryana, INDIA
Phone: +91-129-2666600, Email: nccbm@ncbindia.com,
Website: www.ncbindia.com

NCB-HYDERABAD
NCB Bhavan, Old Bombay Road, (Mehidipatnam-Gachibowli Road), Hyderabad-500104 Telangana, INDIA
Phone: +91-40-23180400/405
E-mail: ncbh@ncbindia.com

NCB-AHMEDABAD
Smeet Bungalows, Behind Planet House-2 (PH-2), Opp. Shukan Shubh-Labh Apt, Off. Judges Bungalows Road, Bodakdev, Ahmedabad 380054, Gujarat, INDIA
Phone: +91-79-268855840
E-mail: brcncb@rediffmail.com

NCB-BHUBANESWAR
Plot 145, Zone B, IDCO Central Store, Mancheswar Industrial Estate Bhubaneswar-751010, Odisha, INDIA
Phone: +91-9999104569
E-mail: uicncbbh@ncbindia.com, uicncbbh@gmail.com