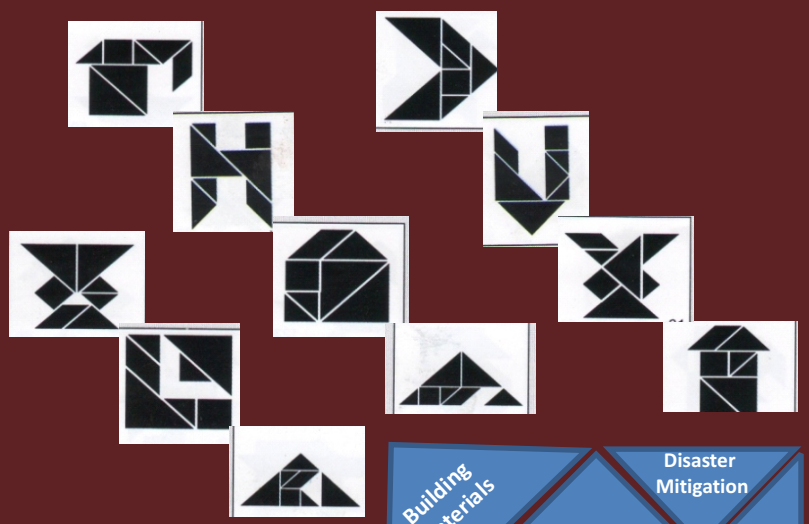
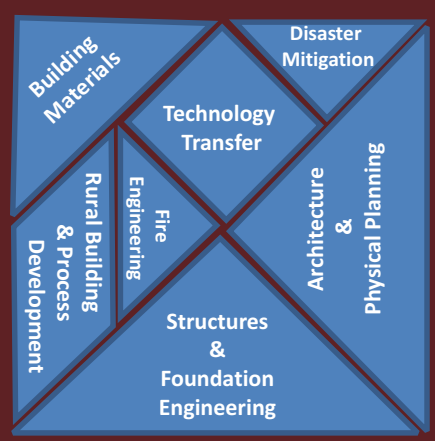
वार्षिक प्रतिवेदन
Annual Report
2009-2010

by Co-ordination

Progress





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CSIR - Central Building Research Institute
(A Constituent Establishment of CSIR)
ROORKEE 247 667 (India)

With Best Compliments
from

Prof. S. K. Bhattacharyya
Director

CSIR-Central Building Research Institute
Roorkee-247667 (India)

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Contents

From the Director's Desk

It gives me a pleasure to present the Annual Report of CSIR-Central Building Research Institute, Roorkee. The report highlights the progress made by the Institute during the year 2009-10.

During the year notable achievements have been made in the area of Shelter Planning, New Materials, Disaster Mitigation and Structures & Foundation Engineering. In the area of Shelter Planning, the focus has been on green and energy efficient buildings. A research study on Code of practice on use of glass in buildings sponsored by All India Flat Glass Manufacturers Association (AIFGMA) has been completed and the Code has been sent to Bureau of Indian Standards for its implementation.

Rural housing being an important activity, a study on Revision of unit cost under Indira Awaas Yojana (IAY) in various geo-climatic zones of the country, sponsored by Ministry of Rural Development, Govt. of India, New Delhi had been undertaken. The study was carried out in thirty two districts, covering all the geo-climatic regions of the country. The focus was to study the existing typology of rural housing, materials, and construction technologies, to suggest the unit cost of construction using environmental friendly and cost - effective technologies.

A Supra Institutional Project on High performance materials and construction technologies for sustainable built space was continued. CSIR Network Projects on Engineering of structures against natural & other disasters and Advancement in metrology were continued.

Building Materials has been an area of strength for CBRI since its inception. Development of new building materials and technologies continues to receive high priority. Studies on dehydrating agents and strength enhancers in making gypsum plaster for use in weather resistant binders, boards and blocks from industrial wastes, were carried out. In the area of Organic Building Materials, Eco-friendly composite boards and panels using plywood/veneer industry waste, Thermal insulation roofing tiles using exfoliated vermiculite waste, High performance polymer based repair materials and protective coatings based on modified epoxy resins have been developed. In the area of Energy conservation, Studies on development of solid state lighting system for interiors were completed.

In the area of Structures and Foundation Engineering, projects of National importance are being taken. This includes Third Party Quality Assurance work at Common Wealth Games village in Delhi, Doon University campus development at Dehradun, housing colony of CGEWHO at Meerut etc. Prospects of societal value such as Sarva Shiksha Abhiyan in the state of Uttarakhand is also being steered by the Institute. Institute has completed important projects in the field of Geotechnical Engineering in its efforts to solve the problems of Landslide Hazard.

In the area of Disaster Mitigation, studies on fire severity in fire damaged buildings, effect of wall lining materials on fire growth and spread, Environment friendly fire retardant rigid polyurethane foam, CFD modelling of fire in building corridor, Visibility of fire exit signs in fire smoke etc. were pursued. Geotechnical properties of stabilized fly-ash for development of appropriate foundation; Evaluation of rock slope parameters for in-stability assessment; Evaluation of seismic ground motion parameters based on site characterization in Dehradun region were also completed.

The Institute has organized a number of training cum awareness programmes and other events during the period. A workshop on Extension Strategy for Innovative Housing Technologies was organized and the same attracted a large number of delegates from academia and industries.

Institute observed open days on the occasion of the National Science Day, CSIR Foundation Day and CBRI Foundation Day to make the students and general public conversant with the R&D programmes of the Institute. Institute celebrated Hindi week in the month of September. Various Hindi programmes and competitions were organized during the period. To make regular interaction and communication with the people of India and abroad, the Institute attended to more than 2000 inquiries related to various problems of building and construction sector. Demonstration-cum-construction training programmes, technical exhibitions etc. contributed significantly for the creation of general awareness about the new research and technologies in the building sector. The Institute alongwith the extension center at Delhi continued to maintain liaison with Central, State, Public/ Private Sectors throughout the country.

In order to steer the R&D activities in the area of Building Science & Technology, MoU has been executed between CBRI and IIT Roorkee . An MoU has been signed between CBRI and M/S Meta Dynamics, South Africa to formulate the Super Sulphated Cement from Fluorogypsum. Technologies on Brick Cutting Table & Brick Making Machine have been transferred to M/s KSB Engineering Works, Yamunanagar. Rice Husk Plastic Composite profiles have been developed. This product has similar properties to natural wood both in their surface appearance as well as carpenter friendly properties and commercially manufactured in the brand name of 'Wood without Tree'. This product satifies the requirement of BIS for timbers.

The above could not have been possible without the sincere and honest efforts made by the fellow scientists, technical officers and administrative staff members who worked hard in successfully completing the work assigned to them. I record my deep appreciation and best wishes to all of them. I wish to record my sincere appreciation and thanks to my predecessor Dr. M.O. Garg for his contribution to the Institute. Last but not the least it is a happy moment for me to remember the support and co-operation provided by our valued customers, sponsorers, well wishers and ex-staff members of CBRI. With the unprecedented growth in the buildings and infrastructural industry, we are looking forward to an exciting future.

(Prof. S.K. Bhattacharyya)
Director

Dated : November 20, 2010

निदेशक की कलम से

मुझे केन्द्रीय भवन अनुसंधान संस्थान, रूड़की की वार्षिक रिपोर्ट प्रस्तुत करते हुए बहुत प्रसन्नता हो रही है। रिपोर्ट संस्थान वर्ष 2009–10 में की गई प्रगति का उल्लेख करती है।

वर्ष के दौरान आश्रय नियोजन, नई निर्माण सामग्रियों, आपदा न्यूनीकरण तथा संरचनात्मक एवं नींव इंजीनियरी के क्षेत्र में उल्लेखनीय उपलब्धियां प्राप्त की हैं। आश्रय नियोजन के क्षेत्र में ग्रीन तथा ऊर्जा दक्ष भवनों पर फोकस किया गया है। आल इंडिया लैट ग्लास मैनुफेक्चरर्स एसोसिएशन (एआईएफजीएमए), द्वारा 'कोड ऑफ प्रैक्टिस ऑन यूज ऑफ ग्लास इन बिल्डिंग्स' पर प्रायोजित अनुसंधान पूरा किया गया तथा कार्यान्वयन हेतु कोड को भारतीय मानक ब्यूरो को प्रेषित किया जा चुका है।

ग्रामीण आवास एक महत्वपूर्ण क्रियाकलाप रहा है, इसीलिए ग्रामीण विकास मंत्रालय, भारत सरकार, नई दिल्ली द्वारा देश के विभिन्न भू–जलवायु क्षेत्रों में इंदिरा आवास योजना के अंतर्गत इकाई लागत की समीक्षा पर अध्ययन का कार्य अपने हाथ में लिया है। देश के सभी भू–जलवायु क्षेत्रों को कवर करते हुए 32 जिलों में अध्ययन कार्य किए गए। अध्ययन में ग्रामीण आवास, निर्माण सामग्रियों तथा निर्माण प्रौद्योगिकियों के वर्तमान वर्गीकरण पर फोकस करते हुए पर्यावरणानुकूल तथा लागत–प्रभावी प्रौद्योगिकियों के उपयोग से इकाई निर्माण की लागत का सुझाव देना है।

सतत निर्मित स्थल के लिए उच्च निष्पादन सामग्री तथा निर्माण प्रौद्योगिकियों पर सुप्रा संस्थागत परियोजना जारी है। संरचना इंजीनियरी पर माप–पद्धति में प्राकतिक एवं अन्य आपदाओं तथा उन्नयन पर सी.एस.आई.आर. नेटवर्क परियोजना जारी रही।

सी.बी.आर.आई. की संकल्पना से ही निर्माण सामग्री एक सुदृढ़ क्षेत्र रहा है। नई निर्माण सामग्रियों तथा प्रौद्योगिकियों के विकास को सदैव उच्च प्राथमिकता दी गई है। औद्योगिक अपशिष्टों से मौसम रोधक बंधकों, बोर्डों तथा ब्लाकों में उपयोग हेतु जिप्सम प्लस्तर बनाने में निर्जलन एजेंट तथा सुदृढ़ता वर्धकों पर अध्ययन किए गए हैं। कार्बनिक निर्माण सामग्री, इको–फ्रैंडली कम्पोजिट बोर्डस तथा पैनलों के क्षेत्र में प्लाईवुड/वेनीर औद्योगिक अपशिष्ट, तापीय रोधन व छत टाइलें, छिलन वर्मिकुलाइट अपशिष्ट, उच्च निष्पादन पॉलिमर आधारित मरम्मत सामग्रियों तथा सुरक्षात्मक लेप, संशोधित एपॉक्सी रेजिन के आधार पर विकसित किए जा चुके हैं। ऊर्जा संरक्षण की दृष्टि से दूर–दराज के इलाकों में प्रकाश की पक्की व्यवस्था के विकास हेतु अध्ययन किए जा चुके हैं।

संरचना तथा नींव इंजीनियरी के क्षेत्र में इसमें राष्ट्रमंडल खेल गांव, दिल्ली, देहरादून में दून विश्वविद्यालय कैम्पस का विकास, मेरठ में सी.जी.ई.डब्ल्यू.एच.ओ. की आवासीय कालोनी इत्यादि में थर्ड पार्टी गुणवत्ता आश्वासन कार्य सम्मिलित हैं। उत्तराखंड राज्य में सामाजिक मूल्यों की विवरणिका जैसे – सर्वशिक्षा अभियान भी संस्थान द्वारा संचालित किया जा रहा है। संस्थान ने अपने प्रयासों से भू–तकनीकी इंजीनियरी के क्षेत्र में भूस्खलन जोखिम की समस्याओं का समाधान करने के लिए महत्वपूर्ण परियोजनाएं पूरी की हैं।

आपदा न्यूनीकरण के क्षेत्र में, अग्नि ग्रस्त भवनों में अग्नि की तीव्रता पर अध्ययन, अग्नि वृद्धि तथा प्रसार पर वाल लाइनिंग सामग्रियों का प्रभाव, पर्यावरणानुकूल अग्नि अवरोधक ठोस पॉलियूरथिन फोम, भवन कॉरिडोर में अग्नि का सी.एफ.डी. मॉडलिंग, अग्नि धुएं में अग्नि निकास चिन्हों की दृश्यता इत्यादि लगवाए गए हैं। देहरादून क्षेत्र में समुचित नींव के विकास के लिए स्थिरीकत उड़नराख के भू–तकनीकी गुणों, अस्थिरता निर्धारण के लिए चट्टान ढलान मानदंडों का मूल्यांकन, स्थल विशेषता के आधार पर भूकंपीय भौम गति मानदंडों का मूल्यांकन भी पूरे कर लिए गए हैं।

इस अवधि के दौरान संस्थान ने अनेकों प्रशिक्षण–सह–जागरूकता कार्यक्रमों तथा अन्य क्रियाकलापों का आयोजन किया। नवीनतम आवास प्रौद्योगिकियों हेतु प्रसार–नीति पर कार्यशाला का आयोजन किया गया जिसने बड़ी संख्या में शिक्षा तथा उद्योग जगत के प्रतिनिधियों को आकर्षित किया।

संस्थान ने राष्ट्रीय विज्ञान दिवस, सीएसआईआर स्थापना दिवस तथा सीबीआरआई स्थापना दिवस पर मुक्त दिवस मनाया जिसमें संस्थान के अनुसंधान एवं विकास कार्यक्रमों के बारे में जानकारी देने के लिए छात्रों तथा आम जनता को आमंत्रित किया गया। संस्थान ने सितंबर माह में हिन्दी सप्ताह का आयोजन किया। इस अवधि के दौरान विभिन्न हिंदी कार्यक्रम तथा प्रतियोगिताएं आयोजित की गई। देश तथा विदेश में नियमित रूप से विचार–विनिमय बनाए रखने के लिए संस्थान ने भवन तथा संरचना क्षेत्र की विभिन्न समस्याओं से संबंधित 2000 से अधिक प्रश्नों के उत्तर दिए। निदर्शन–सह–संरचना प्रशिक्षण कार्यक्रमों, तकनीकी प्रदर्शनियों इत्यादि ने निर्माण क्षेत्र में नए अनुसंधान तथा प्रौद्योगिकियों के बारे में सामान्य जागरूकता के सृजन में महत्वपूर्ण भूमिका निभाई है। संस्थान तथा इसके दिल्ली स्थित प्रसार केन्द्र ने देश भर में केन्द्रीय, राज्य, सार्वजनिक/निजी क्षेत्र के साथ निरंतर संपर्क बनाए रखा है।

भवन विज्ञान एवं प्रौद्योगिकी के क्षेत्र में अनुसंधान एवं विकास गतिविधियों के संचालन हेतु सीबीआरआई तथा आईआईटी, रूड़की के बीच एक सहमति–पत्र का निष्पादन किया जा चुका है। सीबीआरआई तथा मैसर्स मेटा डायनेमिक्स, दक्षिण अफ्रीका ने लूरोजिप्सम से सुपर सल्फेटिड सीमेंट बनाने के लिए सहमति–पत्र पर हस्ताक्षर किए हैं। ब्रिक कटिंग टेबल एवं ब्रिक मेकिंग मशीन की प्रौद्योगिकी को मैसर्स के.एस.बी. इंजीनियरिंग वर्क्स, यमुनानगर को हस्तांतरित किया गया है। धान भूसी प्लास्टिक सम्मिश्र रूपरेखा विकसित कर ली गई है। इस उत्पाद में प्राकतिक लकड़ी की ही भांति ऊपरी दिखावट के साथ–साथ बढ़ई अनुकूल गुण होते हैं तथा वाणिज्यिक उत्पादन में इसके ब्रांड का नाम 'वुड विदाऊट ट्री' दिया गया है। यह उत्पाद लकड़ी के लिए भारतीय मानक ब्यूरो की अपेक्षाओं के अनुरूप हैं।

उपर्युक्त सभी कार्य वैज्ञानिक साथियों, तकनीकी अधिकारियों तथा प्रशासनिक स्टाफ के कर्तव्यनिष्ठ तथा ईमानदार प्रयासों के बिना संभव नहीं थे, उन्होंने सौंपे गए कार्यों को सफलतापूर्वक पूरा करने के लिए कठिन परिश्रम किया है। मैं उनकी दिल की गहराइयों से प्रशंसा करता हूँ। तथा सभी को शुभकामनाएं देता हूँ।

मैं इस संस्थान के पूर्व निदेशक डा. मधुकर ओंकारनाथ गर्ग की भी उनके योगदान के लिए प्रषंसा करता हूँ। अन्त में, अपने मूल्यवान ग्राहकों, प्रायोजकों, षुभचिंतकों तथा सीबीआरआई के सेवानिवृत्त स्टाफ सदस्यों के सहयोग तथा सहायता का स्मरण करना मेरे लिए कुछ कम तथा प्रसन्नतादायक नहीं है। भवन निर्माण तथा आधारिक संरचना उद्योग में अभूतपूर्व वृद्धि के साथ हम उज्जवल भविष्य की ओर देख रहे हैं।

एस.के. भट्टाचार्य

(प्रो. श्रीमान कुमार भट्टाचार्य)
निदेशक

दिनांक : 20 नवम्बर 2010

Shelter Planning

Shelter Planning

Development of Methodology for Eco-friendly and Energy Efficient Buildings in National Capital Region (NCR) *(OLP- 323)*

R.K.Garg and Team

Present day energy crises necessitate the demand of integrated approach of energy efficient buildings, as buildings consume substantial amount of energy. Therefore, Environmental protection and energy efficiency of buildings are the major concern in the present day scenario. The study will provide the framework and guide lines for sustainable and energy efficient buildings, utilizing the available resources in Indian conditions.

The study revealed that in India there are two popular systems prevailing namely LEEDS and TERI GRIHA. The LEED (Leadership in Energy and Environmental Design) US rating system evaluates environmental performance from a whole building perspective over a building's life cycle, providing standards for rating new and existing commercial, institutional and high rise residential buildings. TERI-GRIHA (TERI- Green Rating for Integrated Habitat Assessment) is for measuring and rating building's environmental performance by its qualitative and quantitative assessment criteria in the context of India's varied climate and building practices.

Based on the case studies of the existing green buildings and available literature a methodology for Eco friendly and Energy Efficient Buildings has been developed for NCR. Also, Design parameters contributing towards eco-friendly and energy efficient buildings and the salient features of Green Building which need to be considered are:

- Site planning
- Building envelope design
- Building system design: HVAC (Heating, Ventilation and Air Conditioning), lighting, plumbing, electricity, and water heating
- Integration of renewable energy sources to generate energy on-site
- Water and waste management
- Selection of ecologically sustainable materials
- Quality of indoor ambience
- Minimal disturbance to landscapes and site condition
- Use of recycled and environmental friendly building materials
- Use of non-toxic and recycled/recyclable materials
- Efficient use of water and water recycling
- Use of energy efficient and eco-friendly equipment
- Use of renewable energy
- Indoor air quality for human safety and comfort
- Effective controls and building management systems

The above design features and methodology would be beneficial for the energy efficiency and improvement in the quality of life of people at large.

Design and Development of Standardized Housing Units with Prefabricated Components for Low-Rise Housing *(OLP-322)*

R.D.Singh and Team

The housing industry is a fundamental and strategic sector linked to improving the standard of living. The housing sector depends highly on technological innovation as a constant driving force. Technological innovation creates added value, it improves the product and cuts the costs, thus, allowing for a greater distribution of the product on the market. The conventional construction technique, due to the slow pace of construction and higher cost, it is not able to meet the housing demand. In the light of such situation, a partially prefabricated system of construction has been developed. Quality, speed of construction and savings in labour and material cost are main features in the proposed housing system which can be handled by semi-skilled labour. This project is an attempt to provide easy to erect, portable and cost effective standardized prefabricated housing components. In India, adoption of prefabricated building techniques has many advantages in the context of availability of materials, labour and technical skills.

Photo 1 : Hollow Panel Unit

Photo 2 : Half Hollow Panel Unit

Small hollow panel units of dimension 150 x 450 x 300 mm have been developed with 35-60 mm thick concrete sections. It is designed on one side as male and other side as female part to give proper connectivity. Other unit as half one of dimension 150 x 220 x 300 mm has also been conceived for proper masonry work avoiding vertical joints.

Type Design of Houses

Using the above wall panel units, standard house designs for one room unit having an area of 23.75 sq.m and two room unit with an area of 45.6 sq.m have been conceived using fixed number of panel units of both sizes. The full blocks and half blocks in different walls at the junctions and corners are united with small columns of 150 x 150 mm with normal reinforcement and a lintel band of 75 mm thick can be provided on doors/

windows which combined together shall take care of earthquake forces. The roof in this case may be used as in-situ or with other systems of prefabricated roof units developed at the institute like RCC panel & joists or Brick Panel & RC joists etc.

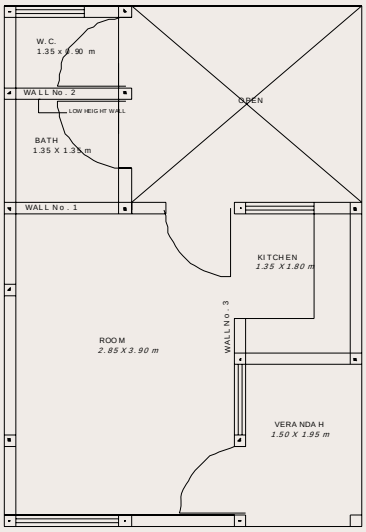


Fig. 1 :Plan of Standard House Design
(One Room Unit- Plinth Area-23.75 sq.m)

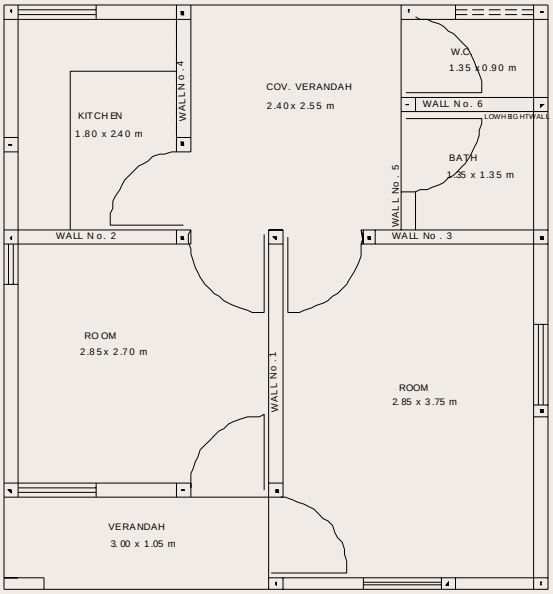


Fig. 2 : Plan of Standard House Design
(Two Room Unit - Plinth Area-45.6 sq.m)

Review and Upgradation of Space Norms for Inclusive Education & Energy Efficient Educational Buildings up to Secondary Level *(OLP-296)*

Neeta Mittal and Team

The education scenario which form one of important part of rehabilitation cycle of disabled present a grim picture in our country today. The objective of the project has been to review and upgrade the existing space norms up to secondary level education for inclusive education for the disabled & normal children. Inclusive education means, schools should accommodate all children regardless of their physical, intellectual, emotional, social linguistic or other conditions as per UNESCO.

The study highlights the accessibility and other features which are essential for integration of physically handicapped, visually handicapped and deaf children in the schools with the normal children. To implement the inclusive education system it is essential to create the Barrier free buildings and built Environment through Architectural planning and designing of buildings for the physically challenged children.

Accessibility features include ramp, door width, railings etc. for physically handicapped, tactile flooring adequate safety provisions for visually handicapped. To study and identify the need of children with various disabilities a number of schools imparting education to such type of children studied. It is essential to provide the special teaching aids and facilities for the visually handicapped children and deaf children.

Focus is required on following aspects of School Buildings:

- Access to the School Building
- Shape and Size of the Classroom
- Vocational activities
- General exercise / Physiotherapy
- Equipment's for various games
- Toilets and their approach
- Ramps and Staircases
- Classroom Furniture
- Display Charts
- Height and Width of chalk board
- Special education room
- Audio visual facilities

Photo 3 : NIVH Dehradun

There is also a need to bring awareness among the society for common education to normal and children with disabilities for providing equal opportunities to them in urban and rural areas.

Development of Solid State Lighting System for Interiors (OLP- 297)

Shree Kumar and Team

Few prototype LED lamps have been designed and fabricated to be used for task and general lighting of buildings and their photometric characteristics such as luminous flux. Luminous intensity have been determined using photometric bench and integrating sphere photometer of 1m diameter. Appropriate power supply has also been designed so that these lamps may be used on AC mains or from rechargeable batteries which are being charged from solar photovoltaic panels, so that utilization of solar energy is made for interior lighting. Solid state lamp using white LEDs of 10mm size having numbers 316 has been fabricated.

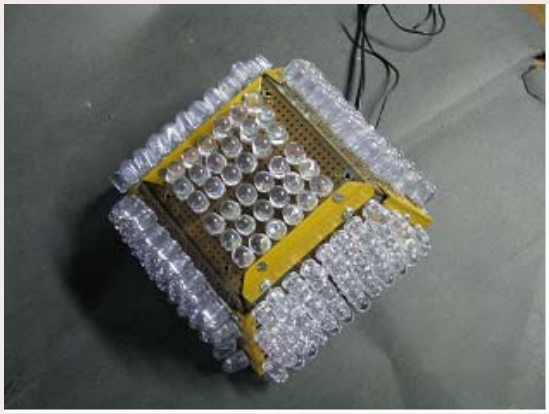


Photo 4 : A view of LED lamp developed.

New Materials

New Materials

New Composite Material as Wood Alternative using Plywood/ Veneer Waste *(OLP-324)*

S. P. Agrawal

The waste generated in plywood & veneer industries is substantial and there is no economic use of it at present (Photo 1). The development utilizes the lignin available within the wood waste itself directly as binder via in-situ conversion. A laboratory level process has been developed and prototypes meet the requirements of IS-3087 specifications for medium density particle boards for general purposes (Photo 2). The technology is ready for transfer at laboratory level.

Salient Features

- Waste utilization & environment friendly
- Cost effective
- Meets most of the requirements of IS: 3087
- Adaptable technology for large, medium & small level industries
- Aesthetic appearance
- In-situ lamination possible
- Carpenter tool friendly
- Suitable for door & window shutters, panels, walling, furniture, partitioning etc.
- Zero waste generation
- Patent pending.

Photo 1 : Veneer & Plywood Industry Waste

Photo 2 : Composite Prototypes

New Thermal Insulation Tile using Exfoliated Vermiculite Waste *(OLP-324)*

Rajni Lakhani

Vermiculite is a safe inert material, light in colour (Photo 3). When heated it expands (exfoliates) up to 30 times its original volume. The exfoliation process converts the dense flakes of ore into lightweight porous granules containing innumerable minute air layers (Photo 4). Exfoliated (expanded) vermiculite is light and clean to handle, has a high insulation value, acoustic-insulating properties and absorb and hold a wide range of liquids.

Photo 3: Vermiculite

Photo 4: Grades of Exfoliated Vermiculite

Substantial amount of exfoliated vermiculite waste is available in India. This waste is used for converting it into roofing tile for thermal insulation purpose incorporating water dispersible polymer. Tiles developed using this waste (Photo 5) will provide good thermal insulation as well as good sound insulation and good adhesion to different kind of substrates.

Tiles of different sizes (150-300 mm) were cast using cement, exfoliated vermiculite (1-3 mm size), water dispersible polymer, and catalyst. The developed tile prototypes were characterized for its physico-mechanical behavior and the process was optimized with the optimization of following parameters:

- Cement - vermiculite ratio
- Polymer content
- Pressing time and pressure
- Curing time

The properties of the tile meet the requirement of IS : 3346 specifications for thermal insulating materials. A laboratory level process has been developed and prototypes found suitable for thermal insulation purposes for roofs and ready for transfer at laboratory level.

Photo 5: Thermal Insulation Tile for Roof using Exfoliated Vermiculite Waste

Salient Features

- Waste utilization and environment friendly
- Cost effective
- Meets most of the requirements of IS:3346
- Adaptable technology for large, medium & small level industries

Development of Polymer based High Performance Repair Materials *(OLP-326)*

S. R. Karade

Repair and retrofitting is an important area in the construction industry. There is always a need of appropriate repair materials suiting to different environments. Now a days, polymer based mortars are mostly used as repair materials in civil engineering applications. However, polymers degrade at elevated temperatures but cement does not loose strength below 100°C. Higher temperature conditions prevail in several industrial buildings and structures such as coke handling plants, thermal power plants, prilling towers, chimneys, furnaces, heat treatment plants etc. The main objective of this study was to understand the influence of temperature and chemicals on the performance of polymeric modified mortars and to formulate suitable composition for such higher temperature exposure conditions. The bond testing of one typical formulation of repair material under slant shear test in UTM is shown in Photo 6.

Experiments were conducted to assess the effects of thermal cycles, fire, acidic environment on different types of repair mortar. Influence of thermal cycles on bond characteristics is studied by using slant shear test specimens and on flexural behaviour for 60 and 120 cycles. To understand the influence of exposure to acidic environment, the specimens were submerged in a sulphuric acid solution (5%) and the changes in weight, shape, colour and compressive strength are recorded at various intervals of exposure time. The effect of thermal cycles on compressive strength of various repair mortars is shown in Fig. 1. The changes in properties of different mortar specimens dipped in an acidic solution for 180 days is shown in Fig. 2. Fire behaviour of the above mentioned mortars was also studied.

Photo 6 : Polymer Modified Repair Material under Test

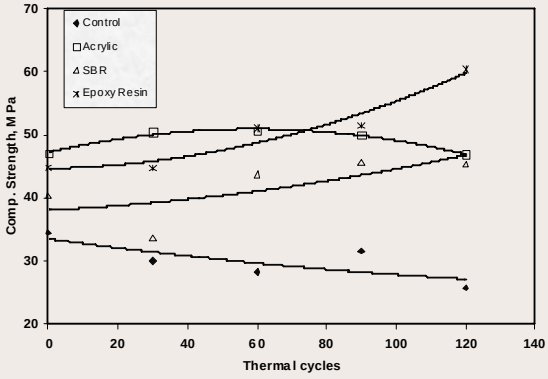


Fig. 1: Effect of number of thermal cycles on compressive strength of repair mortars

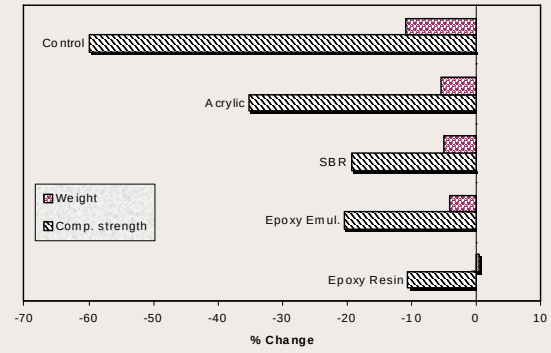


Fig. 2: Change in compressive strength and weight of repair mortars after 180 days exposure to acidic solution

The study concluded that:

- The plain cement mortar is greatly affected by heating & cooling cycles, high temperature and acidic environment.
- Epoxy mortar has the best resistance to acidic exposure and to the thermal cycles, but it has poor strength at higher temperature. Thus, on cooling epoxy mortar regains its strength.
- The latex modified mortars have moderate resistance to heating & cooling cycles, high temperature and acid.
- While selecting a suitable repair material for a given condition, these results will be helpful.

Development of Coating Systems for Fertilizer Industries based on Modified Epoxy *Resins (OLP-325)*

P. C. Thapliyal

Part 1: Development of modified epoxy coating system

The objective of the project is to formulate coating system/s for the fertilizer industries. This part reports data generated for a newly developed three component coating system and comprise of cardanol modified virgin/pigmented epoxy and polyurethane. In total, four coating systems were studied. The developed coating system showed remarkable performance under laboratory and accelerated conditions (Photo 7) and hence can be used on concrete structures exposed to aggressive environments. The coating properties of the system were investigated for their physico-mechanical and corrosion resistance. Compositions of four coating systems are as follows:

System A = Unmodified epoxy + Pigmented epoxy + Pigmented epoxy
System B = Unmodified epoxy + Pigmented epoxy + Polyurethane
System C = Modified epoxy + Pigmented epoxy+ Pigmented epoxy
System D = Modified epoxy + Pigmented epoxy + Polyurethane

Part 2: Development of coating for areas exposed to higher temperature

In the second part, formulation for coatings suitable for areas exposed to higher temperature were attempted. The coatings were developed using modified epoxy with flake type additive. Epoxy resin was procured from local vendor and used as such. Formulated coatings were labeled as A and B, with or without inorganic flake type mineral filler respectively. Non volatile content was kept at around 60% of total volume in this formulation. The initial studies showed encouraging results and more work are needed to establish their efficacy.

Conclusions

In comparison to virgin resin tensile strength decreased slightly but elongation increased appreciably. Also bond strength increased almost by 40%. Water vapour transmission increased appreciably due to presence of inorganic mineral type flakes in the coating B.

The coating also did not showed any damage in heat resistance test even after 120 days. So it can be concluded that the results are promising

and it has the potential to be developed into a good coating system for areas exposed to high temperature. More studies need to be done.

Photo 7 : Coated panels with developed formulations under test

Development of Polymer Modified Cementitious Repair Materials for Building Applications *(GAP-5027)*

Rajni Lakhani

This project was supported by Department of Science & Technology, New Delhi.

Study of multi component polymeric system is advancing day by day from scientific & practical point of view. Various physical properties of polymer blends are particularly interesting as being related to the composition, interaction between components, phase structure as well as to the conditions of processing.

Keeping this in mind, the studies have been planned for the development of polymeric systems incorporating polymer blends for building applications. Water dispersible polymer blends were prepared by selecting polymers depending on intended use such as high strength, durability, and chemical resistance. Developed blend has been characterized by determination of mechanical properties, by FTIR, SEM and DSC techniques. On the basis of the data obtained, the composition was optimized.

The optimized composition of the polymer blend has been used for the preparation of different repair materials having different application. Different parameters such as mix proportion, polymer-cement ratio, water-cement ratio (Fig. 3), curing condition, were optimized on the basis of physico-mechanical properties (Fig. 4). The developed repair materials have been evaluated for long term performance tests.

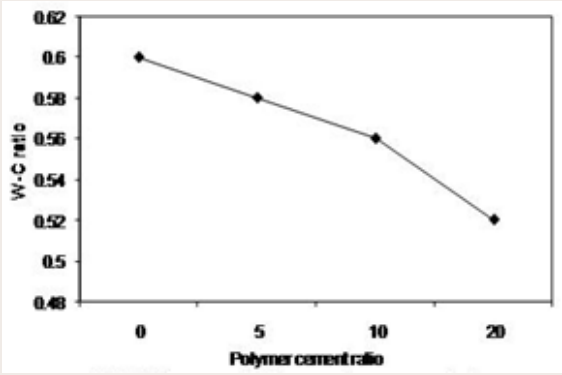


Fig. 3: Water cement ratio vs polymer cement ratio

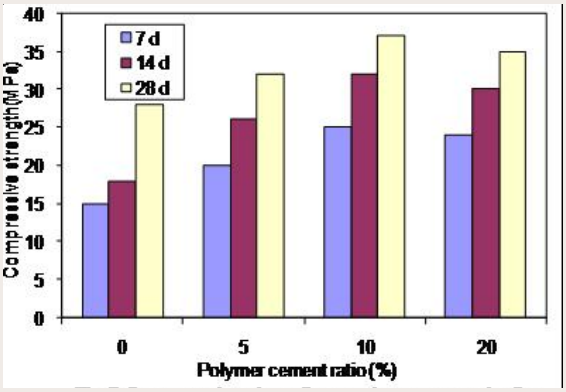


Fig. 4: Compressive strenth vs polymer cement ratio

The developed system has some of the following salient features:

- Variable strength (High/low as per the requirement)
- Low porosity
- Cost effective
- Durable
- Environmental friendly

Development of Bio-Degradable Nursery Pots using Forest Waste *(GAP-0579)*

S. P. Agrawal

There is direct relation of environmental problem and depletion of natural resources of the forests. Forests are very important resources in any region and play a very significant role in the process of economic development. As a result of indiscriminate felling of trees for commercial purpose and pressure on forests for domestic purposes, the forests have gradually disappearing from the region. The problems of people for their survival are linked with the forests. Forests serve as a primary resource base along with cultivable land in every state. They are a source for fodder, fuel and timber, which affect the entire economic activities and social life of the people. The first and foremost challenge in its development is the problem associated with the degraded environment and ecological imbalance.

In view of the above, it can easily be revealed out that there is an immense need to develop such technologies, which can easily be adopted by local people without affecting the forest cover. In this respect, CBRI has conceived an idea to utilize the forest litter to make value added product which also enrich the region with further forestation and save the forests from pollution. There is a need in the country to conserve our precious forests too by using waste material whose ultimate national impact will be the conservation of forest wealth, pollution control and will save the people from various deforestation effects. In this direction an innovative R&D project has been undertaken under the support of Ministry of Environment & Forest to develop bio-degradable nursery pots using forest waste. Work is in progress.

Cost Effective Value added Thermal Insulated Tiles for Insulation Purpose *(GAP-0509)*

Rajni Lakhani

The project was sponsored by BMTPC in October 2009. The objectives of the project are:

1. To develop roofing tiles for thermal insulation purpose
2. Characterization and Optimization of develop tiles as per IS specifications.
3. Optimization of operating parameters and to make prototype for field trials.

Facilities for Material Characterization

Material characterization to assess the performance of various new and alternative material before their use is a prime requirement for all materials. Facilities for all physico-mechanical characterization of building and other materials have been created and access has also been made available to the clients (Photo 8). This help in quality improvement of their products as well as in monitoring the quality. This characterization also helps in identifying the end application of different products. Major clients of these facilities include The Supreme Industries Ltd., New Delhi and Mumbai, NTPC, Talchar, Muzaffarpur, Shemadri, Remmers India Ltd., Mumbai, Tihri Hydro Development Corporation Ltd., Uttarakhand etc.

Photo 8: Inside View of the Laboratory

Studies on Dehydrating Agents and Strength Enhancers in making Gypsum Plasters for use in Weather Resistant Binders, Boards and Blocks *(OLP-299)*

Mridul Garg and Neeraj Jain

Effect of Admixtures on the Properties of Anhydrite Plaster

Soluble and insoluble anhydrite plaster was prepared by calcining phosphogypsum at temperature 300 & 1000°C. The retention time of calcinations was maintained at 3.0 hrs. The properties of anhydrite plaster like density, pH and loss on ignition were studied as per IS: 2542-1978. Density was found 2650 and 2900 kg/m^3; pH 7.1-7.2; loss on ignition 3.0 and 1.6 of soluble and insoluble anhydrite respectively. The effect of various chemical activators, namely sodium sulphate, ferrous sulphate, ammonium sulphate, potassium sulphate, potassium dichromate, calcium chloride & calcium hydroxide was studied on setting time and strength development of anhydrite plaster and shown in Table 1.

Data show that strength increased with curing period with all type of activators. The enhancement in compressive strength with hydration period may be correlated with the progressive increase in combined water with curing period as given in Fig.5. The strength complied with minimum specified value of 17.0 MPa at 28 days as given in ASTM: C61-50-1981. The hydration of hardened plaster was assessed by DTA (Fig. 6). DTA of the hardened anhydrite plaster exhibited an increase in the intensity of double dehydration endotherms of gypsum obtained at 130-150°C and at 170-190°C and that of inversion of $\gamma CaSO_4$ into $\beta CaSO_4$ at 360-380°C. The increase in the intensity of endotherms and exotherms confirm the formation of gypsum from gypum anhydrite plaster.

Table 1: Setting time and compressive strength of anhydrite plaster with different activators

S.N.	Chemical Activators, (by wt.%)	Setting time (min)	Compressive strength (MPa)			
			1d	3d	7d	28d
1.	$(NH_4)_2SO4$					
	1.0	275	1.35	5.50	5.80	24.30
	2.0	260	1.30	5.40	8.60	32.23
	3.0	240	5.20	9.50	15.20	34.30
2.	$Ca(OH)_2$ (3%)+$CaCl_2$ (0.5%) +Na_2SO_4 (2%)	200	13.16	18.42	28.70	37.20
3.	$Ca(OH)_2$ (4%)+$CaCl_2$ (0.5%) +Na_2SO_4 (2%)	180	12.30	18.0	23.50	36.00
4.	Na_2SO_4 (1.5%) +$FeSO_4$ (0.5%)	200	5.50	12.50	25.50	38.90

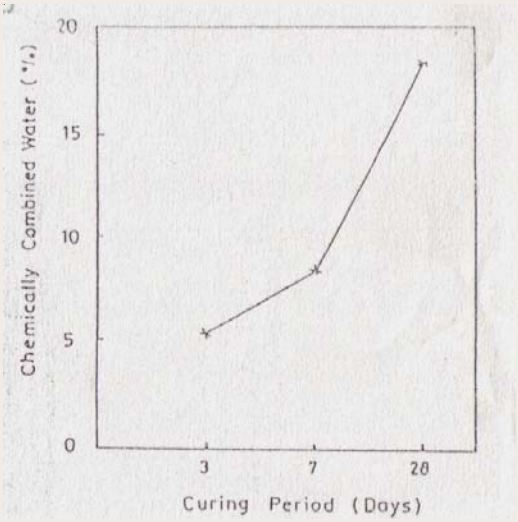


Fig. 5: Effect of curing period on chemically combined water of gypsum plaster

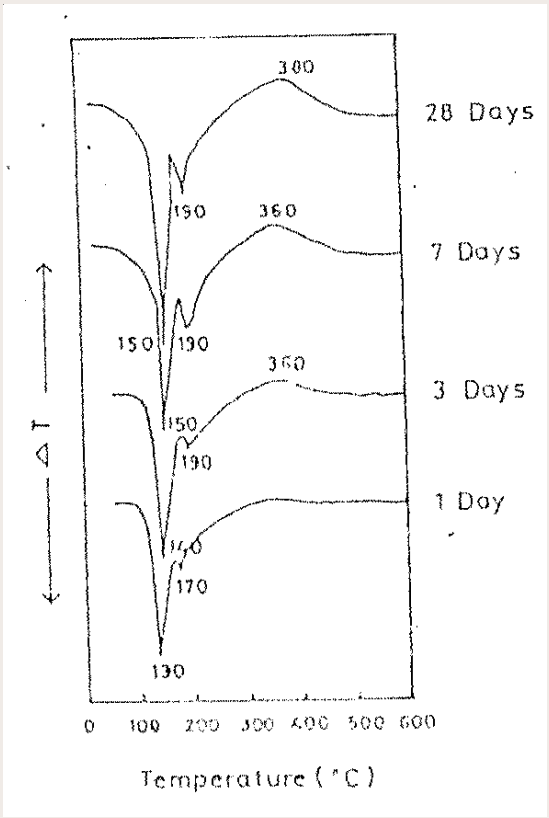


Fig. 6: DTA of anhydrite gypsum plaster at different hydration period

Formulation of Cementitious Binder

Fluorogypsum, a by-product of hydrofluoric acid industry was characterized and found to possess impurities of fluoride and free acidity. It is therefore, essential to neutralize fluorogypsum with hydrated lime. After neutralization, it was used to formulate a colourless cementitious binder of high compressive strength by blending (75-85%) fluorogypsum (300m^2/kg) with marble dust, white cement and additives in different proportions followed by grinding in a ball mill to a fineness of 400 m^2/kg (Blaine). The cementitious binder was tested and evaluated as per IS: 4031-1988; Methods of physical test for hydraulic cement and IS: 6909-1990; Specification for super sulphated cement respectively. The binder of composition having fluorogypsum 85%, marble dust 10%, white cement 3% and activator gave setting time: initial -1.3 and final -3.6 hours while the compressive strength was 12.2, 29.3 and 42.1 MPa at 3, 7 and 28 days of curing period respectively. DTA studies show that strength development of gypsum binder takes place through formation of CSH and ettringite.

The durability of binder has been studied by its performance in water and by accelerating aging i.e. alternate wetting and drying as well as by heating and cooling cycles at temperatures in the range of 27-50°C. The results indicate decrease of strength of binder with increasing cyclic studies at different temperatures.

The water absorption was below 10.0% and was in the ascending order with respect to curing period. The achievement of low water absorption in increasing order show absence of leaching of the gypsum whereas plain gypsum plaster showed leaching of gypsum after 3 days of immersion in the water. The use of fluorogypsum based cementitious binder is recommended for external use and for prefabricated building components.

Investigations have shown that Jute fibre reinforced gypsum binder boards (Breaking load: 600-750N, water absorption: 18-20% against 360-390N and 35-39.5% values of plain plaster boards respectively) and blocks (compressive strength: 4.2-5.6 MPa, bulk density: 1066Kg/m^3) of improved properties were produced from the fluorogypsum binder (Photo 9 and 10).

Photo 9: Fibre reinforced gypsum board

Photo 10: Gypsum blocks

Evaluation of Chlorfluazuron 0.1% based Termite Bait for Termite Management in Buildings *(SSP-6717)*

B S Rawat and Team

The 'green building' concept is gradually gaining momentum and acceptance in India. They are also designed to meet certain important objectives such as protecting occupant's health and improving employee productivity, thus reducing the overall impact to the environment. "Green Buildings" might be excellently good for keeping out cold air in the winter and hot air during the summer, but they often warm welcome various building pests. These building pests not only contaminate our inbuilt environment but also spread several types of dreaded diseases and damage valuable properties. Termite baiting system is an alternative approach and newly emerged termite management tool for buildings. Small amount of bait material is deployed to eliminate the whole termite colony present in structures. Foraging termites consume bait material and share it with their nest-mates, resulting in a gradual decline in numbers. In the present study, a baiting system containing Chlorfluazuron 0.1% in termites food was studied in different climatic and soil conditions in India. Chlorfluazuron is a benzoyl phenyl urea insecticide, which requires ingestion by target pests to be efficacious. It disrupts the formation of chitin at the time of moulting, resulting in the failure of termite to complete the moulting process and eventually kills the affected termites.

This baiting system has two main components: (i) In-Ground Bait Stations (IGBS): Each IGBS consisting of two interlocking halves with horizontal slots to allow the entry of termites and a lockable plastic lid. On inside wall of the station are a series of vertical slots that house six wooden interceptors used to facilitate contact between the termites and bait material. The bait stations are placed in the ground around the exterior of buildings. Each IGBS has a capacity of 700gm bait material. (Photo 11-13) (ii) Above Ground Bait Stations (AGBS): It is a plastic box measuring 180mm x 80mm x 80mm, with an approximate capacity of 500gm bait material. AGBS are made of rigid plastic with a removable cover, without any wooden interceptor. It is mounted directly on the termite infested spot of building with the help of screws. Bait material is placed inside AGBS at the time of installation. The cover is held in place with six tamper - resistant screws (Photo 14) .

Photo 11: Internal view of an IGBS with wooden interceptors

Photo 12: IGBS filled with bait material

Photo 13: Complete IGBS before installation

Photo 14: AGBS after installation on wall

Three experiments were carried out in the project:

(i) **Elimination of termite colonies from termite infested buildings:** Eight infested buildings were selected in each experimental site. Bait stations were installed at a distance of 1.5ft to 2ft away from the structure and the perimeter linear distance between IGBS to IGBS was three metres. IGBS were placed strategically at or near points of known or suspected termite entry into structures. AGBS were installed only on the points in the structure, where termite activity is already noticed. Termites enter the bait station through termite entry holes formed in the bottom of station. Once bait material is consumed it was refilled with fresh bait material. Each bait station was inspected regularly till the end of experimental period. (Table 2).

Table 2. Total number of bait stations installed and summary of results

Name of Site	Total building treated	Total bait station installed			Number and % age of bait station attacked Months				Number and % of bait station not attacked
		IGBS	AGBS	Total	0M	02M	04M	06M	
RKE	08	121	65	186	(105) 56.0%	(24) 13.0%	00	00+	(57) 31.0%
DDN	08	100	37	137	(73) 53.2%	(27) 19.7%	00	00+	(37) 27.0%
MYE	08	95	34	129	(82) 63.5%	(23) 17.8%	00	00	(24) 18.6%
TOTAL	24	316	136	452	(260) 57.5%	(74) 16.3%	00	00	(118) 26.1%

Abbreviations: RKE-Roorkee, DDN-Dehradun, MYE-Mysore,
+ One IGBS was found attacked on 6th month's observation

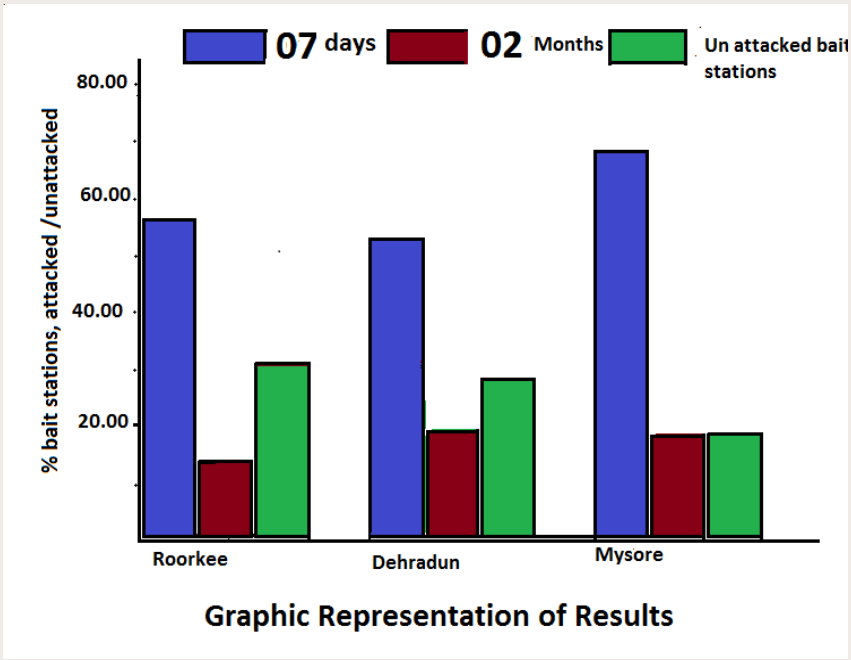


Fig. 7: Graphic representation of data received from all the three sites.

(ii) **Colony elimination of mound building termites:** The baiting system was studied directly on the active termite mounds. Eight active termite mounds were selected in each location- Roorkee, Dehradun and Mysore. There were fifteen treated and nine untreated (control) termite mounds in all the locations. The mounds were selected on the basis of their physical proximity, easy to access, and other subjective attributes. Four in-ground bait stations were installed in each mound. Keeping in view, the termite activity inside the mound, the bait material along with wooden interceptors has also been added in each bait stations. Approximately, each IGBS was replenished with 200 gm of bait material initially in all the mounds and in all site . (Photo 15-16)

(iii) **Study on leaching effect of toxicant from Chlorfluazuron 0.1% termite bait :** In order to determine the residual toxicity of soil treated with Chlorfluazuron 0.1%; the IGBS were taken out and 100 gms soil was collected from the bottom of three IGBS. The soil samples were collected from 0-15cms, 15-30cms and 30-45cms depth using augur. The mortality rate of termites were determined in the laboratory by bio-assay method.

Based on the results and observation of all the tests; the conclusion can be drawn as under: (i) 100% protection from termites was achieved within fifteen to seventeen weeks from the date of installation of bait stations (IGBS and AGBS) in all the treated buildings located in all the three distantly located experimental sites in Roorkee, Dehradun and Mysore.(ii) The termite bait containing Chlorfluazuron 0.1% as an active ingredient; was found 100% effective to control termites in active mounds of *Odontotermes obesus* species within six months in all the sites, (iii) There is no difference in mortality rate of termites on the soil collected from 0-15 cms, 15-30 cms and 30-45 cms depths underground the IGBS and with the untreated soil samples.

Photo 15-16 : Installation of bait stations on the termite mounds

Discovery, Development and Commercialization of New Bio-active and Traditional Preparations *(NWP-037)*

B S Rawat and Team

It was a CSIR coordinated inter- laboratory network project. Twenty laboratories of CSIR were working together under this project. Some of the laboratories were working for development of Drugs and some other for the development of herbal pesticide. The main objective of the pesticide development group was to "discover new pest management agents with herbal and single molecules which are plant based and non toxic to humans". Among all - CIMAP, NBRI, CSMCRI, NCL, IIIM (Jammu), IHBT, RRL (Jorhat), IMMT (Bhubaneshwar), AMPRI (Bhopal) and IICB Kolkata were associated in this project for collection and extraction of plants while CFTRI, CIMAP, IICT, IHBT, NCL, RRL (Jorhat), RRL (Thrivanatpuram) and CBRI Roorkee were screening laboratories. Total 149 samples of plant extractives were evaluated during interim period for their termiticidal properties, but none of the samples were found positive. Total 301 samples were received during the interim period. Overall, more than 320 samples were found positive, which have shown termite mortality more than 85% in the laboratory condition. (Photo 17, Table-3&4)

Photo 17: Various types of herbal material having pesticidal properties

Table 3. Progress of work during the interim period (2009)

Sl No.	Laboratory	Sample Received	Sample Screened	Positive Samples
1	CBT	00	00	00
2	CIMAP	20	10	00
3	CSMCRI	28	26	00
4	IHBT	95	33	00
5	IICB	00	00	00
6	NBRI	10	00	00
7	NCL	10	00	00
8	AMPRI	94	59	00
9	IIIM	00	00	00
10	RRL	44	21	00
11	IMMT	00	00	00
	TOTAL	301	149	00

Table 4. Overall, laboratory wise break up of samples received

Sl No.	Laboratory	Sample Received	Sample Screened	Positive Samples
1	CBT	20	20	02
2	CIMAP	1880	773	48
3	CSMCRI	559	309	27
4	IHBT	1029	504	58
5	IICB	397	249	53
6	NBRI	428	271	15
7	NCL	532	248	09
8	AMPRI	1051	293	05
9	IIIM	1212	1063	93
10	RRL	329	144	10
11	IMMT	95	09	00
	TOTAL	7530	3883	320

The only task of screening of herbal extractives was assigned to this laboratory. Some of the extractives have shown excellent results with more than 85% insect mortality during primary screening, out of which some of the samples could not performed well in secondary screening. It may be due to the seasonal variation and other environmental condition during collection of raw material. The test dose was 1000 ppm, number of test insect 10 and duration of test was 24 hrs for each herbal extractive. Further, all the positive samples require detailed chemical investigation for fractionation, isolation, structure elucidation and formulation of effective molecule. We need expert help of other associated chemical laboratory as we do not have these facilities in the institute. Final report has been submitted to nodal laboratory.

Studies on Microbial Formulation (Metarizium Spps) for Termite Management in Buildings *(SSP-188)*

B S Rawat and Team

Metarhizium anisopliae, formerly known as *Entomophthora anisopliae* is a fungus that grows naturally in soils throughout the world and causes disease to various insects by acting as a parasite. *Metarhizium anisopliae* strain infects insects, primarily beetle larvae. It has been approved as a microbial pesticide. Many strains of *Metarhizium anisopliae* have been isolated worldwide from insects, nematodes, soil, river sediments, and decomposing organic material. No harm is expected to humans or the environment, when pesticide products containing *Metarhizium anisopliae* are used according to label instructions. In the present project, three tests is to be carried out to study the effectiveness of the product, of which two tests are completed.

Modified Ground Board Test

In a modified ground board method; known concentration and volume of chemical solution (3 litre/m^2) was applied to the surface of 43 sq.cm. of soil that has been cleared of vegetation.(For Formulation both F-1 & F-2: A:@45 gm powder per slab (03 nos),B:30 gm powder per slab,C:75 gm powder per slab and D:50 gm powder per slab). After the chemical has been soaked into the soil, it was covered with polyethylene vapour barrier. A 10 cm. diameter capped plastic pipe was placed in the centre of the soil to serve as an inspection port. The vapour barrier was removed from inside the pipe and a short (5 x 5 x 5mm) wooden block (mango wood) was placed in the pipe which rests on the soil surface. The soil and vapour barrier surrounding the inspection port was covered with a 2.5 cm layer of concrete .Wood placed in the pipe was examined at regular intervals of six months. (Photo 18-19).

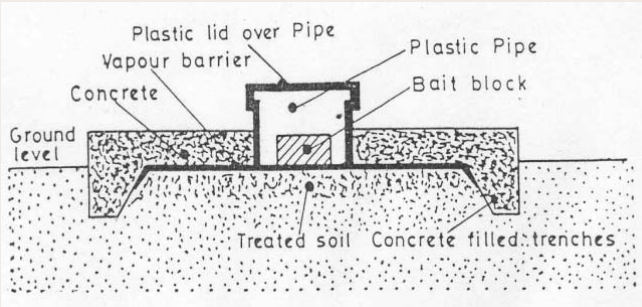


Photo 18-19 : Line diagram and actual site photo of Modified Ground Board Test showing test block

Photo 20 : Modified Ground Board Test at Pune

The experiments were started in different climatic and soil conditions in Roorkee, Dehradun and Pune. Recording of observation is going on as per schedule programme.

Experimental anti-termite treatment in staff quarters

About 1000m^2 covered area of buildings was treated with each of the formulation of Metarhizium. About 250m^2 covered area was treated with each dose rate mentioned above. The methodology used for post construction treatment of termite - infested houses was in accordance with Code of Practice for Anti-Termite Measures in Buildings Part-III, Post Construction Measures, IS:6313-1981. The treatment was done at Roorkee only. In order to treat the building to control the subterranean termite attack, the aim was to provide a continuous barrier of pesticide between soil and building. It was somewhat in the same way as per site pre-treatment. However, in the post-construction treatment due to presence of floors, walls, aprons, garages etc., the task was a bit difficult. To achieve the goal the holes were drilled through the floor to inject pesticidal solution, so that it should reach the soil under the building. According to the observations recorded, some termite infestations were observed in two buildings after one rainy season. It indicates that the formulations works well during first six months after that slowly its effectiveness decreases. Further, recording of observation is going on as per schedule programme.

Photo 21-22: Pumping of Item Secure Technology and a Junction Box.

Monitoring and Termite Resistant Test of Item Secure Technolgy for Termite Management in Buildings *(SSP-499)*

B S Rawat and Team

Item secure technology is very cost effective and revolutionary concept for anti-termite treatment in buildings. It consist an intelligent network of joint less pipes with in-built chip in it, which is laid under the floor and covers the internal and external periphery of the building. Once the building is ready, pesticides are pumped into the network. Network uniformity spreads the pesticides in the soil. This treatment is repeated as and when necessary. This technology is useful in pre-constructional stages of buildings. (Photo 21-22).

The technology was installed in four building in CBRI staff quarters and post office. First phase of installation and first pumping is completed. Imidacloprid (Premise) termiticide was used to prepare pesticidal solution. Further, monitoring and installation work at Chennai and Ahmedabad site is also completed. Recording of observation is in progress. (Photo 23)

Photo 23: Installation work of Item Secure Technology at construction site in Ahmedabad

Evaluation of Plant Extractives for Termite and other Pest Management in Buildings *(OLP-302)*

B S Rawat and Team

Keeping in view of pesticidal toxicity, environmental contamination and health aspects; botanical insecticides are excellent alternatives for pest management in buildings. Plants are excellent source of organic chemicals- Rotenoids, Terpenoids, Pyrethroids, Steroids, Polyacetylenes, unsaturated isobutylamides and alkaloids etc. These phytochemicals may act as toxic, repellent, and behavior modifier to pests. In the present investigation, herbal crude extractives were prepared in the laboratory using locally available plants having pesticidal properties such as: *S. cumini, C. reticulate, N. indicum, A. marmelus, H. rosasinemis, P.trysterephorus* (F), *L. canara, M. kocginii,C. occidentalis* and *C. occidentalis* etc. The extractives were prepared in four solvents - P. Ether, Acetone, Ethanol, and Methanol. (Photo 24-25).

Photo 24-25: Preparation stages of herbal extractives in the laboratory

Finally, prepared extractives were studied against *Microcerotermes beesoni* species of termites for their effectiveness as termiticide and results were compared with untreated control with similar environmental conditions. (Fig. 8)

Some of the plant extractives have shown excellent mortality against termites. Acetone extract of seed of *S. cumini* has shown 90%± 6.32 S.D.; acetone extract of leaves of M.koiginii 96.6% ± 5.16 S.D., ethanol extract 100%, methanol extract 90% ± 6.32 S.D.; Leaves extract of L.kamara in acetone has shown termite mortality 96.6% ±5.16 S.D., petroleum ether extract 100% and seed extract of *C. occidentalis* in methanol has shown 100% termite mortality, whereas in control experiments termite mortality was observed less than 20%. The project is completed.

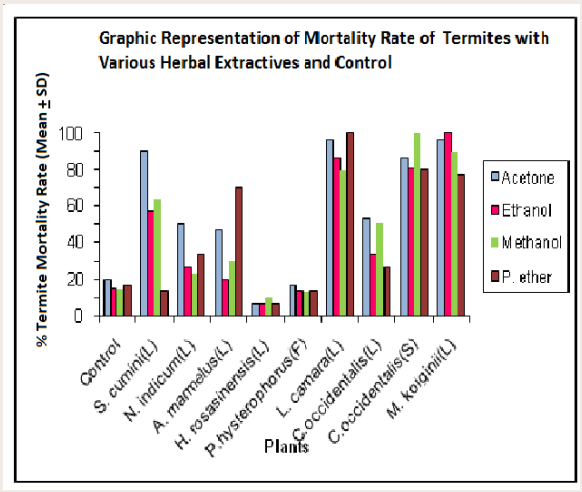


Fig.8: Graphic representation of results

Structures and Foundation Enginnering

Structures and Foundation Engineering

Augmentation of Storage Capacity of Red Mud Pond Renukut *(SSP-0428)*

A. Ghosh and Team

Thermal power stations are using pulverized coal as fuel producing enormous quantities of ash as a by product of combustion. Presently the country is producing ash to the tune of about 10 million tons every year in which only 23% of ash is used. Still about 77% of ash is left out as unused solid industrial waste. Similarly large amount of red mud is left when bauxite is used as a raw material in the manufacturing of aluminum. Unfortunately red mud in this country does not find any use and is dumped as waste material. Use of ash and red mud as resource material for embankment construcion not only reduces environmental pollution, it is also helpful in promoting sustainable development by avoiding unnecessary use of natural soil. For laboratory evaluation of engineering parameters both this major industrial waste e.g. red mud and ash was collected from a large aluminum manufacturing industry. The samples were tested after mixing homogenously different percentage of ash and red mud in the laboratory. The tests were carried out to determine the geotechnical parameters. e.g. consolidations, permeability, specific gravity, shear & index properties etc.

An experimental program was carried out to find the optimum mix of red mud and ash so as utilize the same for the construction of embankment. Particle size analysis, Proctor density test, Direct Shear test, Permeability and Consolidation test were carried out in the laboratory. The Shear test and Consolidation test were carried out using red mud and ash in the ratios of Ash : Red mud :: 50% : 50%, 70% : 30% , 30% : 70%, 60% : 40% and 40% ; 60%. The results are given on table 1 - 3.

Table 1. Properties of ash and Red Mud

Type of Material	Grain Size Analysis			Proctor Density		Specific Gravity
	Sand %	Silt %	Clay %	OMC %	Dry Density gm/cc	
Ash	62	38	-	32	1.22	2.36
Red Mud	22	64	14	29	2.04	3.15

Type of Material	Direct Shear Test				Consolidation Properties		Permeability
	Unsaturated		Saturated		Cv	Cc	cm/sec
	Cohesion kg/sq.cm	Angle of Friction (degree)	Cohesion kg/sq.cm	Angle of Friction (degree)	Sq.cm/sec		
Ash	0.07	40	0.05	38	1.29×10-3	0.076	0.38×10-4
Red Mud	0.26	33	0.06	30	0.85×10-3	0.23	0.43×10-5

Table 2. Particle Size, Compaction Parameters & Specific Gravity of Mix Composition

Mix Composition (Mud + Ash)	Grain Size Analysis			Proctor Density		Specific Gravity
	Sand %	Silt %	Clay %	OMC %	Dry Density	gm/cc
50%+50%	65	28	7	28	1.49	2.74
70%+30%	50	40	10	28	1.56	2.91
30%+70%	70	28	2	29	1.41	2.44

Table 3. Direct Shear, Consolidation and Permeability Properties of Mix Composition

Mix Composition (Mud +Ash)	Direct Shear Test				Consolidation Properties		Permeability
	Unsaturated		Saturated		Cv	Cc	cm/sec
	Cohesion kg/sq.cm	Angle of Friction (degree)	Cohesion kg/cm^2	Angle of Friction (degree)	Cm^2/sec ×10^{-3}		×10^{-4}
50%+50%	0.38	38	0.17	36	1.05	0.059	0.14
70%+30%	0.19	37	0.10	35	0.95	0.086	1.25
30%+70%	0.12	39	0.05	38	1.14	0.082	0.42

The embankment design was checked against slope failure. Limit equilibrium and seismic stability analysis were carried out to check the stability of the embankment.

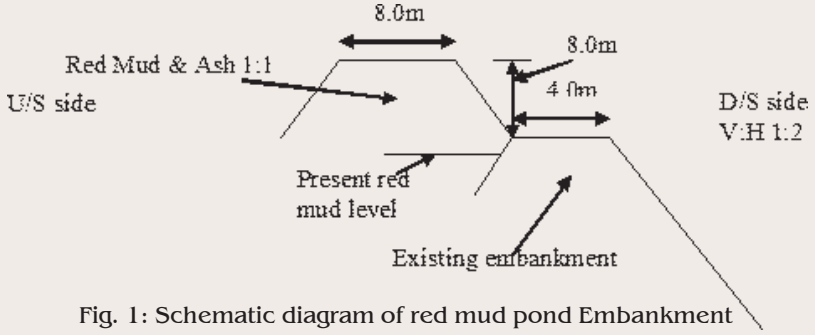


Fig. 1: Schematic diagram of red mud pond Embankment

Huge quantity of red mud and ash could be gainfully utilised. Time and money for transporting good quality of soil and or rock fragments from the borrow pit area other wise required for raising the embankment height could be saved.

Geotechnical Properties of Stabilized Fly-ash for Development of Appropriate Foundation *(OLP-315)*

A. Ghosh and Team

With the increase in number of coal based thermal power plant in India, generation of fly ash has increased to enormous proportion. The average ash content of the coal being 45%, close to 110 million tons of ash is accumulated every year. Disposal involves design and installation of ash ponds which occupies large area at each plant site and creates environmental problems as well. Avenues are explored by different organizations to enhance the utilization of ash in this country. One such avenue is to reclaim the abandoned ash ponds for human settlement purposes. CBRI in the past worked on this issue for the first time in this country under the sponsorship of fly-ash Mission, TIFAC, DST. While working on the said project it was felt that geotechnical properties of stabilized ash needs to be evaluated in the laboratory for design of grout columns made of ash and lime/cement. This will help enormously for the design of civil structures utilizing stabilized ash.

The sample of fly-ash has been collected from Indraprashta Thermal Power Station, New Delhi and the geotechnical properties of original fly ash were carried out.

It was decided to stabilize ash with lime commercially available in the market. After stabilization experimental program was undertaken to study the effect of lime on fly-ash with respect to the improvement in strength characteristics. The oven dried fly-ash samples were mixed with lime at optimum moisture content. The lime content varied from 6% to12% with increment of 2% and the mix was transferred to a specially fabricated air tight perspex mould with inner diameter 38mm and length 76 mm maintaining L/d ratio as 2. For every percentage of mix minimum 3 samples were prepared.

After a rest period of 7, 21, 28 and 56 days the samples were taken out from the mould and tested for unconfined compressive strength (Photo 1). The failure pattern is shown in Photo 2.

Table 4. Geotechnical Properties of unstabilized Ash

Grain size analysis			Procter Density Test		Consolidation Properties		Direct Share Test (saturated)	
sand %	Silt %	Clay %	OMC %	Y_d gm/cc	Cv $cm^2/sec.\times10^{-3}$	Cc	C Kg/cm^2	Φ degree
66	28	6	25	1.35	0.67	0.078	0	32


Photo 1: Unconfined Compression Test


Photo 2: Failure Pattern of Stabilized Sample by UCS Test

Unconfined compression tests were conducted to establish a general trend for gain in strength with different percentage of lime. The UCS value turns out to be 0.31Kg/cm2 for a rest period of 7days and the same value was increased to 1.42Kg/cm2 for the rest period of 56days with 6% lime added as stabilizer. The strength value was increased from 0.85Kg/cm2 to 6.89 Kg/cm2 when 10% lime was added as stabilizer and rest period was increased from 7days to 56 days.

Thus more than 4.5 times increase in UCS value is obtained when rest period is increased from 7days to 56 days with 6% stabilizer.

However 8 times increase in UCS is observed when 10% stabilizer is added.

The value of initial tangent modulus E young's modulus increase from 45Kg/cm2 to 150Kg/cm2 for the rest period increased from 7days to 56days with 6% lime added as stabilizer. As the content of stabilizer increases from 6% to 10%, the value of initial tangent modulus also increased from 60Kg/cm2 to 288Kg/cm2 as the rest period increased from 7days to 56days. Thus more than 230% increase in E value is obtained when rest period is increased from 7days to 56days with 6% stabilizer. However 290% increase in E value was obtained with increase in rest period when 10% stabilizer is added.

It is concluded that the behaviour of stabilized ash evaluated through this project will provide basic parameter to a designer.

Numerical Investigation of the Lateral Response of Pile Groups under Combined Loading *(OLP-314)*

S. Karthigeyan and Team

Piles have been one of the oldest and versatile foundations used in variety of soil conditions. In general, these foundations are the most preferred in weak soils or in heavily loaded structures. Larger lateral loads may act on foundations of structures such as transmission line towers, over head water tanks, bridge abutments, high-rise buildings, coastal and offshore structures (Fig. 2). Based on the specific application, these piles are subjected to loading conditions of different magnitudes and in different directions. The loads could be in the form of self weight of the super structure, uplift pressures beneath and from the surrounding soils, wind loads, seismic loads, loads due to wave currents, differential water and earth pressures etc. The loading on the pile foundations may be predominantly vertical, predominantly lateral or combination of vertical and lateral loads. In view of this, most of the pile-supported structures are subjected to the combined action of vertical and lateral loads rather than pure vertical or pure lateral loads.

According to the current practice, the pile foundations are independently analyzed for the vertical loads to determine their bearing capacity and settlement and for the lateral loads to assess their flexural behaviour. In situations where the lateral loads are significantly high; the interaction effect due to the combined action of vertical and lateral loads can become critical. As such, no reliable or rational method is available for analyzing the lateral response of piles under combined vertical and lateral loading.

In field practice, pile foundations are generally grouped together with two or more piles in different configurations. The lateral load capacity of pile group is dependent on the c/c spacing between the piles and the type of soil. Piles are grouped with different configurations in such a manner that optimal performance of the group can be achieved. The c/c spacing between the piles to achieve the optimal performance of the group is defined as critical spacing. Several investigators have studied the critical spacing to achieve optimal performance of the pile group under pure lateral loads. However, there are very limited investigations on the pile groups subjected to combined vertical and lateral loading. Since piles are not often structurally designed to resist lateral loads, the

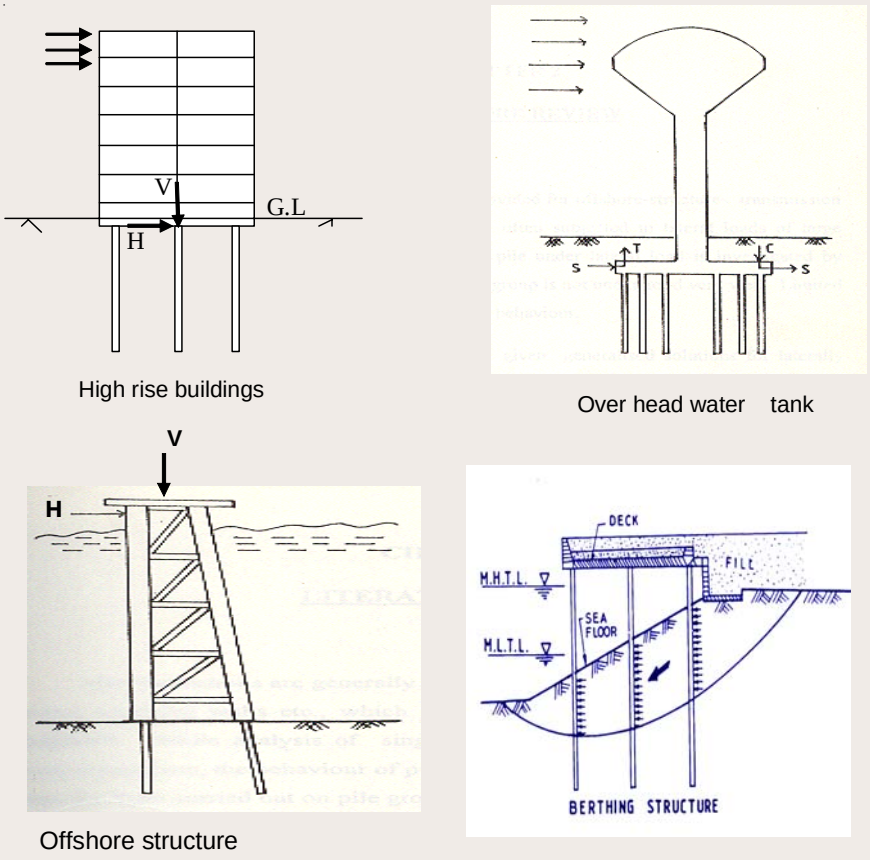
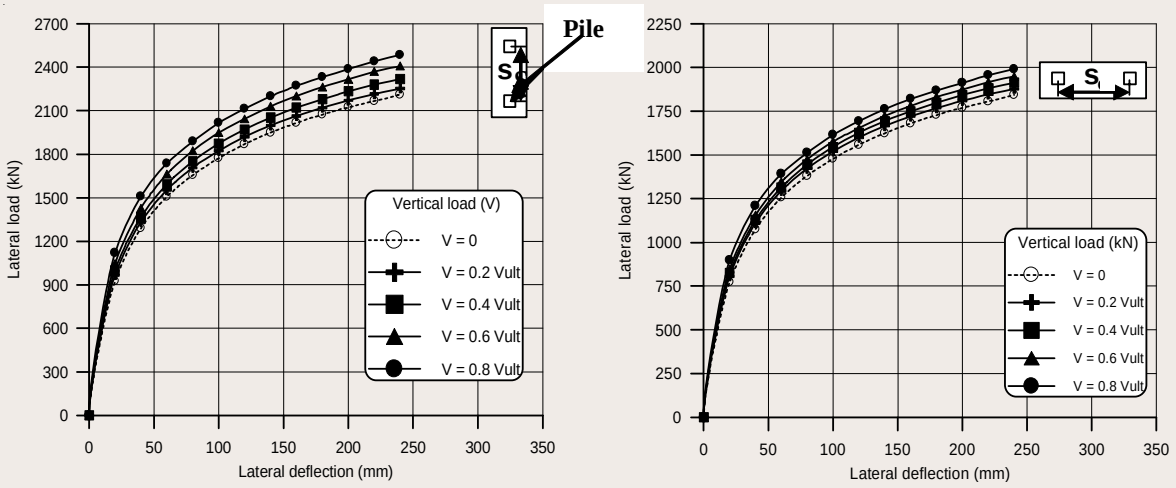


Fig. 2: Typical field cases of piles subjected to combined vertical and lateral loads

lateral response of piles is more critical and interesting for design engineers. Accordingly, this study was aimed to investigate the lateral response of pile groups under combined loading by arriving at an improved design procedure.

A series of 3-dimensional FEM analysis have been performed to study the response of pile groups under pure lateral loads as well as under the influence of combined vertical and lateral loading. The analysis was performed in two stages. In the first stage, vertical loads on the pile group were applied. Then in the second stage, the vertical loads were kept constant and equal lateral deformations were applied to the nodes on the pile top surface. During this phase, the vertical deformations of the pile head nodes were kept constant to prevent the rotation of the pile cap. This process of analysis corresponds to a rigid fixed pile cap that does not rotate during lateral translation.

Fig. 3 shows the typical lateral load - deflection curves of pile groups in sand with respect to two different pile configurations such as piles in series and piles in parallel arrangements within the group. In general, it can be seen from the figure that the lateral load corresponding to specific lateral deflection level of pile group is increases with the increase in vertical load levels.



(a) 2x1 (Parallel) pile group

(b) 1x2 (Series) pile group

Fig. 3 (a-b) : Lateral load - deflection curves of pile groups in sand with respect to two different arrangements of piles within the group

Further, it can be seen that the influence of combined loading is more significant in the case of parallel arrangement of the piles than in the case of series arrangement of the piles within the group. The outcome from the study would leads to new understanding of the laterally loaded behaviour of pile groups. Also, it would be useful for the development of new design guidelines of pile groups by incorporating the influence of combined loading, which is currently not followed in practice.

Evaluation of Rock Discontinuities for Slope Instability Assessment *(OLP-316)*

S. Sarkar and D.P. Kanungo

The present study deals with analysis of various discontinuity parameters of road cut slopes in Himalaya for slope stability assessment of rock slopes. Two rock mass classification systems Rock Mass Rating (RMR) and Geological Strength Index (GSI) were studied in detail for rock mass characterisation. GSI is generally used to obtain a first estimate of rock mass properties based on the engineering geological data which gives a range of GSI values. However, some modifications were suggested to the GSI system by several researchers in order to provide more quantitative basis for evaluating the GSI values. Application of GSI, which is based on blockiness of the rock mass and surface condition of discontinuities, is found to be very useful to classify rock mass in the field.

In the present study GSI for rock slopes were obtained using the original GSI chart (Hoek and Brown, 1997) and the modified quantitative GSI proposed by Sonmez and Ulusay (2002). It was found that the specific GSI values obtained using the modified approach lie well within the GSI range obtained using the original GSI chart but there is no definite trend observed when specific GSI values were compared with corresponding

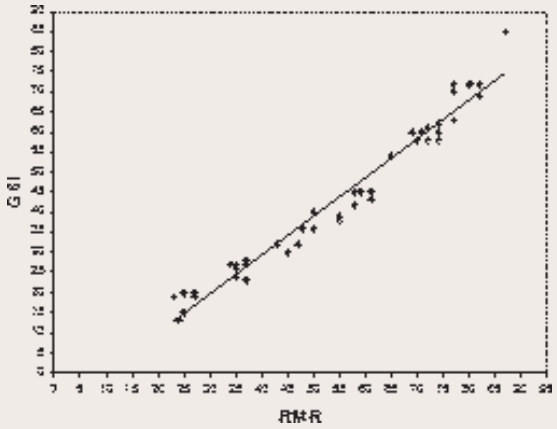


Fig. 4 : RMR and GSI for 50 road cut slopes

GSI range. However, it is possible and advisable that along with a GSI range a precise GSI value should be assigned to a rock mass.

GSI values were compared with RMR values for the 50 slopes in which RMRbasic (i.e., without joint orientation) was considered with ground water condition equal to 0. The data shows that RMR is little higher than the GSI as suggested by the earlier workers. The relation between GSI and RMR obtained from the study is shown in the Fig. 4. From this relation GSI can be correlated with RMR as GSI = RMR - 9 for the road cut slopes in Himalayas. However, more case studies are needed to establish the relation. GSI can be used to estimate RMR and thus can be used to estimate rough approximation of cohesion and internal friction which provide important inputs for slope stability analysis tunnel designing.

From the specific GSI values obtained in the study it can be inferred that in general GSI for disintegrated structure is <25, for blocky disturbed 25-45, for very blocky 45-65, for blocky 65-80 and for massive >80. Examples of types of rock mass structures are shown in the Photo 3. However, there is a considerable scope

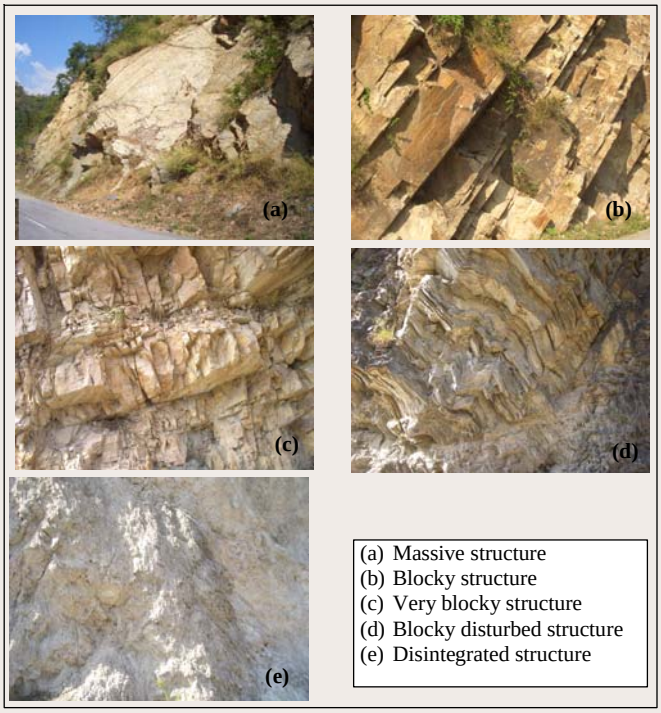


Photo 3: Types of rock mass structures considered in the study

for modification of GSI system based on more case studies.

In the present study Slope Mass Rating (SMR) is employed to assess slope stability which uses RMR and discontinuity orientation data. It is observed that in some slopes SMR is very low even if RMR and GSI are considerably high which shows that even if the slopes have considerable good rock mass quality but due to unfavourable discontinuity orientation they could be potential for slide. This indicates how joint orientation governs stability of rock slopes. For the unstable rock slopes among the studied slopes a few possible protection measures has been suggested.

High Capacity Gypsum Calcinator for Small Scale Industry *(OLP-306)*

S. K. Saini and Narendra Kumar

The Institute has done pioneer work in the field of development of gypsum calcinator. The batch type gypsum calcinator developed few years back with the primary aim of replacing the traditional open pan method with an energy efficient system using fossil fuel having capacity of producing of 8 tonnes plaster of Paris per day (8TPD). Techno-economic feasibility of this calcinator has been found to be well established. A large number of these calcinators have been successfully installed in different parts of the country & producing Plaster of Paris based on CBRI know-how.

There is a need to design a gypsum calcinator for production of gypsum plaster of consistent quality using the ground gypsum (natural/by-product gypsum) having higher capacity. To meet the requirements of small scale industry a gypsum calcinator having 20 TPD capacity has been designed which utilizes heat efficiently from flue gases passing over the sides of pan, by providing broken transverse ribs on the periphery of the pan. The designed system shall produce 20 TPD gypsum plaster of consistent quality and is of modular type (Fig. 5). The following components of calcinator have designed/ finalized :

- Furnace for liquid fuel/gaseous fuel firing
- Pan with the brocken transverse ribs at its periphery
- Power operated churning mechanism
- Temperature sensing and monitoring device
- Supporting structure for mounting shell, churning mechanism.

Salient Features

- Low fuel consumption as compared to conventional methods
- Temperature control ensures uniform quality plaster
- Power churning maintains uniform temperature of charge during calcination.
- Design of calcinator suitable for coal, liquid and gaseous fuel
- Dustless automatic discharge of hot calcined gypsum
- Suitable for calcining gypsum for building, pottery, ceramic & surgical grade plaster. The envisaged impact of the outcome of the R & D work is to provide technology for 20 tons per day capacity gypsum calcinator to produce Plaster of Paris.

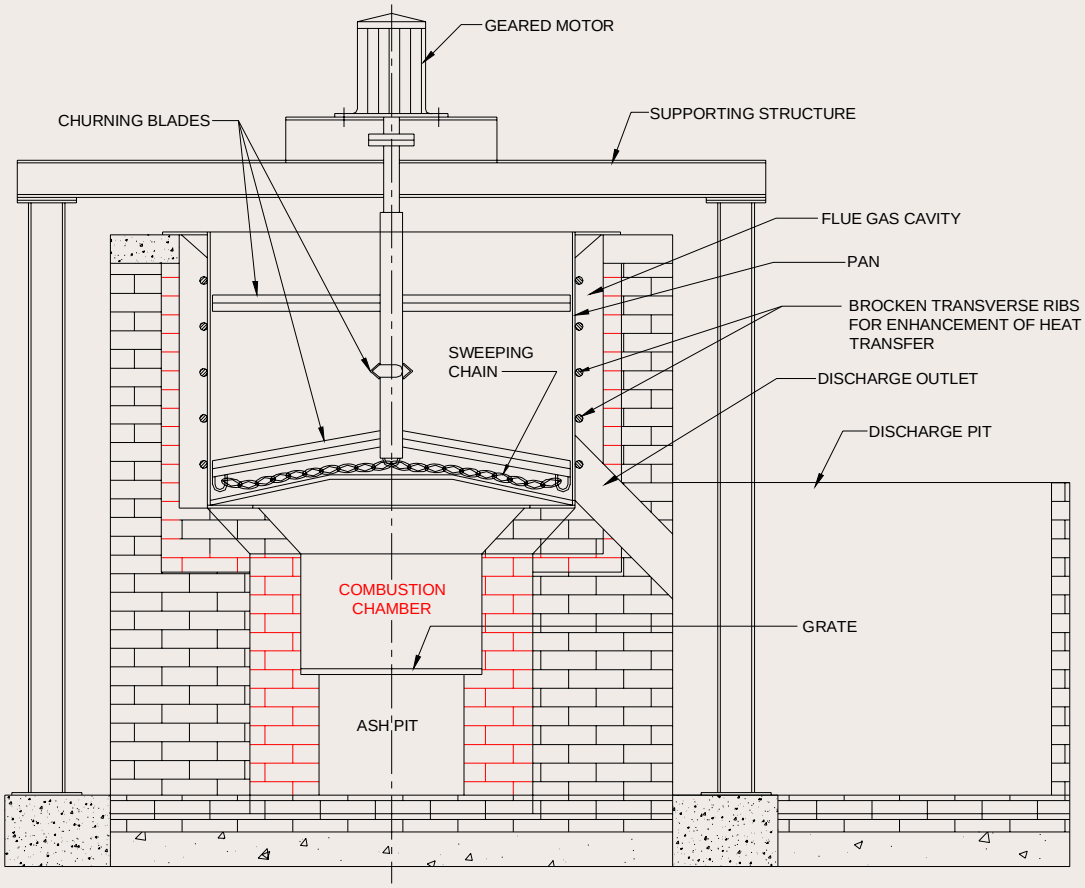


Fig. 5: Sectional View of Calcinator

Disaster Mitigation

Disaster Mitigation

Investigation of Distress in Rashtrapati Nivas at Shimla and Rehabilitation Measures *(SSP-088)*

A. Ghosh and Team

Photo 1: Rashtrapati Nivas at Shimla

Rashtrapati Nivas at Shimla is an old historical building on top of a hillock at Shimla (Photo 1). The imposing Victorian Edifice of the Viceregal Lodge is among British India's most monumental constructions, built in a mock Elizabethan style constructed in the year 1888. The building was donated to Indian Institute of Advance Studies (IIAS) by late president of India Dr S. Radhakrishnan in 1964 and since than the institute is functioning from this premises. The main building comprises ground plus two storey structure with wooden trussed roof and tiles. The kitchen block comprises two basement floors, ground and two additional floors above the ground. The roofing unit of kitchen block is provided with wooden truss and mangalore tiles. The remaining four floors have lime concrete vaults. The traditional technique of vaults has been used in the roofs / floors. Precarious cracks have developed in three floors in the kitchen block.

The IIAS authorities requested Central Building Research Institute to investigate the causes of distress and suggest suitable remedial measures. A detailed investigation has been carried out by CBRI to find the causes of distress in lime concrete vaulted floor and stone masonry walls. The investigation report briefly covers visual observations, material characterization, finite element analysis, load transfer mechanism, identification of possible causes of distress, repair and rehabilitation measures for the masonry structure.

From the distress survey, material investigation, structural analysis, moisture movement, crack monitoring, it is concluded that the cause of distress may be because of material degradation resulting from leakage /seepage of water and possibly also because of localized settlement of the buttresses. Keeping in view of the above facts, repair and rehabilitation scheme has been suggested. The objectives of repair and rehabilitation work are mainly to (i) reinstate the structural integrity and safety of the member by restoring or increasing its strength and stiffness, (ii) to prevent the ingress of distress promoting agents such as moisture to improve durability and (iii) cleaning and replacing distressed drains/ roof tiles/ sanitary pipes to arrest further localized

settlement (iv) to maintain the architectural heritage/aesthetics/appearance of the structure.

Photo 2 : Cracks in the Walls and Vault of Western gallery and dampness marks

Photo 3 : Crack at foundation level on in the buttress wall North Side

A detailed methodology has been developed keeping in view the prevailing methods and repair materials. In this methodology, the strategy has been decided in such a way so as to transfer partially the dead load from the structure through steel trusses and then to repair and strengthen the damaged components using various techniques as per details given below:

(1) Partial load transfer through built up steel beams and columns.
(2) Grouting stone masonry and lime concrete vaults.
(3) Stitching of cracks in stone masonry and masonry vaults.
(4) Removal of dampness in walls and vaults.
(5) Guniting/shotcreting of lime concrete vaults.
(6) Provision of MS tie plates around the outer walls of distressed portion.

The water proofing details for Flat Roof with Lime Terracing are recommended. The area where the glass has been used in overhead glazing/ skylights, tempered glass of 4mm thickness fixed on all four sides has been recommended.

Geological, geotechnical and geophysical investigations were also carried out to address the issues of slope instability and ground settlement in the surrounding areas and to provide suitable remedial measures. Geological investigations of slopes in the rear and front side of the building were carried out to investigate and assess the instability which may be the reason for distress in the building and the surrounding area. Slopes comprise of highly weathered schists and quartzites along with a 2-3 m soil overburden. On the rear side, both the retaining walls are in distress as indicated by bulging and damage at different locations. Temporary drains made of tin sheets are provided to channelize the surface run-off. Development of water pressure inside the slope is also observed. The main central underground drain is observed dry on the downhill slope while water is accumulated in this drain near the base of kitchen block on uphill side. So, underground drains must have been choked somewhere in between and also damaged in some parts adding to the problem of water seepage into the slope. Such water seepage into the slope may aggravate the instability due to weathering of the existing metamorphic rocks causing loss of strength. On the front side, a part of the ground has witnessed subsidence. Newly

constructed retaining wall is in good condition with proper weep holes for drainage. However, old stone masonry retaining wall provided in continuation to this is in bad shape. Topographic survey of front and back slopes was carried out and contour maps on 1:1000 scales with 1.0m contour interval were prepared.

GPR system with 250 MHz frequency antenna was used for profiling various stretches on back side of the building consisting of kitchen block, library block and open space. The backyard of the building has network of drains at various depths and of different sizes. The discharge pipes were broken and water was flowing continuously creating dampness in the area. GPR investigations revealed the presence of two anomalous zone in the area at depth of about 1.5 to 2.0 m. These zones may possibly have loosely fragmented rock soil matrix. The firm strata have also been encountered on many radargrams at a depth of 1.5-2.5 m.

Limit equilibrium and Seismic stability analysis were carried out for circular modes of failures along the profile of the back slope. Based on the results of above investigations and keeping in view the ground settlement and water seepage problems in the area, the following remedial measures are suggested:

On the rear side of the building, the existing old and damaged dry stone retaining wall is to be replaced by a new stone masonry wall bonded with cement mortar of 3.0-4.5 m height all along the slope. The retaining wall should have perforated drainage gallery. The drainage gallery should consist of perforated pipes embedded in coarse sand and pebbles. The drainage gallery should be 1.5-2.0 m long inside the slope. It is also suggested to reconstruct/repair the existing underground main central drain. All the drains should be properly lined and be made impermeable. At present, the kitchen outlet pipe is broken and discharges waste water on the open backyard. It needs to be reconstructed and connected to the main drain. The backyard of the kitchen should be made with plain cement concrete having adequate slope to minimize the local water infiltration during rainy season. The rain and storm water of the area should be channelised through a surface drain to the main central drain.

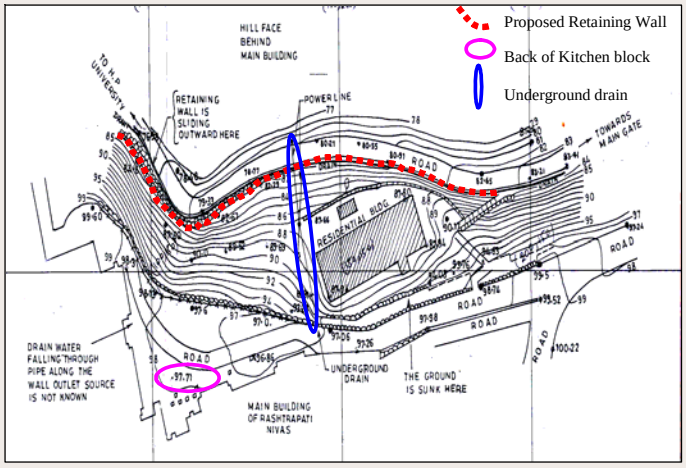


Fig. 1 :Map showing locations where remedial measures are to be implemented

On the front side of the building, the newly constructed existing retaining wall is to be extended up to the end because the old retaining wall is completely damaged and does not serve its purpose. From the level of the reception hut in front of the main building up to the top of the retaining wall, slope modification is recommended with proper terracing. For all the retaining walls adequate weep holes with coarse material as filter are to be provided for proper discharge of pore water.

Evaluation of Seismic Ground Motion Parameters based on Site Characterization in Dehradun Region *(OLP-319)*

Abha Mittal and Team

About 50 million people in India living in Himalayan region are at risk from earthquakes. The Himalayas are very young from geological point of view and hence very unstable. Most of the parts of North India and North-eastern India are mapped as either seismic zone IV or V in the seismic zonation map of India. Most of the seismicity in the Himalayan region is concentrated along a shallow north dipping plane, which indicates under thrusting of the Indian plate. Some of the recent earthquakes in this area are the Uttarkashi earthquake of 1991 (6.4 mb) and Chamoli earthquake of 1999 (6.8 mb). The threat to human activities from earthquakes is sufficient to require their careful consideration in the design of structures and other infrastructure. The occurrences of great earthquakes in India over the last few decades warn us of the need to assess the hazards caused by earthquakes and prepare for future calamities. Himalayan mountain ranges have been formed due to continental collision between the Indo-Pak and Eurasian plates. The NW Himalayan Fold-and Thrust is seismically one of the most active region anywhere in the world.

The Uttarakhand state capital of Dehradun has also paying attention with several scientific studies in recent times by the researchers. This region lies at the foothill of the Himalayan mountain belt and it is surrounded by Himalayan ranges in the North and North-East and Siwalik range in the south. The city lies on a large alluvial fan with coarse clastic fan deposits of Quaternary period within an intermountain longitudinal tectonic synclinal basin (Doon valley) bounded by four prominent faults of the region. This city is one of the seismically active regions and comes under the zone-IV of the zonation map of India has experienced many damaging earthquakes of the 1905 Kangra (intensity VIII) and 1991 Uttarkashi (intensity VI) from the Himalayan region. Dehradun is bounded by the Main Boundary Thrust in the north, Main Frontal Thrust in the south, Ganga Tear Fault in the east and Yamuna Tear Fault in the west. The influence of local geological and soil conditions on the ground response during an earthquake and the related damage has been known since 1906 San Francisco earthquake as reported in the literatures. Therefore it is important to give special importance to seismic response analysis for a specific site in seismic hazard analysis of an area. Accordingly, Dehradun region has been chosen for the study for keeping the importance of the city in terms of tourisms as main economy of the region.

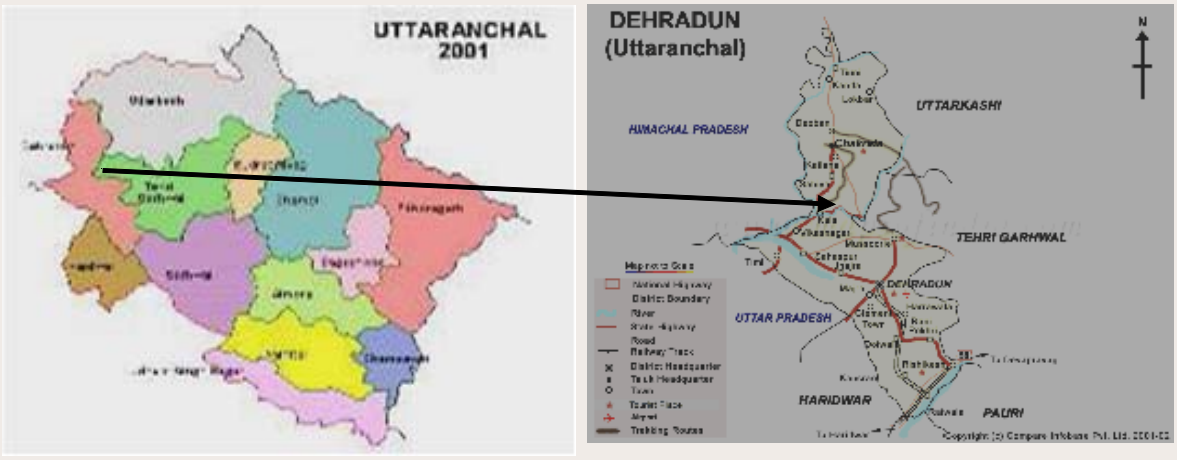


Fig. 2 : Basic map of Dehradun and its Surrounding Region

Dehradun city is located in the intermontane valley within the Siwalik foreland basin of Garhwal Himalaya. It is a crescent-shaped, longitudinal and synclinal valley controlled by a series of tectonic faults on all sides. Most prominently it is bounded by the Main Boundary Thrust (MBT) that brings the Precambrian rocks of the Lesser Himalaya in contact with the Siwalik Group of rocks forming the northern boundary of the Dehradun Valley. The basic map of Dehradun and its surrounding region is shown in Fig. 2.

In this study, seismic hazard analysis has been carried out for evaluating ground motion parameters for Dehradun region using statistical approach. A linear regression analysis was carried out for arriving G-R relationship between magnitude and their cumulative frequency of occurrence of earthquake for a defined period. The Peak Ground Acceleration (PGA) is one of the prime factors used for the design of the structures. Therefore, the number of attenuation relationship developed by different authors for Indian regions were used in the study for evaluating PGA's. The PGA's were estimated with respect to different earthquake magnitudes at various locations of Dehradun region. Fig. 3. Shows the typical PGA contour map against Uttarkashi earthquake of Mag. 6.8 and it can be seen from the figure that the PGA's are varying in the ranges from 0.21 to 0.288 for an earthquake of magnitude 6.8. Probabilities of occurrence of earthquake of different magnitudes have also been computed on the basis of seismicity data collected from earthquake catalogue of past records. The yearly expected and mean return period were evaluated for different magnitudes using Gumbel's approach. It was observed that, yearly expected occurrence of earthquake is decreased with respect to increase in magnitude of earthquakes. The expected outcome of the study will be useful for the preparation of seismic microzonation of Dehradun region.

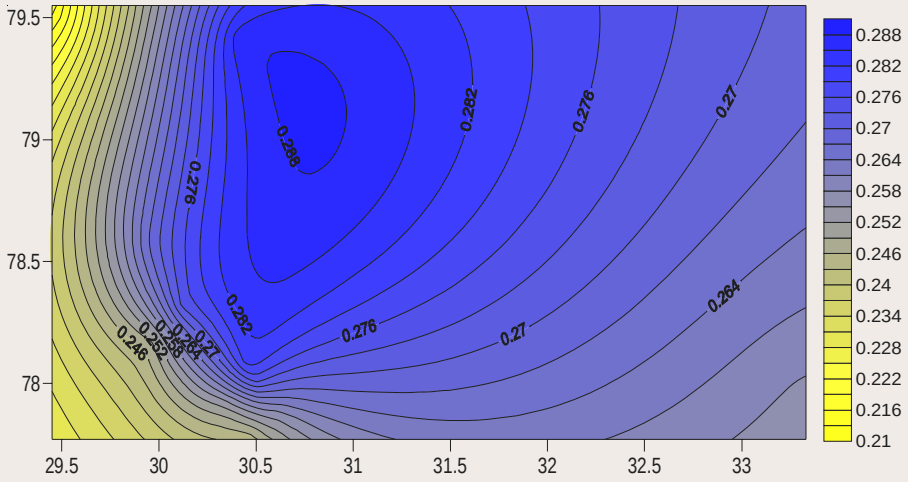


Fig. 3:. PGA Contour Map against Uttarkashi earthquake of Mag. 6.8

Seismic Studies using SMAs in Delhi *(OLP-318)*

P.K.S. Chauhan and Team

After experiencing the effects of the 29th March 1999 Chamoli earthquake in some parts of Delhi- particularly in trans Yamuna area - there is a heightened level of awareness among the public to natural disasters in urban areas.

The influence of local geological and soil conditions on the intensity of ground shaking and structural damage has been well documented. Local site conditions can profoundly influence the major characteristics - amplitude, frequency content and duration - of strong ground motion. The dependence of natural ground frequency on the thickness of overburden is well known among technocrats. But the exact relation between the two is not available for Indian region. Delhi is unevenly divided into various types of ground with differing geological, tectonic and geo-technical features. It has exposed rock; thin to moderate soil cover and thick alluvial deposits. Keeping this in mind the area nearby the floodplains of Yamuna was selected for this study. It covers the both banks of Yamuna River as shown in Fig. 4.

Buildings standing on filled up ground (on river bed or dried up lakes) may experience largely amplified ground motions in future earthquakes. The study area has the depth of bedrock more than hundred meters throughout. These results were inferred on the basis of ground frequency computed on the basis of ambient vibration data.

Fig.4: The Study Area

Ambient Noise data from the Five buildings i.e. DDA building, ICCR Building, Institution of Engineers Building, NIDM Building near ITO and Tarang Apartments from the trans Yamuna Area have been collected. Similarly the data from the Trans Yamuna area of the ground near AKSHHARDHAM MANDIR and from the ground near the RAJGHAT POWER PLANT was collected and analysed for natural ground frequency computation. The results for natural ground frequency are shown in the Tables 1-3.

Table 1. Results of Tarang Apartments

NAME TARANG APARTMENTS	EVENT	FREQUENCY (Hz)
C- Block Ground Floor	LF 001	1.8
Near Dustbin	LG 001	1.8
7th Floor	LH 001	1.8
4th Floor	LI 001	1.8
1st Floor	LJ 001	1.8
A- Block 1st Floor	LK 001	1.8

Table 2. Results of DDA Building at ITO, Delhi

NAME	EVENT	FREQUENCY (Hz)
Basement	KV 001	0.8
Ground Floor	KW 001	0.9
Roof	KX 001	0.7
20th Floor	KZ 001	0.7
16th Floor	LA 001	0.7
12th Floor	LB 001	0.7
8th Floor	LC 001	0.7
4th Floor	LD 001	0.7

Table 3. Results of Institution of Engineers Building

NAME	EVENT	FREQUENCY(Hz)
Lawn	XR 001	2.5
Ground Floor	XQ 001	4.5
First Floor	XP001	4.5
Second Floor	XO001	4.5
Roof	XN001	4.5

The ambient vibration data analysis has revealed the fact that damages due to Chamoli earthquake in the Trans Yamuna area was due to resonance phenomena as the ground frequency at Tarang apartment and the frequency of the buildings are the same. The value was 1.8 Hz for both cases. The ground frequency in other areas of Trans Yamuna like near Akshar Dam is also very low (0.7 Hz) which indicates towards higher ground amplification during earthquake. The natural frequencies near ITO were also not high they vary from 0.7 to 1.2 Hz. However these are different from the frequencies of buildings present in this area. The DDA building (Vikas Minar) at ITO has its frequency close to the ground frequency of the area. Any developmental activity should take this fact into account. New engineering projects coming up in the area should take suitable measures and these values in consideration in their structural design.

On the basis of studies undertaken in Germany for the estimation of sediment thickness by Ibs-Von and Wohlenberg (1999), an attempt has been made to compute the thickness of overburden in the study area. The results show that the thickness of overburden is more than hundred meters through out the study area. At some places where the frequencies are quiet low this depth approaches towards 200m mark.

Study of Visibility of Fire Exit Signs in Fire Smoke *(OLP-305)*

M. P. Singh

A fire produces copious smoke right in its initial stage of development. Rising smoke concentration leads to increasing hazard for building occupants.

The smoke causes **Loss of Visibility**, making escape and evacution difficult. Occupants feel disoriented,irritated & panicked and are often unable to find their wayout for escaping from smoke filled locations.They are trapped once visibility falls below certain threshhold and exit routes become smoke logged. Efficient (and conspicously installed) FIRE EXIT SIGNS help in wayfinding in smoky conditions and are necessary for safe escape & evacution of building occupants during fire emergency.However, Visibility of Fire Exit Signs in different types of smokes and in different conditons of ambiet lighting remains an important consideration. Interaction between occupants and Exit Signage System is critical. Effectiveness/efficacy of Fire Exit Signs depends on several factors such as size & brightness, ambient light conditions, observation angle, familiarty of occupants with building & their ability to interpret a sign or symbol, etc.Conventional Fire Exit Signs use electric power to light-up. However, dependence on electricity is a disadvantage as well because normal power supply may not be available when a building is afire.

Photoluminescent Type Fire Exit Signs

Now a days, newer type of Signs are also being introduced into market which are based on Photoluminescent materials, making use of self-glowing property of these materials in dark/ smoky conditions. Photoluminescent Signs are energized to maximum brightness from ambient light itself. Once energized, these Signs keep on glowing for some time that is critical for escape / evacuation of occupants during fire emergency. Because of property of self glow during dark conditions, fire exit signs based on a photolumiscent material are coming up as newer type and as an alternative to conventional (electrically illuminated) type of exit signs. However, visibility of photolumiscent type of fire exit signs need to be experimentally studied in varying smoke conditions. Distances from which these signs are visible need to be assessed through experiments creating smoke from smoudering / flaming fires. Such a study is required to evaluate efficacy/suitability of Photolumiscent type of signs for use inside building/along exit routes. It is important to quantitatively assess visibility of these signs and examine whether they remain visible from sufficeint distance under different smoke conditions. Also, visibility of this newer type of fire exit signs need to be compared with the visibility of conventional (electrically illuminated) type of exit signs. Such a comparison is useful in selecting the type of Fire Exit Signage System for a given situation.

Experimental Arrangement

A long corridor (20.5m in length X 2.2m in width X 2.38m in height) was used for this experimental study. The corridor was partitioned (lengthwise) into two spaces - Experimental space of 14.0m length and instrumentation space of 6.5m length. Fire Exit Signs and Optical Density (OD) measuring probe were installed and smoke was generated in the experimental space. An observation window (OW) was provided in the wooden partition through which Exit Signs and

other objects in the experimental space could be seen. Black and grey smokes were generated from kerosene, diesel and cotton wicks. Both types of Fire Exit Signs were installed in the experimental space and their visibility observed from Observation Window (OW) as smoke filled the experimental space at a very slow pace. Optical Densities were noted when a sign became invisible. Exit signs (of photoluminescent as well as conventional types) were kept at distances of 14m, 11m, 8m and 6m respectively from the Observation Window (OW) or observers. Mean value of Optical Density (OD) per meter at which Fire Exit Signs (both types) became invisible to the observers are given in the following Visibility Table.

Observations

Visibility of photoluminescent type of Fire Exit Signs, which present a newer variety, has been experimentally determined quantitatively. In terms of comparison between the two types, the observed values show that the visibility of photoluminescent type of Fire Exit Signs is much less than the visibility of conventional (electrically illuminated) type of Fire Exit Signs. At a given smoke density, conventional type of Fire Exit Signs would be visible from a far greater distance than photoluminescent type. Brightness of the photoluminescent material is a serious limitation as far as application of these materials in making Fire Exit Signs is concerned. The results in the visibility table also show that in the black smoke from diesel, visibility of photoluminescent type of Fire Exit Signs is somewhat more than the visibility of these signs in grey smoke from cotton wicks (or kerosene) in general.

Table 4 . Visibility table (Visibility V/s Optical Density)

Visibility (in meters)	Photoluminescent Type, mean OD (in dB/m) at which the sign becomes invisible	Conventional Type, mean OD(in dB/m) at which the sign becomes invisible
Kerosene smoke		
14 m	0.153	2.759
11 m	0.437	3.476
8 m	0.514	4.595
6 m	1.044	6.509
Diesel smoke		
14 m	0.346	2.607
11 m	0.595	3.376
8 m	0.915	4.807
6 m	1.535	6.665
Cotton wicks smoke		
14 m	0.252	2.541
11 m	0.389	3.382
8 m	0.963	4.471
6 m	0.978	6.746

Studies on Species Concentration in Enclosure Fires (OLP-309)

Rajiv Kumar

A complete compartment fire hazard assessment requires knowledge of toxic chemical production in addition to thermal hazard. Toxic gases are composed of asphyxiant gas such as carbon mono oxide, carbon di oxide and deficient oxygen in all the fires, hydrogen cyanide gas in fires related to modern synthetic materials, and irritants like acrolein and hydrogen chloride acid gas. The asphyxiant &/or irritants, individually and additively, contribute to incapacitation / death

of the occupant. Carbon monoxide (CO) is the most common fire toxicant. More than half of the fire fatalities occur due to its inhalation. Though the carbon monoxide concentrations as low as 4000 ppm (0.4 % by volume) can be fatal for one hour exposure, levels of several percents have been observed in full scale compartment fires. A complete toxicity assessment should not only include the toxicity of CO but also the synergistic effects of other combustion products such as elevated CO_2 and deficient O_2 levels. In the present study, an effort has been made to carry out study on species concentration in room fires. Our old model CALTREE has been modified by using Beylor's empirical relations for predicting CO, CO_2 and O_2 concentraton. The modified model has been named as REST (Risk Estimation due to Species and Temperature). Experimental studies have been carried out to obtain the data of CO, CO_2 and O_2 concentrations in room fires. These data have been used to compare the predictions of the modified model.

One new room of size 3.6 m x 2.4 m x 2.4 m height with opening size 2.0 m x 0.80 m has been constructed with conventional material and instrumented. The photographs of the room are shown in Photo 4. The room has been instrumented to to monitor the following parameters.

(i) Hot layer temperature
(ii) Fuel burning rate
(iii) Species Concentration

(i) Hot Layer Temperatures

Arrangement has been made to determine temperatures of the hot gas layer at seven locations. Copper tubes of 8 mm ID have been fixed in the ceiling for installing the thermocouples. Thermocouples are inserted vertically into the compartment through the copper tubes fixed in ceiling in such a manner that the thermocouple beads are 0.028 m below the ceiling. The locations of thermocouple beads are same for all sets of experiments.

Specially designed K-type (Chromel-Alumel) fine wire thermocouples have been fabricated to measure the temperatures. Chromel and Alumel wires, of 0.1 mm diameter, are passed separately through two holes of a 6 mm OD porcelain tube. The porcelein tube is then inserted into a 0.30 m long stainless steel tube of 6 mm ID. One end of both the thermocouple wires is twisted and soldered to have 2 mm diameter bead. The other ends of thermocouple wires are inserted into two copper terminals fitted on a 9 mm thick porcelein plate of 45 mm diameter. While fabricating the thermocouple, it is ensured that the 2 mm bead is left in the open. This is done to make sure that the thermocouple bead is in direct contact of the hot gases.The thermocouples have been marked as T1, T2, T3, T4,T5, T6. All the thermocouples have been connected to a 16-Channel Data Logger for recording the output.

(ii) Fuel Burning Rate

Fuel burning rate is determined by measuring the loss in fuel mass with time. A weight loss measurement platform has been installed to measure the loss in weight of the fuel. The arrangement for fixing the weight loss measurement platform is shown in Photo 5. The platform has been hanged inside the room on a steel wire, which is passing through the hole in ceiling to outside of the room and supported on a S shape hanger with load cell. The whole assembly of load cell and the platform is hanged

over the horizontal M.S. pipe supported on two vertical girders. The size of the platform is 0.40 m x 0.40 m and its centre is located as shown in Photo 5. The different fuels viz. kerosene, heptane, benzene and methanol are burned in square metal tray. The M.S. tray, of area 0.0625 m^2, has been used for carrying out experiments. Fuel trays were kept at the centre of the platform and burned. The height of the fuel tray is kept 0.210 m above the floor. The heat release rate is determined with the help of the following equation.

$$\dot{Q} = m_f^0 \ \Delta H_c \qquad \ldots (1)$$

Where is the loss in fuel mass per unit time, kg/s. is the heat of combustion of the fuel, kJ / kg,.

(iii) Species Concentration

Species have been measured with the help of Gas Analyzer in the outgoing gases. The probe of gas analyzer has been placed in mid of the door at 25 mm below the soffit so that its pumps sucks the hot gases and measures the CO, CO_2 and O_2 concentration.

The data are logged in the main analyzer unit which are transferred to PC for further analysis.

Photo 4: Experimental Room of size 3.6 m x 2.4 m x 2.4 m

Photo 5: Weight loss measurement in Experimental Room

Comparison with Experimental Data

Experiments in the above enclosure have been conducted by burning four fuels- Kerosene, Heptane, Benzene and Methanol in the tray of size 0.25 m x 0. 25 m on a weight loss platform as shown in Photo 5. The temperatures of hot layer have been measure at six location below the ceiling. The average of these temperatures has been calculated which is used for comparing with the prediction of REST. Concentration of CO, CO_2 and O_2 in the outgoing hot layer have also been measured. These data have been used for comparing the predictions.

Inputs required for Validation

The data required as input to REST, are room size, door size, fire size, fire heights, radiative loss, boundary loss fractions and experimental heat release rate of the fuel. The experimental heat release rate is calculated by equation (1) with the help of measured weight loss data. Although

the experiments were conducted with four fuels, yet data for kerosene used as fuel, are being presented here in view of space limitation. Data for Heat Release Rate for kerosene fuel is reported in the Fig. 5. Other input parameters are Maximum CO_2 yield and O_2 depeletion.

Results

The comparison of the predictions of REST with experimental data of kerosene fuel in respect of hot layer temperature and species concentrations are presented in Fig. 6 and Fig. 7, respectively.

It can observed from Fig. 6 that the experimental as well predicted temperatures vary according to the heat release rates. When HRR increases, the both the temperatures increase and with decrease in HRR, there is decrease in the predicted and measured temperatures. The predicted values are very close to the experimental temperatures. The trend of comparisons in all the experiments carried out with other fuel (Heptane, Benzene and Methanol) is same.

Fig. 7 shows the comparison of species concentration predicted by REST with experimental values observed in the present test using Kerosene as fuel. It can been observed that variation of predicted CO concentration follows the same trend as has been observed in experimental values. It is also observed that as O_2 concentration decreases, the CO_2 concentration increases. The similar results are obtained in the experiments with other fuels (Heptane, Benzene and Methanol).

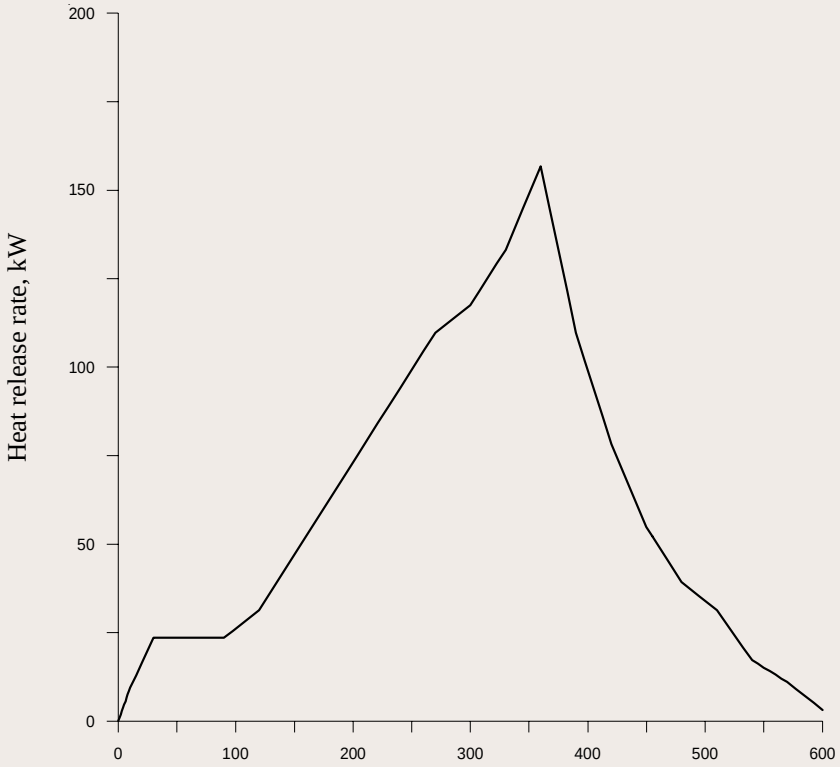


Fig 5:. Heat release curve for Kerosene Fire of size 0.0625 m^2

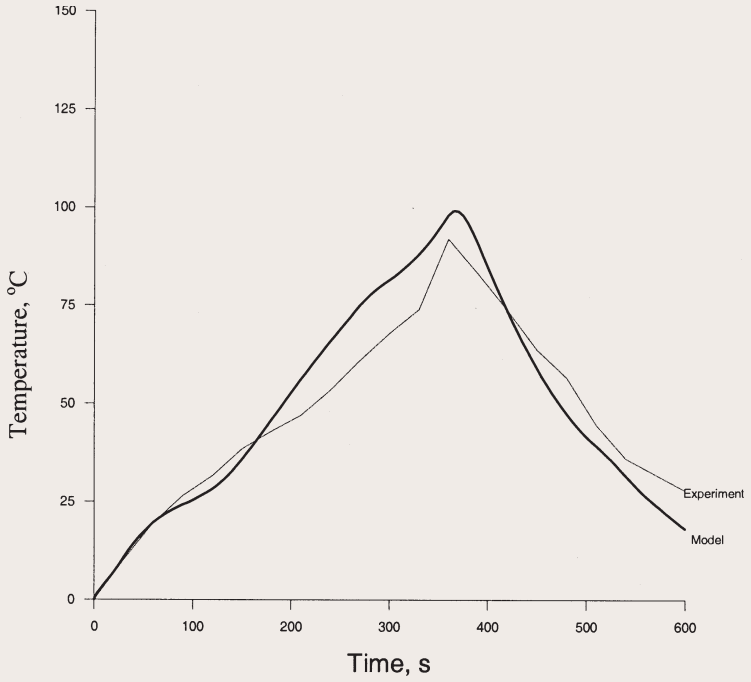


Fig. 6: Comparison of REST's predictions with the experimental temperatures observed using Kerosene Fire of size 0.0625 m^2 in the enclosure of size 3.6 m x 2.4 m x 2.4 m

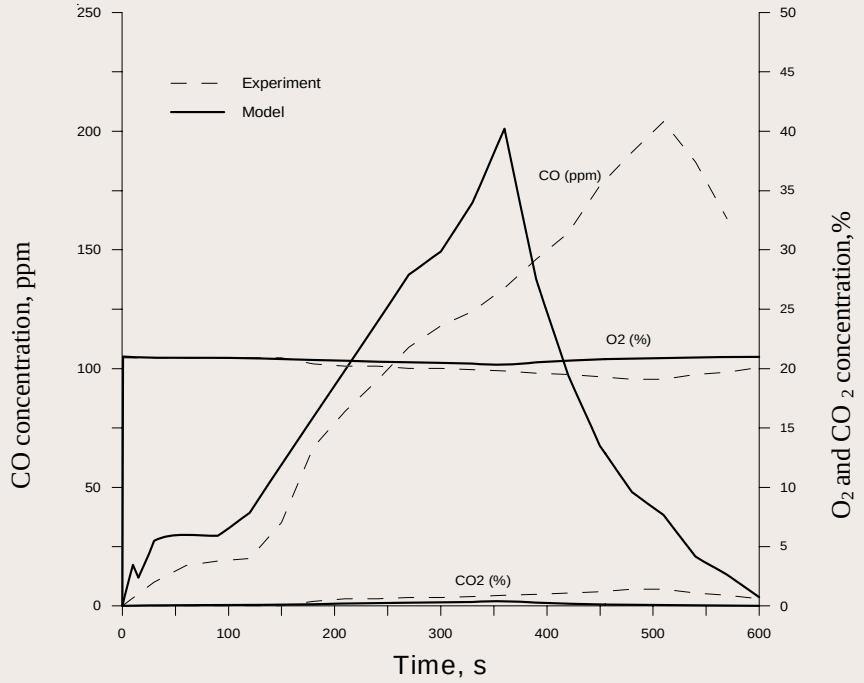


Fig. 7: Comparison of REST's predictions with the experimental species concentration observed using Kerosene Fire of size 0.0625 m^2 in the enclosure

Supra Institutional Project

Supra Institutional Project

Coarse Fly Ash as a Supplementary Cementitious Material in Cement Concretes

Simmi Tyagi, M. Gupta and Team

A systematic research programme is initiated on processing of unused coarse fly ash as pozzolan in cementitious materials. It is known that reject of the classifying process i.e. coarse fraction has an inherent drawback of its slow reactivity because of high carbon content and large particle size (> 45 µm) and does not meet the fineness criteria of IS: 3812. Thus, a need is identified for a processing method to accelerate the pozzolanic character of fly ash for effective use instead of disposing it as a waste. The focus of most beneficiation methods has been to minimize the negative effects that carbon have in normal strength cement mortar and concrete. In view of this, froth floatation method has been used before activation to remove unburnt carbon of fly ash (Photo 1). After frothing process, the unburnt carbon content has been reduced from ~ 2% to 0.5% after loss on ignition test. CHN analyzer results also show that coarse ash contains 0.4% carbon content adsorbed onto ash particles.

The coarse ash was activated by mechano-chemical treatment and characterized for fineness, particle size distribution, microstructure and pozzolanic reactivity. The particle size analysis shows that activated ash has less average particle size (D50) and wider particle size distribution than the unprocessed ash (Fig. 1). The specific surface area of activated ash is also increased. EDAX analysis indicates that the ratio of Si/Al in the coarse fly ash is 1.07 - 1.81 whereas activated ash exhibited Si/Al ratio 2.19. Al/Fe ratio of coarse fly ash (5.60-7.86) was higher than the activated fly ash (3.0 - 3.9). Microstructurally, activated ash particles are rough and irregular contrary to coarse of smooth, spherical and hollow particles such as cenospheres or plerospheres. The activated ash particles seem to be spongy and exhibited high surface area indicating higher amount of amorphous content (Photo 2). This ash is further examined for lime reactivity, strength activity index and lime solubility curve by Frattini test. The lime strength of coarse ash is 2.2 MPa while activated ash possesses strength ranging between 4.6 - 6.7 MPa. The strength activity index of coarse ash is ~ 67% only. When the ash is treated mechano-chemically, the samples attained more than 80% of the control mix after 7 and 28 days curing. The results of Frattini test indicate that the values of activated ash just lying above the line show pozzolanic activity, whereas coarse ash showed zero pozzolanic activity. The characteristics of activated coarse ash are also compared with the requirements of IS: 3812. Results are satisfactory.

Photo 1: Froth processing of fly ash

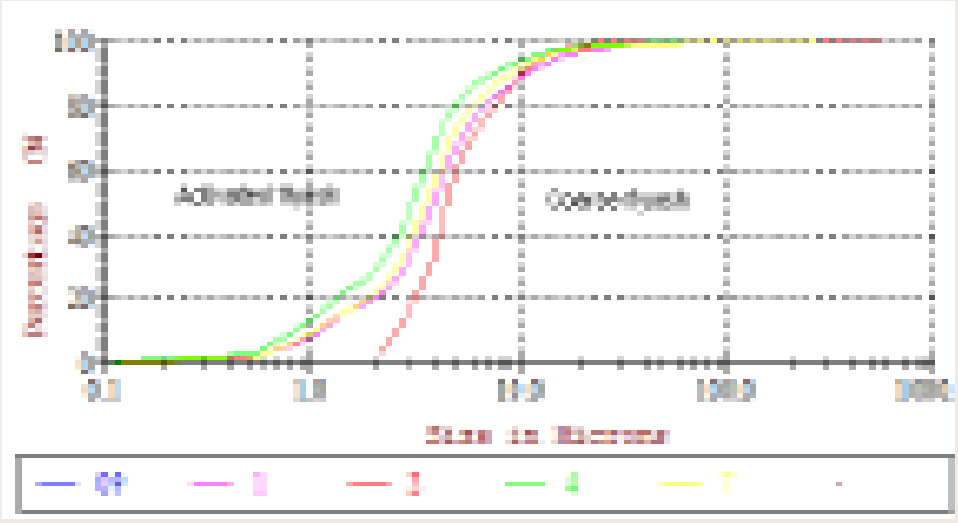
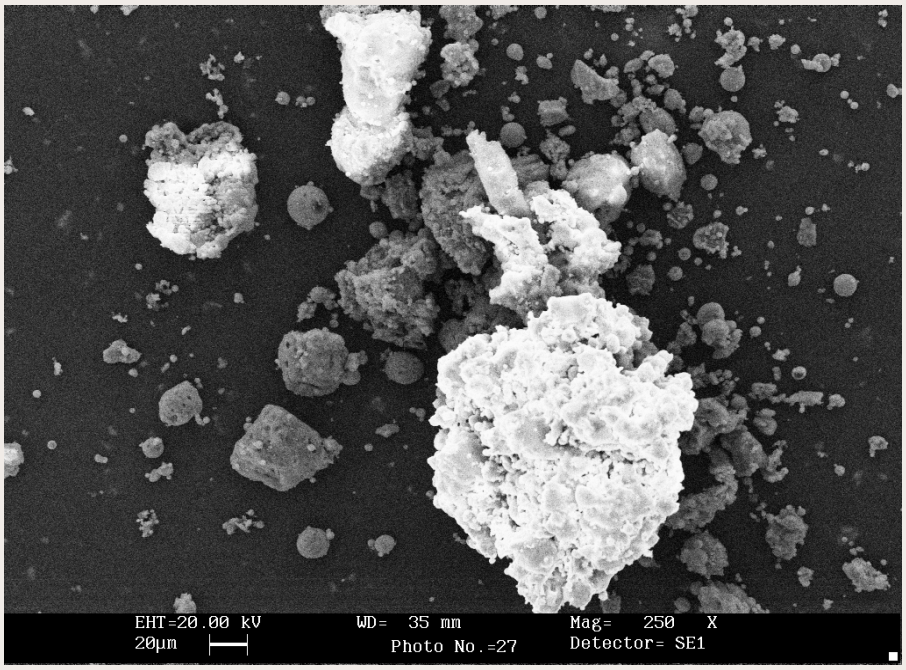
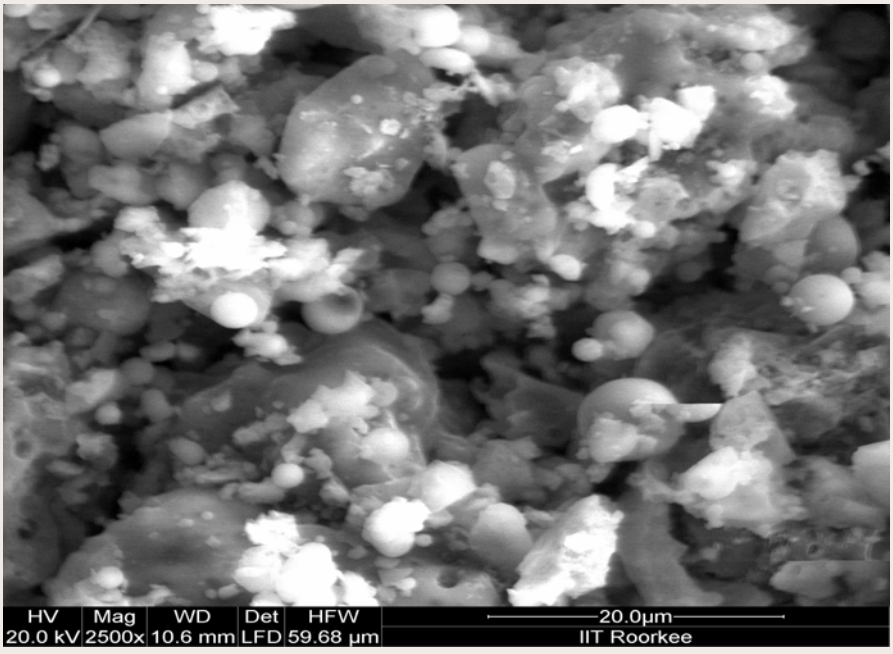


Fig. 1: Particle size distribution of coarse and activated fly ash



(a)



(b)

Photo 2: FESEM of fly ash (a) Coarse (b) Activated

Hybrid Polymer Network Matrix for Jute Composites

B.Singh, Manorama Gupta and Team

Jute fibre reinforced polyester composites have been widely studied as wood substitutes in buildings for panels, partitions, doors & widows etc. However, the performance of these composites is questioned due to their poor delamination resistance caused by brittleness and high cure shrinkage of unsaturated polyester resin (USP) matrix. It is therefore necessary to use tough composite matrix with adequate fibre-matrix adhesion. At the Institute, hybrid polymer network (HPN) of unsaturated polyester-urethane resin is synthesized to obtain a kind of elasticity in brittle polyester with low cure shrinkage. Various HPN systems of NCO/OH molar ratio of 0.23 - 1.53 were prepared and characterized for their physico-mechanical, thermal and microstructure properties. The tensile strength of HPN systems is 37 - 43% higher than the neat USP. On the contrary, elastic modulus of HPNs is reduced to 17 - 32%. An improvement of 103 - 136% in energy to break of HPNs is observed at a NCO/OH ratio of 0.76 - 1.15. The curing behavior of these resins was evaluated by rigid body pendulum type instrument (RPT). At room temperature, the hardness of base resin is more than that of HPN system when tested as per ISO1522. It is noted that the size and distribution of molecular network in the cured HPN resin is higher than the parent system.

Master curves of HPN and base resin were constructed using time-temperature superposition of DMA data. It was found that storage and loss moduli of HPN resin was less frequency dependant than base resin (Fig. 2). The presence of distinct phase separation and formation of network between urethane and cross-linked polyester in HPN contrary to base resin is viewed under Atomic force microscope (Photo-3). The compatibility of constituent phases (polystyrene, cross linked polyester and urethane) of HPN is more than base resin. Signature of shrinkage in conventional polyester resin is observed contrary to hybrid polymer network resin.

The jute composites have been prepared using alkali treated non- woven jute mats and HPN matrix. The water absorption of HPN matrix composites was nearly 50% less than that of the base resin after 24 hr immersion. The thickness swelling was also reduced significantly (66%) compared to the base resin. It is observed that tensile strength and energy to break of HPN matrix composites are improved by 23.48% and 25.55% respectively whereas tensile modulus of system is reduced by 26.47% only. Elongation at break increased marginally. Area under the tensile load - deflection curve of HPN matrix composites is more than that of parent resin. The samples were aged in boiling water for 2 hrs. A decrease of 13.52 - 25.55% in tensile strength and ~ 54 % in tensile modulus was observed in both HPN and base systems. It is noted that HPN matrix composites retained ~ 12% more tensile strength than the base resin composites. The elongation at break of aged samples increased (16.72 - 34.44%) probably due to debonding between jute fibre and resin. The fractography of failed aged and unaged samples were carried out by scanning electron microscopy. The HPN sample clearly shows matrix cracking and

presence of resin adherence on the surface of fibres. The fibres are embedded throughout the surface. Whereas in the base resin composites, the occurrence of fibre breakage and fibre pulled-out are clearly seen. Under aged condition, the base resin composite exhibited extensive fibre pulled-out with no resin adherence whereas HPN matrix composites show only embedded fibres. This suggests that HPN matrix system is more hydro-thermally stable than the base resin composites.

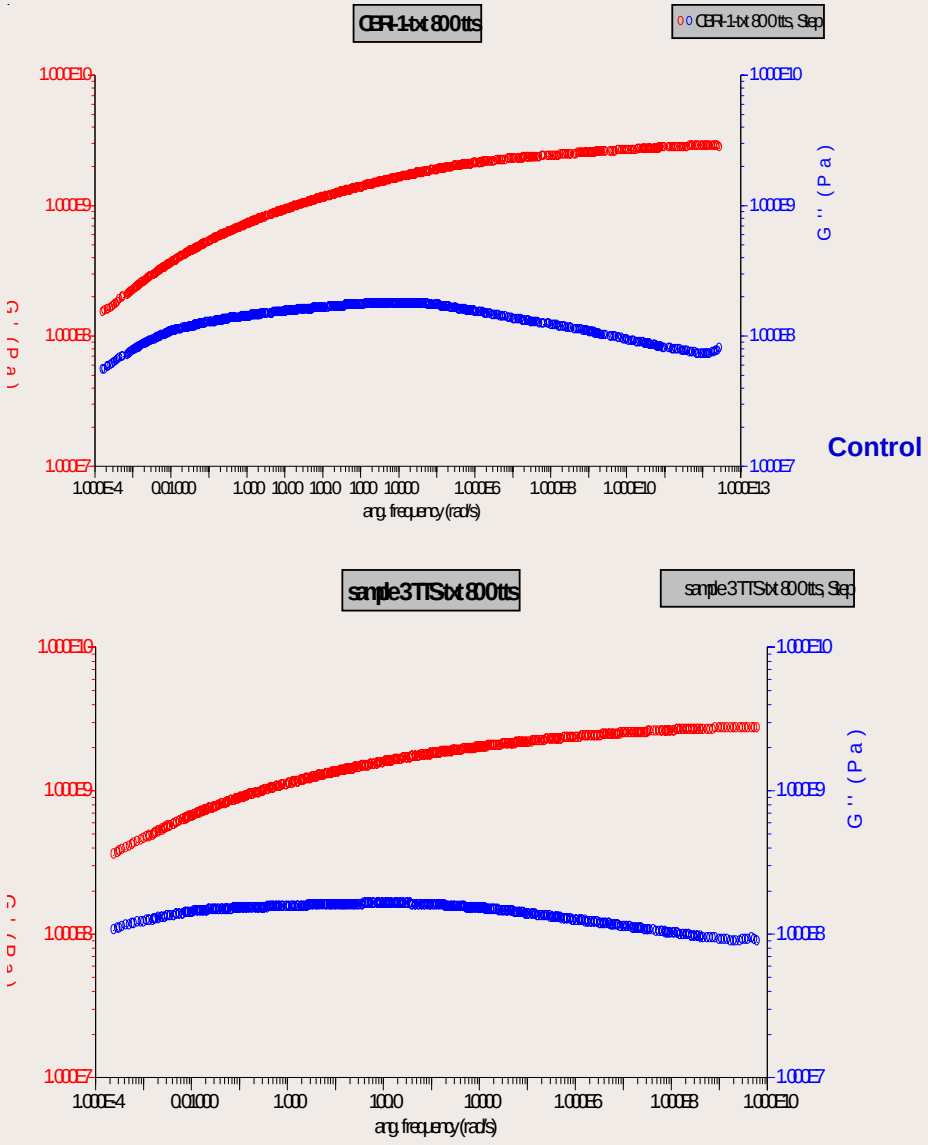


Fig. 2: TTS Master Curves of base and H P N Resins

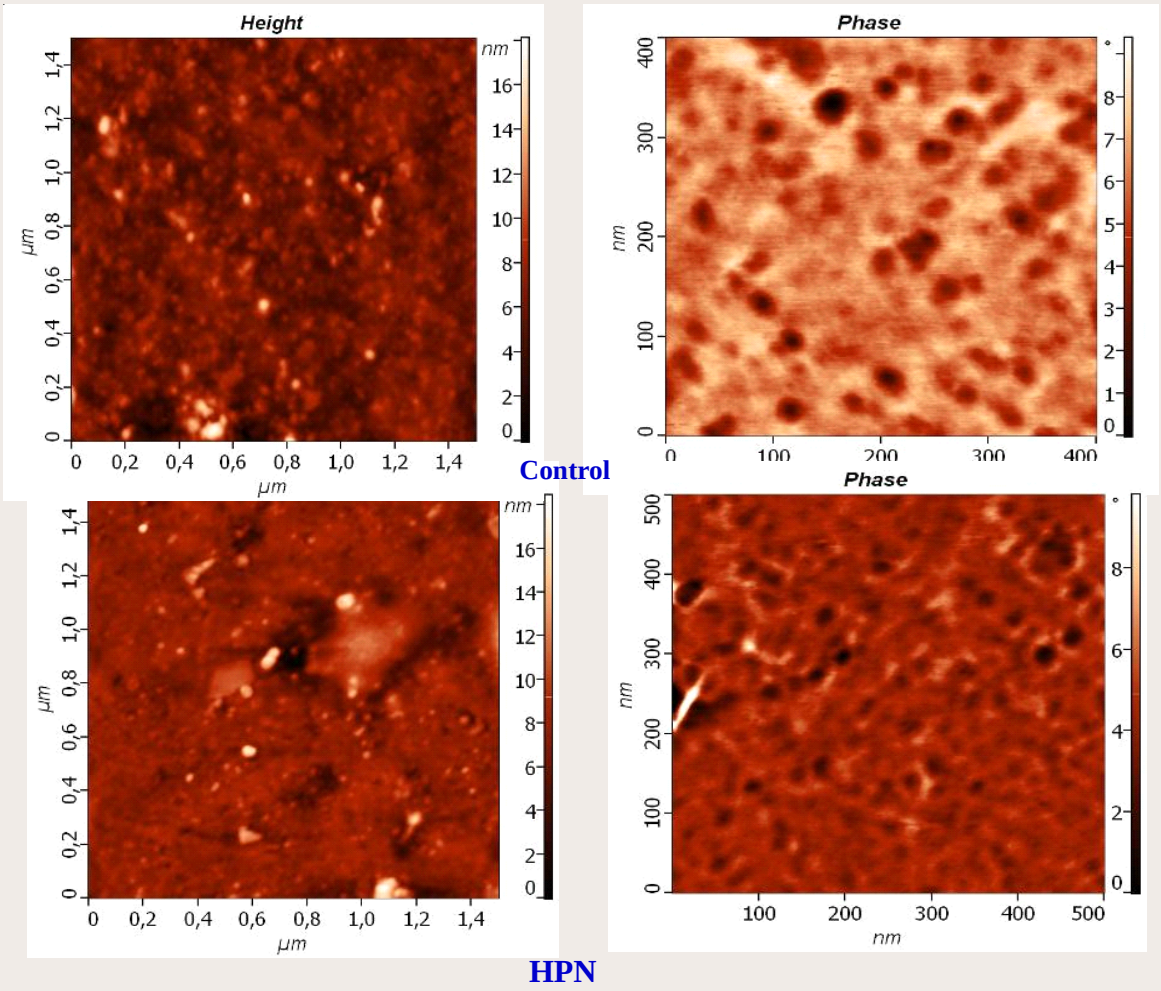
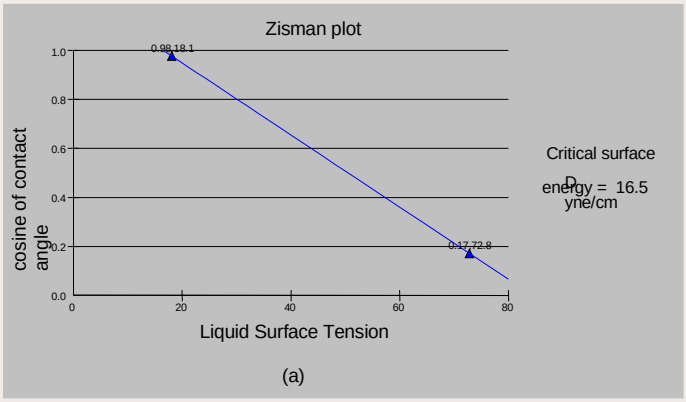


Photo-3: AFM images of base and HPN resins under semicontact phase contrast

Pine Needle Composite Boards/ Panels

Manorama Gupta, Monika Chauhan and Team

Pine needles are renewable resources, available in huge quantity in the western part of Himalayas. Since it is under utilized, every year forest fire causes substantial damage to the forest resources. Because of waxy coating, needle furnish does not present an easy surface for bonding of adhesives used in panel products manufacturing. Keeping this in view, a systematic study is undertaken on the utilization of pine needles for making building boards / panels. The physico-mechanical properties of these composites were evaluated as a function of resin content, treatments and particle size. Wettability of the needles was characterized by measuring a critical surface tension through Zisman's rectilinear relationship between surface tension and cosine contact angle (Fig. 3). The reduced polar component of surface-free energy of these treated



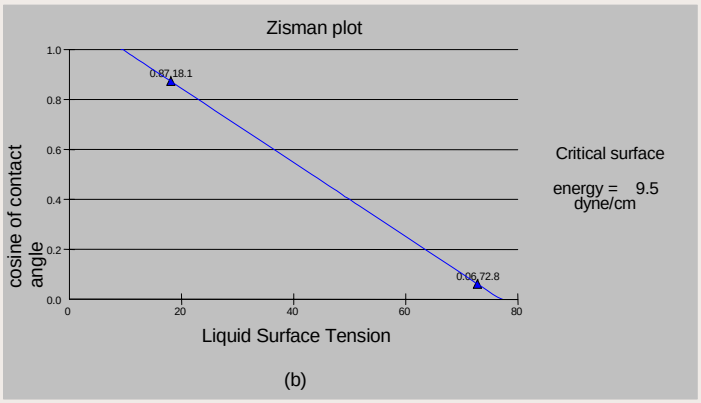
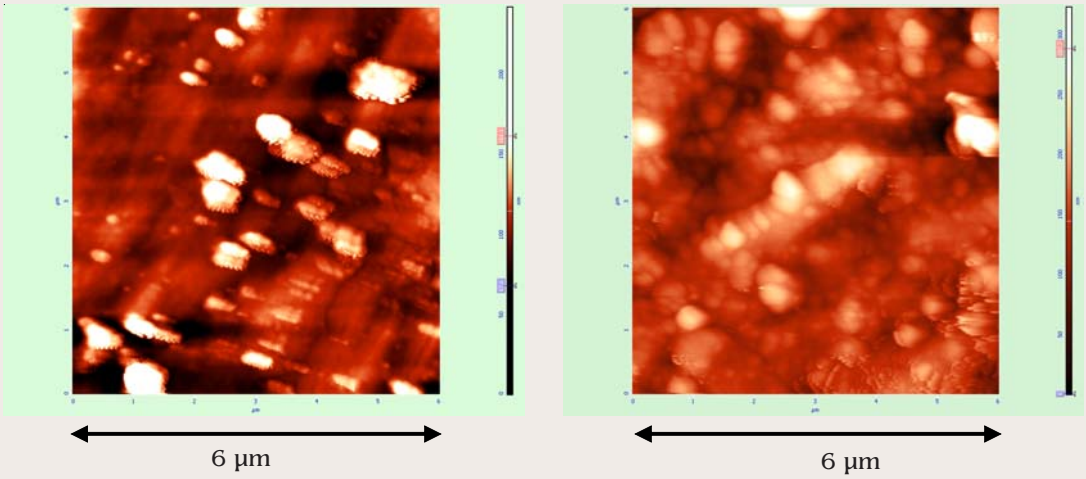


Fig. 3: Zisman plots of (a) Untreated pine needle (b) Treated pine needle

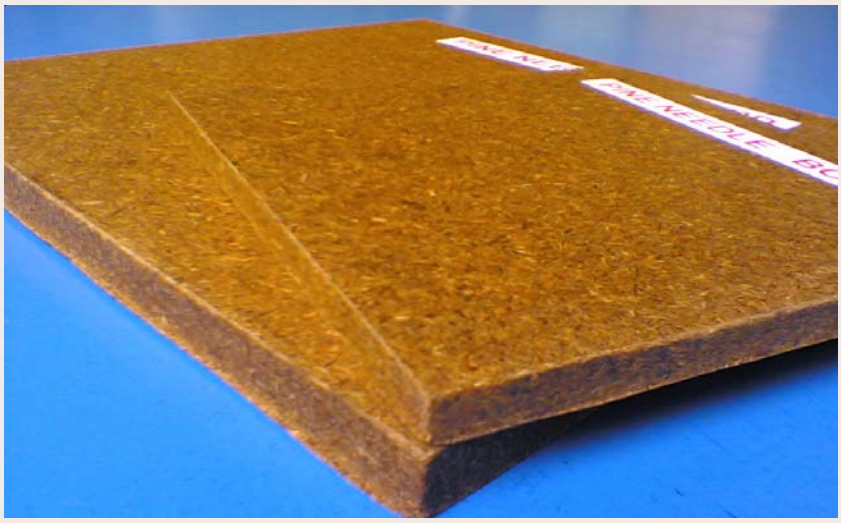
needles indicates superior spreading of adhesive onto their surfaces as compared to control samples. It is found that pine needle behaves as low energy surface (28 mJ / m^2) as compared to the wood (56 - 97.6 mJ/m^2). Because of this, the composite boards made from treated pine needles exhibited less water absorption (43 - 45%) and thickness swelling (21- 54%) than that of untreated pine needle boards. The linear expansion of treated pine needle boards is also 2-3 times less than that of untreated boards. Its internal bond (split tensile strength) and screw withdrawal load were increased by 90% and 95% respectively compared to untreated needle boards. DMA run indicates that treated samples imparted higher loss modulus and Tan delta as compared to untreated showing dominancy of their viscous components.

The composite boards were prepared from these treated needle furnishes and resin adhesive. The results indicate that internal bond strength, modulus of rupture, tensile strength and screw withdrawal load increased with the increase of resin adhesive content. At lower humidity, the

boards with varying resin adhesive contents exhibited 2 - 7% thickness swelling at equilibrium moisture content whereas at higher humidity, the thickness swelling in the boards ranged between 13-23%. Under immersed water, the composite boards swelled 2 - 3 times as much as the samples exposed at 98% RH. After aging, the internal bond strength of boards was reduced by 41-67% in accelerated water and 54-78% in cyclic exposure respectively. Fractographic evidences such as pulled out of needle fibres, fibre fracture and debonding due to swelling of fibres in the aged samples could be used to explain the loss of strength. The screw withdrawal load of the high resin adhesive content boards was comparable to the natural wood. In another attempt, biopolymer based adhesive is used for making pine needle boards. A marginal slope



(a)



(b)

Photo 4: Pine needle composite boards (a) AFM images (b) Photo image

(invisible knee point - matrix cracking) in the load-deflection curve of the samples was observed as compared to the base adhesive bonded composites showing their improved cohesive strength. An increase of ~ 26 % in internal bond strength of biocomposites was noticed over the base system. The modulus under split tensile mode was ~ 41 % higher. It is noted that biopolymer modified matrix composites retained slightly higher internal bond strength than the unmodified composites under wet condition. Photo 4 shows the photoview of the composite boards. The developed composite board satisfies the requirements of Standard Specification: IS: 3087 -2005. The surfaces of composites are smooth and needle fibres were homogeneously distributed throughout the composite. The composites can be easily laminated with either conventional, preferably isocyanate based adhesives or same resin adhesive used in panel making. They can be easily cut, sawn and finished.

Rice Husk Plastic Composites

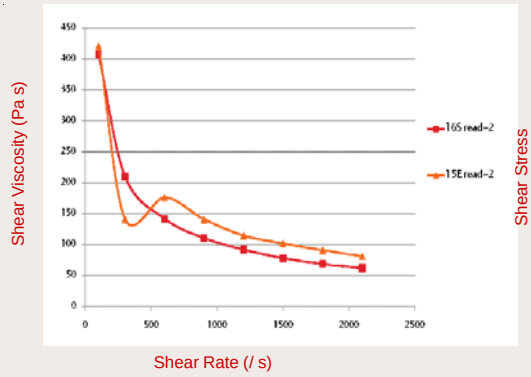
B. Singh, M.Gupta and Team

A systematic study was undertaken on the development of rice husk plastic wood through melt blend processing for building applications. The main objective is to produce plastic composites as similar to natural wood in surface appearance and carpenter friendly properties. The selection of rice husk was made because of its huge availability and superior heat stability due to high silica content over other agro-residues. Various issues such as preparation of rice husk in a moldable grade, optimization of rice husk loadings in plastic, compatibility between fiber and matrix, durability under hygro/ hydro thermal conditions and processing parameters related to product development have been carefully addressed. The optimized composite recipe was moulded into solid profiles to be used for making various products. Effect of various additives on the rheology of granules was studied (Fig. 4). Samples aged as per IS: 12406 in boiling water (2 hrs aging) and alternate wetting & drying cycle tests showed 10 - 12% reduction in tensile strength. The extruded profiles were tested for termites under lab and field conditions. The weight loss in the samples was less than 10%. A fire test of profiles was also carried out to know their role in the growth of fire.

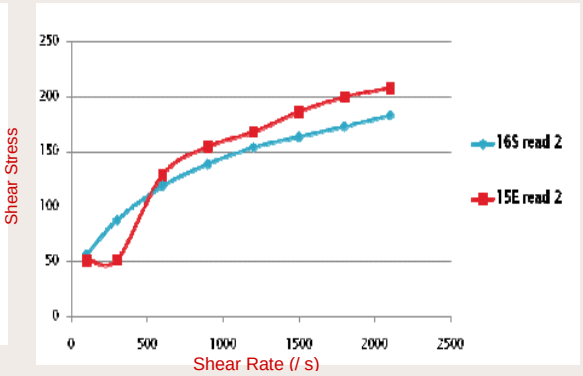
After assessing the suitability of the materials, industrial trial was carried out for making rice husk WPC compounds and their subsequent processing in the injection and extrusion mouldings. The density and water absorption of the injection - moulded sheets are 1.12 g/cm^3 and 0.60% (24 hrs immersion) respectively. The tensile strength and modulus of the sheets are 16.30 MPa and 754 MPa respectively. The drop impact strength of the rectangular box (30 x 30 x 30 cm^3) made by nail jointing of the injection moulded sheets shows that the sheets were intact when the box filled with sand was dropped from 3 meters height. It can be easily machined similar to wood (parting, surfacing and turning). Threading in the rods can be easily made. Few prototype products such as paneled door, pelmet, stool, cable drum, box and extruded lumber were prepared to demonstrate the suitability of materials for various wood substitute applications.

The salient features of extruded sheets/ profiles are: wood like surface appearance, carpenter friendly, biologically durable, recyclable and meet the requirements of National Building Code, 2005 when tested as per IS: 1708. The typical applications include: door and window profiles, frames, decking, fencing, lumber, furniture and other industrial applications (Photo 5). Indian patent has been filed (0120 NF 2008).The proposed installed capacity of compounding extruder is 100 kg/hr and 10-20 meter/hr for profile extruder respectively.

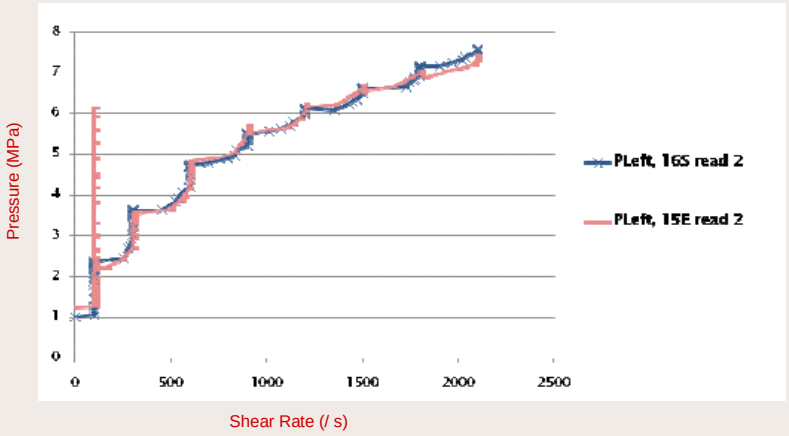
For commercialization of research output, the Institute has transferred the technology know-how to Mr. Bhupesh Khanna, Director of M/s Shivaye Namah Manufacturing Company Pvt. Ltd., New Delhi (Works: Malanpur Industrial Area, Gwalior, Bhind). On the basis of know-how, the party has set-up a commercial units for production line for rice husk flour preparation, compounding line for pellets production and extrusion line for profiles production. The factory is under commercial production.



Shear Viscosity Vs Shear Rate at Temp 190°C



Shear Stress Vs Shear Rate at Temp 190°C



Pressure Vs Shear Rate at Temp 190°C

Fig. 4: Rheological properties of rice husk plastic granules

Photo 5: Composite profiles and products

Geopolymer Bonded Bricks

Sarika Sharma, B. Singh and Team

A systematic study is undertaken on development of geopolymer pastes from aluminosilicate sources for making building bricks, coatings and fibre reinforced composites. The optimization of pastes in terms of strength development is carried out by varying SiO_2/Al_2O_3, M_2O/Al_2O_3, liquid/solid ratio and curing conditions. It is observed that compressive strength of pastes ranged between 12-32 MPa. The water absorption of

samples was 1.78 % after 24 hrs in immersed water. SEM-EDAX analysis has indicated that Si/Al ratio in the geopolymerized paste is >2 suggesting formation of poly (sialate-silaxo) polymer structure. At higher activator concentration, the pastes exhibited cracks due to quick condensation reaction between aluminates and silicates. The aluminosilicates exist in the form of chabasite and phillipsite type zeolitic phases in the structure (Fig. 5). TGA curve indicates a continuous loss of water/ moisture (~8%) in the hardened paste upto 500 °C. Thereafter, the paste is thermally stable upto 1000 °C. It is noted that decomposition temperature of paste under DTG occurs between 77 and 85 °C (Fig. 6). FT IR spectra of paste exhibited an intense hydroxyl peak at 3480 cm^{-1} and shifting of peak position at 1037 cm^{-1} (Si-O) and appearance of peaks at 1640 cm^{-1} and 1456 cm^{-1} with respect to its raw source showing formation of gel structure. XRD showed a hump between 16 - 30 theta° showing its amorphous character.

The optimized geopolymeric paste was used for consolidation of fine aggregates in different ratio for making briquettes of size 100 x 50 x 30 mm. These briquettes were tested for water absorption and compressive strength. About 50 bricks of size 23 x 11.5 x 7.5 cm were made (Photo 6). The properties of bricks are: Density 1.92 - 2.1g/cm^3, Compressive strength 12 -25 MPa. Bricks can be easily jointed with ordinary cement mortar.

Durability of geopolymeric cubes was studied by immersing samples in de-ionized water, HCl, H_2SO_4, sodium sulphate, magnesium sulphate and mixture of sodium sulphate and magnesium sulphate upto 90 days. It is found that the samples immersed in mixed solution of sodium sulphate and magnesium sulphate exhibited wide cracks, while in magnesium sulphate solution alone showed only deposition of salt on the surface of cubes. After 28 days, 35% strength reduction of cubes in sodium sulphate and 37% in magnesium

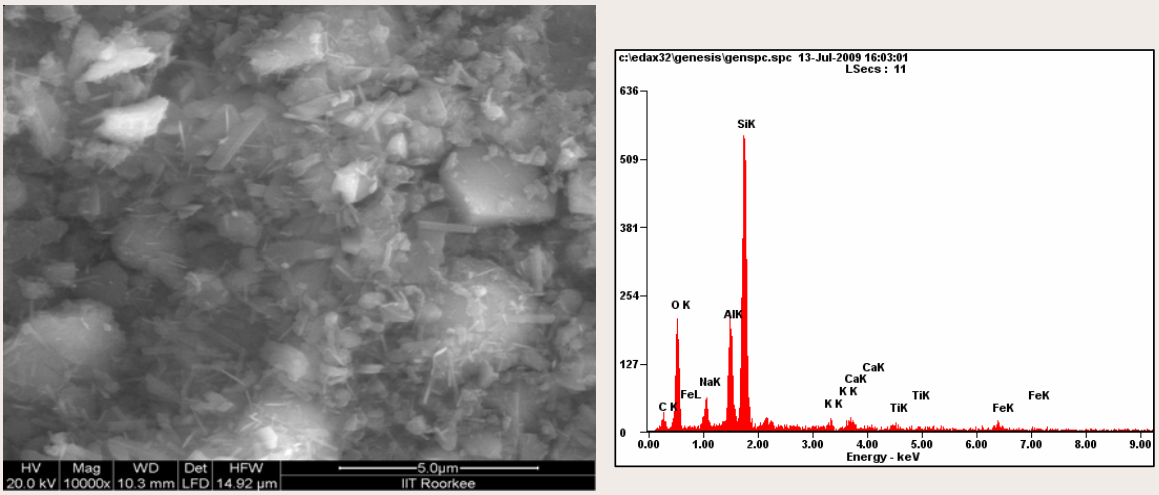
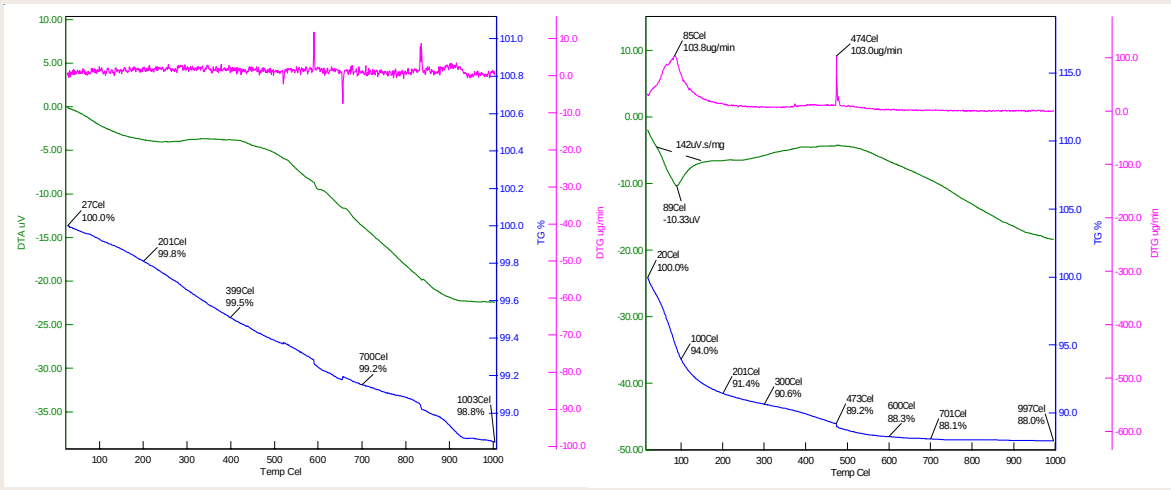


Fig. 5: FESEM- EDAX micrograph of geopolymer paste



(a) (b)

Fig. 6: TGA/DTA curves of (a) Raw source (b) Geopolymer paste

(a) (b)

Photo 6 : (a) Geopolymer bricks (b) Jointing of bricks with cement mortar

sulphate and 70% in mixed solution of sodium sulphate and magnesium sulphate were obtained. The weight loss of geopolymeric pastes in all solutions is upto a level of 2% only. In acidic environment, the strength of geopolymeric paste is reduced 2.5 times in HCl and 3.5 times in H_2SO_4 respectively after 28 days.

Experimental and Theoretical Study of Masonry Walls Subjected to Non-Nuclear Blast Loading

A.K. Pandey

Analysis of masonry walls subjected to blast loading requires precise determination of blast

pressure for different amounts of blast charges at different detonation distances. Important shock front parameters required for computer simulation are over-pressure, the reflected over-pressure, the dynamic pressure, duration of the positive phase, velocity of the incident and the reflected shock front and the air density behind the shock front. An algorithm and software has been developed for computer simulation of blast pressures for masonry walls. Masonry walls are the weakest link in a framed structure in resisting the forces during a blast event. Current codal provisions take care of only flying splinters for blast resistant design of masonry walls. Comprehensive design procedures / guidelines are required for masonry walls in a framed structure depending upon the vulnerability of the structure. Some experimental and theoretical investigations are reported in international literature however more experimental and theoretical investigations are required to evolve a comprehensive design procedure for a blast resistant design. IS-4991-1968 requires that a building may be designed for a bare charge of 100kg at distance of 40 m for residential building, 30 m for community buildings (schools, offices etc.) and 20 m for buildings housing services (hospitals, power stations). Calculations for blast pressures and positive phase duration have been made using a developed software for 100 kg blast at a distance of 20, 30 and 40m. Variation of blast pressure (Fig. 7) and blast load parameters for detonation of 100 kg TNT at a distance of 40 ,30, 20 m are shown in Table 1, 2 & 3 respectively.

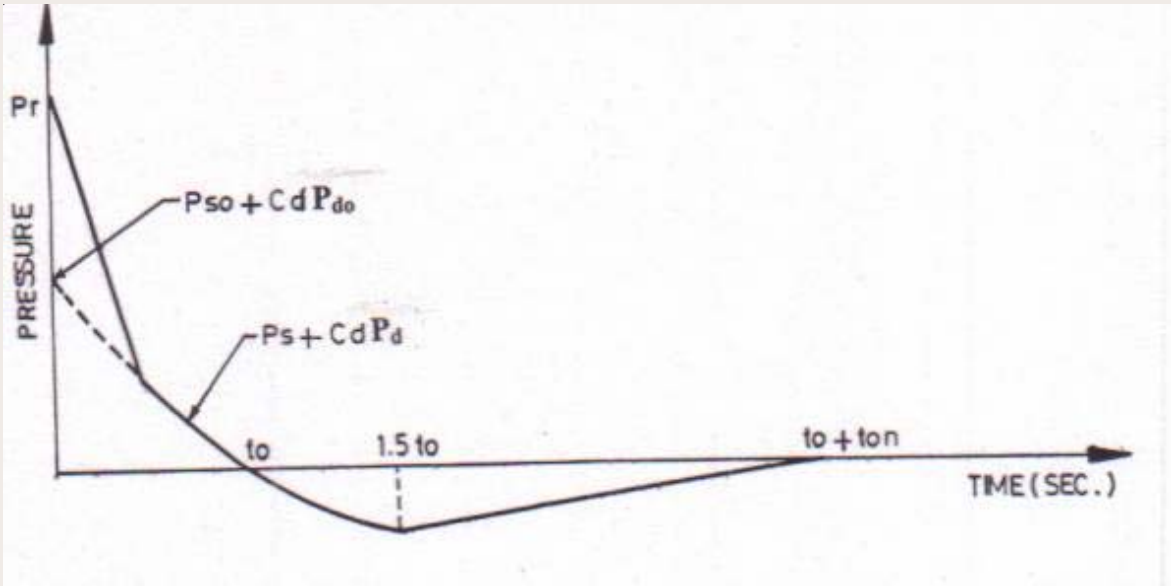


Fig. 7 : Blast pressure variation with time

Table 1. Blast load parameters for detonation of 100 kg TNT at a 40 m perpendicular distance from masonry wall

Positive face duration(t_o)	20 ms
Clearance time for reflaction(t_c)	15 ms
Peak static over pressure(p_{so})	0.193 kg/cm^2
Peak reflected over pressure(p_{ref})	0.658 kg/cm^2
Peak dynamic over pressure(p_{do})	0.067 kg/cm^2
Pressure after clearance reflection effects (p_{tc})	0.065 kg/cm^2

Table 2. Blast load parameters for detonation of 100 kg TNT at a 30 m perpendicular distance from masonry wall

Positive face duration (t_0)	18 ms
Clearance time for reflaction (t_c)	14 ms
Peak static over pressure (p_{so})	0.306 kg/cm^2
Peak reflected over pressure (p_{ref})	1.044 kg/cm^2
Peak dynamic over pressure(p_{do})	0.105 kg/cm^2
Pressure after clearance reflection effects (p_{tc})	0.091 kg/cm^2

Table 3. Blast load parameters for detonation of 100 kg TNT at a 20 m perpendicular distance from masonry wall

Positive face duration (t_0)	14 ms
Clearance time for reflaction(t_c)	14 ms
Peak static over pressure(p_{so})	0.62 kg /cm^2
Peak reflected over pressure(p_{ref})	2.11 kg/cm^2
Peak dynamic over pressure(p_{do})	0.2 kg/cm^2
Pressure after clearance reflection effects (p_{tc})	-

Linear time history analysis has been made for the above referred blast pressure using homogenized masonry properties for a wall of size (4 m in width and 3 m height) and the results of the study indicate that when masonry is used as a filler wall in a framed structure the flexural stress is 9.19 MPa and the response of the wall is impulsive, in order to reduce the stress level and deflection of the masonry wall it may be connected with the frame and in this case the additional blast load will be borne by the frame and the frame should be designed for the additional blast load. The debris will travel a distance of 1.37 m horizontally from the filler wall for the velocity of 1.77 m/s from the filler wall. The parametric study also indicates that change in boundary condition results in change in behaviour of the masonry (impulsive to dynamic).

Table 4. Summary of the linear analysis of the masonry wall for blast of 100 kg TNT at different detonation distances

Loading Case	Boundary Condition Case	Peak dynamic deflection (mm)	Peak dynamic flexural stress (MPa)	Ratio of Peak dynamic and static deflection	Ratio of Peak dynamic and static flexural stress	Peak Velocity m/s
D=40	Filler Wall in Frame	29.8	9.19	0.42	0.46	1.77
D=40	Load Bearing Wall	3.5	5.12	1.44	1.27	0.89
D=40	Load Bearing wall (opening)	3.0	3.13	1.44	1.13	0.88
D=30	Load Bearing Wall	5.4	8.14	1.38	1.27	1.44
D=20	Load Bearing Wall	10.6	16.61	1.34	1.28	2.94

Nonlinear Material Model

As the flexural stress values are higher, nonlinear analysis is required for predicting the behaviour of the masonry under the above blast load. Few experimental results on bricks and mortar shows that both are strain rate sensitive. A nonlinear material model based on elasto-viscoplastic theory using homogenization approach is being developed. Mohr-Coulomb yield and failure criterion is being implemented into existing finite element code. Masonry cuboids and wallets have been casted for stress-strain curve under uniaxial compression. Existing stress-strain curves for Indian Masonry has been studied and elasto-viscolpastic differential rule has been tried to get fludity parameter for the available stress-strain curves (Fig. 8).

$$\dot{\varepsilon}_{ij}^{vp} = \gamma \langle \varphi(F) \rangle \frac{\partial f}{\partial \sigma_{ij}}$$

$$\langle \varphi(F) \rangle = 0 \; if \; F \le F_Y$$

$$\langle \varphi(F) \rangle = \varphi(F) \; F > F_y$$

$$\varphi(F) = \left(\frac{\sigma - \sigma_y}{\sigma_y} \right)^k$$

$$k = 1/2 \; \& \; k = 1/3$$

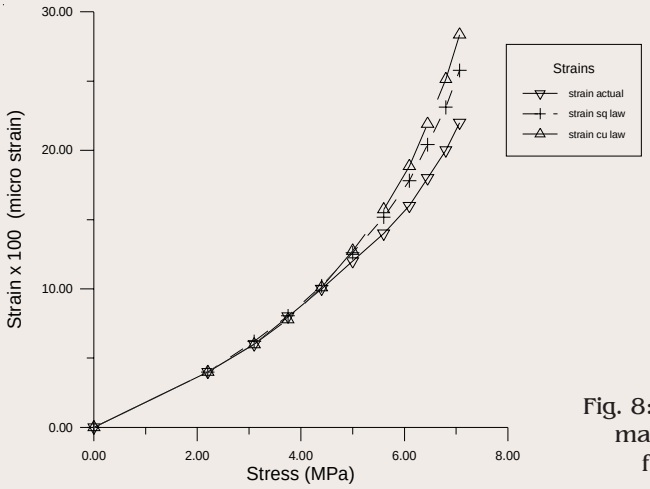


Fig. 8: Stress-strain curve of masonry with different fluidity parameter

Information, Extension & Project Management

Information, Extension & Project Management

Publication

The Publication Group (earlier International & Information Management Division) continued to serve as the nerve center of the Institute conducting and co-ordinating multifarious activities, such as, collection, storage and dissemination of R&D information; handling scientific and technical enquiries; publicity and public relations. Compilation, editing and publication of Annual Report to meet the inter and intra-institutional information needs, editing and publication of CBRI Newsletter and Bhavnika periodically, publication of Building Research Notes, Project Profile, Technical and Divisional Brochures etc., preparation of other scientific/ technical reports and filling up of questionnaires and performae received from various departments/organizations; preparation of write-ups for the CSIR Annual Report as well as for CSIR News and CSIR Samachar; reporting of the scientific and technical work carried out at the Institute in Hindi and English and publicity of the Institute's R&D capabilities through print Media.

Knowledge Reseource Centre

CBRI Library now known as Knowledge Resource Centre is actively engaged in acquisition, technical processing and updating the collection and providing the platform for e-access of information sources to expand the horizon of information base to the scientific community.

Acquisition

Books: The library added 261 numbers of books.
Journals: The library has subscribed 103 (61 foreign & 42 Indian) journals. 179 volumes of journals were got bound.
Library Statistics: The present position of library Collection:

Books including reports; standards; conference proceedings; theses & maps	: 43127
Bound Periodicals	: 19600
Microfilms	: 56

Institutional Membership

The library continued to renew the membership of learned national/ international professional societies and received their publications against the membership.

National (India)

Indian Building Congress (IBC), Delhi; Indian Geotechnical Society (IGS), Delhi; Institute for Steel Development and Growth (INSDAG), Kolkata

International / Foreign

International Council for Research & Innovation in Building and Construction (CIB), Rotterdam, The Netherlands; International Union of Laboratories & Experts in Construction Materials, Systems and Structures (RILEM), Bagneux, France, International Federation for Structural Concrete (fib), Lausanne, Switzerland.

Exchange of Publications

Besides membership, the library received Annual Reports; News Letters; Technical Reports; Reprints and other materials in exchange from National and International Organizations.

Resource Sharing and Local Networking

CBRI library is maintaining continuously good relationship with the libraries located in Roorkee viz. Indian Institute of Technology; National Institute of Hydrology; Irrigation Research Institute; Bengal Engineering Group and so on, providing resource sharing through inter library loan. Besides the local network, library is maintaining the liaison with the libraries of CSIR Laboratories and other academic/research institutions.

Library Services

Library is playing a coordinating role between users and the literature, providing personal Information service through Current Awareness (CAS) and Selective Dissemination of Information (SDI) using modern information technology. Besides the day to day circulation, reference and xeroxing services, library is also rendering the following services:

Documentation

Paper clipping service continued through scanning of eight no. of newspapers in English and Hindi version. The topics of the interest of the institute under eleven major heads like- Building Materials; Structure & Foundation; Disaster Management: earthquake & landslides; Shelter Planning & Policy; Environment Science & Technology; Fire Research; CSIR/ CBRI etc. The paper clipping are kept in classified order for providing current awareness service to users.

List of Latest Addition

Library is bringing out a quarterly list of latest arrivals of books for the general awareness of library users.

Bibliographic Service

Library is providing bibliographic service to users on demand on the subject of interest from in house data base as well as international databases.

OPAC Search

Library has created a bibliographic database of documents and providing search facility through computer. Users can search any document through any access point like author, class no., subject, title, keyword and combination of search (Boolean search).

CD-ROM Search

Library has subscribed International Construction Database (ICONDA). Other CD-ROMs are also available in library viz. CIB

Conference Proceedings, ACI Manual, Patestate: a database of CSIR patents and heritage buildings and sites.

In-house Database

- Library is maintaining in-house created bibliographic database of books and bound volumes of journals.

Internet Facility & Access of E-Journals

Access to over 3000 full text of e-journals of leading S&T publishers, full text of Indian & ASTM Standards as well science & patent databases are available online under CSIR-DST E-journals Consortium.

Development, Construction & Extension Division

APPLICATION	:	• Extension of CBRI's know-how for construction and building materials.
USES	:	• Construction of cost effective and efficient buildings • Establishment of production facilities/industry using CBRI Knowhow
BENEFITS	:	• Durable/Comfortable buildings • Savings in scarce materials, cost and time • Efficient use of local materials and skills • Human resource development • Aid to building industry • Institute's image building
ADVANTAGES	:	• Employment generation • Entrepreneurship development • Enhancement of quality of life • Poverty alleviation
INFLUENCE	:	All over the country; both in rural & urban sector; through various government and non-government agencies.

Activities :

Mass Awareness Programme

	Theme	Date and Venue	Organizing Agency/ Department	Witnessed by
1	3rd Destination Uttarakhand 2009 International Exhibition and Business Summit	10 -12 October, 2009, Dehradun	Friendz Exhibitions & Promotions Pvt. Ltd., New Delhi	Over two hundreds of visitors
2	Exhibition during UCOST	10 -12 Nov. 2009; GBPUAT, Pant Nagar, Uttarakhand.	Uttarakhand Council of Science & Technology, Dehradun	Delegates of the Congress
3	Exhibition during Audhyogik Vikash evem Sanskritik Mela	10-12 Nov. 2009; Gaucher, Chamoli, Uttarakhand	District Administration, Chamoli	About five thousands visitors comprising of students, lecturers, political leaders, self help groups etc.
4	Exhibition on Rural Housing Technologies	1-3 December 2009, Shillong, Meghalaya	CBRI & Council of Science & Technology , Meghalaya	Participants of training programme
5	Exhibition on Rural Housing Technologies: Appropriate to West Bengal	9-16 Dec., 2009 Bajkul, Purba Medinipur, W.B.	Agargami Handicapped Samity, Medinipur, West Bengal	About three thousand visitors including villagers from nearby villages.
6	Exhibition on CBRI Technologies	9-10 Feb., 2010 CBRI, Roorkee	CBRI, Roorkee	Workshop delegates and guests of CBRI Foundation Day
7	Exhibition on Innovative Building Materials & Process in 'Green Building Convention'	18-20 Feb. 2010, Pune	INIS Enterprises , Mumbai	Over 500 professionals, entrepreneurs & industrialists.

Live Demonstrations/Training organized

	CBRI techniques/processes	Date & Venue	No. & type of participants
1.	Correct method of providing vertical steel bars in brick masonry; Correct method of laying earthquake bands in buildings and mud houses; Correct method of making bonds at corners and junctions of walls; Rat-trap bond brick masonry; Fire and rain resistant thatch roof, Production of cement flyash bricks; Precast RC plank and Brick panel systems of roofing; Precast Channel Unit roofing; Two pit rural latrine; Rural waste water disposal system; Methods of protecting mud walls against floods and rains; Bamboo reinforced Ferro- cement wall cladding; C-brick machine and process.	29-31July, 2009, Muzaffarpur, Bihar	83 trainees consisting of engineers from government departments and Rajiv Smiriti Seva Ashram, masons and Gharamis (Thatch roof binders) from various nearby villages and civil engineering students and about 100 women of self-help group of village Anjankot
2.	Production of Flyash Bricks, Clay Flyash Bricks and Tiles and some Rural Housing Technologies.	28-30 Oct. 2009, CBRI, Roorkee	5 representatives and trainers from a NGO of Muzaffarpur, Bihar
3.	Stone Concrete Blocks, Solid Cement Concrete Blocks (Manual & by Machine); Two Pit Latrine, Terrafill Water Filter; Correct method of providing vertical steel bars in brick masonry; Correct method of laying earthquake bands in buildings and mud houses; Correct method of making bonds at corners and junctions of walls; Rat-trap bond brick masonry; Fire and rain resistant thatch roof, Production of cement flyash bricks; Precast RC plank and Brick panel systems of roofing; Precast Channel Unit roofing; Two pit rural latrine; Rural waste water disposal system; Methods of protecting mud walls against floods and rains; Bamboo reinforced Ferro- cement wall cladding.	1-3 Dec. 2009 Shillong, Meghalaya	More than 100 persons consisting of social workers, NGOs, engineers from government departments, masons, thatch roof binders etc.

Vocational Trainings

Conducted vocational trainings of 1-4 months duration for 63 Science & Engineering students of various institutions in the country.

Orientation Programmes / Technical Exposure for Engineering & Science Students

	Date	No. & kind of trainees
1	17.04. 2009	15 Architectural students of Giyani Jail Singh College of Engineering & Technology, Bathinda (Punjab)
2	26.04.2009	18 Civil Engineering students of IET Lucknow
3	26.11.2009	67 science students and two faculty members from Arya Kanya Inter College Roorkee; 43 science students along with two faculty members of a SSDPC Degree College, Roorkee.
4	23.12.2009	172 selected brilliant students of class XII under Mission Excellence Programme, Madhya Pradesh Council of Science & Technology, Bhopal.
5	11.03.10	36 final year Civil Engineering students and two faculty members from Govt. Polytechnic, Kolhapur, Maharashtra.
6	17.03.10	74 Architecture students and two faculty members from Chitkara School of Planning & Architecture, Chandigarh.

Visits Conducted

- Mr. M. Nagrag with other three members of INDEF Bangalore, on 22.04.2009.
- Mr. Julian J. Gonsalves, Associate Civil Engineer, Habitat for Humanity India Mumbai branch visited the Institute on 22nd July, 2009 for low cost environment friendly and sustainable housing technologies.
- 20 participants, attending a course 'Induction course for chargeman II (LDCE)- Civil Discipline' at Ordnance Factories Institute of Learning Raipur Dehradun, visited the Institute on August 20, 2009.
- 10 participants of the workshop held at Institute on ' Strategy for Extension of Innovative Housing Technologies' on Feb. 09, 2010.

Technical Lectures Delivered

Subject	Speaker	Date and venue	Participants	Remarks
'Success Story of CBRI Technology Transfer'	Shri S.G. Dave Scientist G	18 Sep., 2009, CBRI, Roorkee	CBRI staff	Hindi week celebrations
Extension and Mass Application of Green Housing Technologies	Shri S.G. Dave Scientist G	13 Nov., 2009, Delhi	Delegates of an International seminar on 'Waste to Wealth'	Organised by BMTPC, New Delhi, 12-13 Nov., 2009
Cost Effective Improved Rural Housing and Entrepreneurship Development	K.L. Chhabra Tech. Off.	14 Dec., 2009, Bajkul, Purba Medinipur, W.B.	Hundreds of common people including villagers	During Krishi & Banijaya Mela
Efficiency of Grain Storage & Ancillary Buildings.	Shri H.K. Jain, Tech. Off.	11 January, 2010 at Amity University, Noida	About 30 Engineers and Managers of Food Corp. of India	Invited by Amity University
Cost Effective Precast Building Components	Shri S.G. Dave Scientist G	-do -	-do-	-do-
"Application of Green Housing Technologies in Affordable Housing"	Shri S.G. Dave Scientist G	19 Feb., 2010 Pune	About 100 delegates of 'Green Building Convention 2010'	Organized by INIS Enterprises Mumbai
Expertise and Capabilities of the Institute	K.L.Chhabra Tech. Off.	11 March, 2010 CBRI, Roorkee	45 final year Civil Engineering students from Govt. Polytechnic Kolhapur	During their visit to CBRI

Documentation

- Prepared 7 Entrepreneurship profiles on CBRI Rural Housing Technologies for incorporation in CSIR 800 RSWNET rural development site.
- Preparation of training readers in Hindi and English incorporating technical information on selected technologies for
  - Muzaffarpur, Bihar
  - Shillong, Meghalaya
  - Roorkee, Uttarakhand

Users / Beneficiaries

Several Govt./non-Govt. organizations and private individuals availed the benefits of CBRI know-how and technologies in furthering the cause of construction of cost effective, safe and comfortable buildings. Some of these are as follows:

- Ordinance Factory, Institute of Learning, Dehradun Uttarakhand
- BIS, New Delhi
- Delhi State Industrial and Infrastructure Development Corporation
- Gorkha Resettlement Training Unit, Raiwala, Dehradun, Uttarakhand
- Government Polytechnic, Kolhapur, Maharashtra
- Many NGOs and Building Centres located all over the country
- Several Technical/ Science Institutions of the country

Partners

- Building Materials and Technology Promotion Council, Delhi
- National Housing Bank
- Indian Building Congress, Delhi
- Adlakha & Associates, New Delhi
- CAPART, New Delhi
- Meghalaya State Council of Science, Technology and Environment.
- Rajeev Smiriti Sewa Ashram, Muzaffarpur, Bihar.
- Central Jail , Bhopal

Facilitators

- GB Pant University of Agriculture & Technology, Pantnagar
- Uttarakhand State Council of Science & Technology, Dehradun
- Agargami Handicapped Samity, Medinipur, West Bengal
- District Administration, Chamoli

Implémentation of CBRI Construction Technologies

CBRI construction technologies and materials including concrete blocks in masonry, precast roofing components for roofs and pile foundation in Black Cotton Soil are repeatedly being used in construction of thousands of houses by NGOs, Central and State Government Departments and private builders at various rural and urban locations of the country. Several Building Centres and Rural Building Centres are in regular production of precasts concrete/ ferrocement components engaging local artisans and labour.

During the year, some of the important constructions in and around Delhi adopting cost effective CBRI technologies under technical support and guidance by CBRI Extension Centre Delhi are listed below :

Housing Projects Completed

- 1184 housing units - Type III of area 39.75 sq.m. at Bawana, Delhi using Under Reamed Pile foundation, R.C. Plank and Joist roofing scheme.
- 1982 housing units - Type III / Type I at Narela, Delhi using strip Foundation and RC Plank & Joist Roofing scheme.

Housing Projects in Progress

- 1272 hosing units - Type III / Type I of area 39.75 sq.m. / 31.75 sq.m. at Bhorgarh, Delhi using open trench foundation and RC plank and joist scheme.
- 5552 housing units - EWS of area 30 sq.m. at Baprola, Delhi using open trench foundation and RC Plank & Joist roofing scheme.
- 1848 EWS houses of about 32 sqm.area in 3 storyed blocks at Greater Noida using mechanized perforated modular bricks in walling RC Planks & Joist in intermediate floors as well as in roof slabs, precast staircase steps, ferrocement shelving units and precast sunsheds named as "EWS Housing Omiran -I" by Greater Noida Industrial Dev. Authority.

Extension efforts made at a nominal expenditure attracted a huge cost and effort of the user organizations in actualizing the technology transfer in the form of construction of buildings all over the country utilizing CBRI's technologies and processes. Large-scale involvement and investment of the building industry towards meeting national aims through CBRI's national extension network, has been a unique feature of the programme.

Over 500 Entrepreneurs, Building Centres, Rural Building Centres spread all over the country are regularly using CBRI know-how in regular production of building components and completing construction of buildings worth millions of Rupees.

CSIR 800 RSWNET Programme

A project on 'Dissemination, Training and Demonstration of Appropriate Rural Housing Technologies' amounting to Rs. 80 lakhs has been approved by CSIR under its rural development progamme for Rural, SC/ST, North East, Tribals (RSWNET) under XIth Five Year Plan.

The problems of shortage of adequate durable housing, unemployment, vulnerability to natural hazards and shortage of skilled manpower are the foremost challenges in the way of improving quality of life of villagers. The National Agenda for Governance has been advocating 'Housing for All' as a priority area, with particular emphasis on the needs of the vulnerable groups.

In order that the available resources may be utilized most efficiently, it is necessary to promote use of innovative building materials and construction techniques. Dissemination and extension of energy and cost effective building materials, utilization of agro-industrial byproducts/wastes as well as locally available raw materials, cheaper and time saving building construction techniques and efficient house plans at affordable cost meeting the minimum basic requirements of the users has assumed a greater significance in the present scenario.

The main objective of this project is to disseminate, promote and extend safe and healthy

housing technologies which will improve housing and living conditions of the rural masses and also improve the skill of local artisans and construction workers through mass awareness programmes, training programmes, on-site demonstration and entrepreneurship development in rural society in the production of building materials and use of appropriate housing technologies by villagers, SC/ST and womenfolk.

In the year 2009-10 the institute organized 3 Training-cum-Demonstration Programmes on Appropriate Rural Housing Technologies at Muzaffarpur, Bihar, and Shilong, Meghalaya and one at CBRI Roorkee on production and use of Flyash Bricks. Training was imparted to about 400 persons including about 50 engineers, 200 rural artisans and construction workers, 20 NGOs and 100 women. 5 trainers of the NGO also got training for arranging sequence of training and production activities using women self help groups.

Seven exhibition/ mass awareness programmes were also organized at the following places:

- Dehradun, Uttarakhand,
- Roorkee, Uttarakhand,
- Medinipur, West Bengal,
- Gochar, Uttarakhand,
- Muzaffarpur, Bihar,
- Pune, Maharashtra
- Shilong, Meghalaya

Exhibitions and awareness programmes had reach of about 5 lakh persons in different parts of the country. The above activities covered cost effective rural housing technologies, rural sanitation, healthy living environment and earthquake/ cyclone/ flood/ fire/ termite and corrosion resistant rural houses. Some of the technologies included were;

- Precast RC plank and Brick panel systems of roofing
- Precast Channel Unit roofing
- Two pit rural latrine
- Rural waste water disposal system
- Methods of protecting mud walls against floods and rains
- Bamboo reinforced ferrocement wall cladding
- C-brick machine and process
- Fire retardant thatch roof
- Non erodible mud plaster
- Natural Fiber Composites
- Boards and Panels
- Wood substitute
- Fly Ash Utilization
- Improved Brick Technologies
- Fire, termite and Corrosion resistant Materials

Faculty Training & Motivation and Adoption of Schools and Colleges by CSIR

The Council of Scientific and Industrial Research (CSIR), New Delhi, through its National Laboratories has launched a nationwide programme on Faculty Training & Motivation and Adoption of Schools and Colleges by CSIR Labs. The main objective of the programme is to promote interest, excitement and excellence in science education at the school and under-graduate level.

In the year 2009-10 the institute selected SSDPC Girls Degree College and Arya Kanya Inter College Roorkee for activities under the

Programme. The following activities were organized:

- Visit of about 150 science students and faculty members from Arya Kanya Inter College and SSDPC Girls' Degree College, Roorkee to CBRI labs
- Visit of a group of about 100 selected brilliant students from Madhya Pradesh to CBRI Labs
- Six groups of BSc students of SSDPC Girls Degree College, Roorkee enthusiastically undertook science projects with scientists of CBRI
- On the National Science Day, Feb 28, 2010, the students displayed and presented their project.
- Visit of selected science students to Indian Institute of Petroleum, Dehradun
- Organized concluding function on March 30, 2010 and Certificates were given away to participating students.

The science faculty and students witnessed various laboratories and R&D facilities of CBRI to motivate them in the area of science. After conducting visit in November 2009, the students were invited to propose projects in areas of their interest in consultation with their teachers. Six groups of BSc students of SSDPC Girls Degree College, Roorkee enthusiastically undertook science projects with scientists of CBRI in the following areas:

1. Synthesis of polymer
2. Analysis & Treatment of Drinking Water
3. Model Rocketry
4. Telescope
5. Utilization of Agro-industrial Waste
6. College Web-site

Special Events

Earth Day

The Institute celebrated the 39th anniversary of the Earth Day on 22nd April, 2009 by inviting staff children and arranging talk by Dr. A.K. Saraf Prof. I.I.T., Roorkee. About 80 students of CBRI wards participated in the painting competition held on the occasion in three different categories i.e. for category 1 (Class V & below) on 'Environment Around You'; category 2 (Class VII-X) on 'The Global Warming' and category 3 (Class X-XII) on "Violent Earth'. Prof. Saraf's talk enthralled the children with his presentation on change of Earth temperature due to Earthquakes.

Shri S.G. Dave, Scientist 'G' in his introductory remarks said that we have not inherited this earth from our fore fathers but have borrowed it for our children from them and we should look after it well and should hand over it to our children safely. Shri Vinod Kumar, Scientist 'F' compered and Shri S.C. Tyagi, CoA proposed the vote of thanks.

Sadbhavna Diwas

The Institute observed Sadbhava Diwas on August 20, 2009 with a view to promote harmony amongst people of all religions, languages and states and goodwill towards everyone. Shri M.P. Singh, Scientist 'G' administered the Sadbhavana pledge to all the staff members of the Institute.

Hindi Week

The Institute celebrated Hindi week during 14-18 September, 2009. Dr. Kamal Kant Budhkar graced as Cheif Guest. The inauguration function was presided over by Prof. S.K. Bhattacharyya, Director CBRI. Dr. Budhkar in his speech, applauded the efforts made by the Institute for popularization of Hindi. He dwelt about the role of Hindi in the National and International sphere. He emphasized that we should not think the use of Hindi only in the inter-state level but we have to steer out efforts to make it as a pride in the international level. Dr. Mahavir Agarwal, Gurukul Kangri University, Haridwar, was the Chief Guest on concluding function. Prof. Mahavir Agarwal in his address told that Hindi is symbol of our culture and, by glorifying it, we would be able to get the Hindi at its right place among masses. He emphasized that efforts should be made at the official/government level to make Hindi recognized one of the official language of UNO. Prof. Bhattacharyya apprised that CBRI is always working towards progress of Hindi and he assured that in future also there would be enough support for its upliftment.

During Hindi week, several Hindi programmes and competitions were organized in which a number of Scientific/Administrative staff participated. Shri S.G. Dave, Scientist 'G' presented introduction of the Chief Guest and Shri S.C. Tyagi, Controller of Administration presented a vote of thanks. On this occasion prizes were distributed to the winners of various competitions organized during the Hindi week. Shri R.C. Saxena, Sr. Hindi Officer was the Organizing Secretary.

CSIR Foundation Day

The Institute observed 'Open Day' on September 26, 2009 to commemorate the Foundation Day

of Council of Scientific and Industrial Research. The Institute was kept open to the public and invitations were sent to schools to send their children to interact freely with the scientists of the Institute. Prof. Prem Krishna, Former Professor, IIT, Roorkee graced the occasion as Chief Guest and congratulated scientists and staff members of the Institute for carrying out various R&D programmes concerned with the Building Science & Technology. The R&D work of CBRI has benefited the society, particularly the rural people of the country. He told that the Nation is indeed proud to have an organization like CSIR in the Indian Subcontinent under the aegis of the Ministry of Science & Technology. Prof. Prem Krishna, Chief Guest of the ceremony draw attention on the problem of Global Warming. He also emphasized that the scientists in the Institute should choose few areas and work towards excellence in those. "If you have such excellence, people from all over the world would come to you" said Prof. Prem Krishna. In his inaugural address, Prof. S.K. Bhattacharyya, Director, CBRI welcomed the Chief Guest and highlighted the Institute's R&D activities. He informed that CSIR has always received due importance and appreciation by its President, the Prime Minister of India and Vice President, the Hon'ble Minister of Science & Technology and all those familiar with contribution of CBRI/ CSIR. He apprised that the President of CSIR Dr. Monmohan Singh Ji, in the meeting of CSIR Society has complimented the role of CSIR in the overall development of the country and has appreciated the efforts made by CSIR. The President has great expectation from CSIR and CBRI has to play a major role.

Prof. S.K. Bhattacharyya told that the Scientists of CBRI and other CSIR labs are facing a great challenge to keep pace with the development in different parts of the globe and it is indeed a matter of great satisfaction that our country is now considered as one of the greatest resources of the world market as the Scientists of this country have proved their worth. CBRI is one of those labs which is directly concerned and connected with the upliftment of common man because shelter is considered as one of the basic needs. CBRI has always played a vital role in finding appropriate solutions for providing houses and buildings to meet the aspirations of the people of this country.

On this occasion the retired persons and the employees who have served CSIR for 25 years were honoured. An essay competition on "Water Conservation" and a painting competition for CBRI wards in different groups were organised and selected students were awarded. The function was compered by Shri Y. Pandey, Scientist 'F'. Shri M.P. Singh, Scientist 'G' also spoke on this occasion. The vote of thanks was given by Controller of Administration, Shri S.C. Tyagi. A cultural programme was organized in the evening on this day to celebrate the occassion.

Vigilance Awareness Week

The Institute celebrated Vigilance Awareness Week during 3 to 6 November, 2009. Different programmes which includes special lectures, poster competition for school children of staff wards, debate competition for staff members etc. have been organized during the week. The valedictory functions was organized in the

Institute's auditorium on 6th Nov. 2009. Shri S.G. Dave, Scientist 'G' presided over the function. Shri Pradeep Batra, Chairman, Municipal Board Roorkee was the chief guest and gave away the prizes to the winners of different competitions. Dr S .K. Saini Scientist 'F', Chairman, Organizing Committee presented a brief of the programme organized during the week and the function was concluded by a vote of thanks presented by Shri S.C.Tyagi, Vigilance Officer and Controller of Administration.

Short Term In-house Trainings Course for CBRI Staff

- " Use of Office Automation as R&D Tool" and "Use of Office Automation as R&D Management Tool" during 13-20 April 2009 for 35 CBRI Scientists and staff from Administration and Accounts.
- " Behaviour and Office Work" during 23-24 June 2009 for 39 Group D employees
- "Database Management System" during 20-31 July 2009 for 20 Administrative staff.
- "Modeling & Simulation of Light Through CAD Tools" during 22-28 August 2009 for 15 CBRI staff members.
- "C++" during 30 November to 11 Dec. 2009 for CBRI Scientists.

Workshop on Extension Strategy for Innovative Housing Technologies

On the occasion of the 64th CBRI Foundation Day a workshop on **"Extension Strategy For Innovative Housing Technologies"** was organized on 9th Feb 2010 at CBRI Roorkee. Keeping the objectives of CSIR 800 mission programme, the main focus of the workshop was to deliberate, discuss and evolve a consensus strategy for extension of innovative housing technologies leading to improvement in the construction practices, habits and standards for better quality, speed, economy, safety, durability and hygienic housing to extend economical, environmental and societal benefits to the people of the country. Housing R&D and extension experts from all over the country were invited to participate and contribute in evolving effective and consensus extension strategy. Prof. SK Bhattacharyya, Director, CBRI Roorkee with a team of 17 senior scientists and 13 outside experts associated with housing promotional activities and representing various nodal organizations including BMTPC Delhi, State Councils of Science and Technologies Uttarakhand and Himachal Pradesh, District Urban Development Agency, NITTTR Bhopal, Innovative practitioners, Architects/Builders, Scientists and non-governmental organizations participated in the workshop.

Prof. Bhattacharyya, Director, CBRI, Chaired the workshop and stressed on need based R&D and effective mechanism for quick transfer and field implementation of suitable technologies for the ultimate benefit of masses. Shri S.G. Dave, Scientist 'G' , workshop coordinator, highlighted various CBRI technologies that have been well received and absorbed by the building industry and stressed on need of evolving a consensus strategy by integrating the efforts of all promotional agencies, for commercial exploitation and mass acceptance of newer R&D and technologies. Dr. S.K. Agarwal, Executive Director, BMTPC presented the efforts made by BMTPC for extension and promotion of need based low cost housing technologies and sought

the association of CBRI in successful implementation of various housing schemes of MoUD & MoRD like Rajiv Awas Yojana, Indira Awas Yojana, Building Centers, and a scheme on shelter for all. He was of the opinion that joint efforts may encourage industrial production of energy efficient, substantially cheaper, high quality and faster building systems and technologies utilizing locally available materials and agro-industrial wastes. The presentation on successful implementation of many housing projects using CBRI technologies in several thousand houses in Delhi and other parts of country by Shri Pramod Adlakha, an innovative practitioner and architect-builder was appreciated by all.

Dr. R. Dobhal, Director, Uttarakhand Council of Science and Technology, Dehradun and Dr.S.S. Randhawa Scientific Officer Himachal Pradesh Council of Science, Technology and Environment, desired to plan joint strategy for organization of series of training programmes to generate trained artisans in the implementation of newer technologies. Dr. A K Jain, Director, National Institute of Technical Teachers' Training and Research (NITTTR), Bhopal highlighted the important role of community polytechnics in training, dissemination and technical support right up to panchayats and users and expressed that joint programmes can cover a vast population. Dr. Narendra Rai, Ashok Sansthan, Bihar, Shri S.K.Tiwari Rajiv Smriti Sewa Sansthan, Muzaffarpur, Shri Rishi Jaiswal, a management professional turned NGO and other NGOs narrated their experiences on implementation of CBRI rural housing technologies and earnestly sought technical guidance from CBRI for mass extension and dissemination activities in their respective areas. Almost all participants had good experience of field implementation of CBRI technologies like improved mud and thatch construction, low cost sanitation, prefabricated building components etc and opined that there is great potential in these technologies but improvements are needed to incorporate semi-mechanization for faster construction and quality assurance. They were also of the opinion that resources available with different agencies can be pooled to make an appreciable dent by all round impact.

The day long deliberations and discussions concluded into following suggestions that could help in developing an effective strategy for Extension of cost-effective housing technologies: To meet the huge housing shortage of the lower and lower middle income group, affordable housing technologies need to be widely promoted. Appropriate level of Mechanization has to be introduced in Indian construction system to significantly increase the pace of construction and to ensure quality and durability. Industrialization of the production of building materials using low energy pollution free processes is the need of the hour. Regular and Systematic training and certification system for skilled construction workers of different building trades is an essential requirement for better quality of construction and maintenance, Development of Regional demonstration centers and parks highlighting innovative housing technologies appropriate to the region and to provide technical backup to the interested users. There is a need to develop database and documentation of region-wise specifications and technology packages highlighting advantages over

traditional construction systems. Engineering institutions may be associated to collect and generate local resource database. CBRI may develop a technology museum with working small machines and infrastructure which may be seen and used by interested willing users to try and make products using their local raw materials so as to gain confidence prior to setting up of plant by entrepreneurs.

Model housing projects incorporating newer sustainable and affordable technologies may be explored on Public- Private Partnership (PPP) mode with technical back up from R&D institute and financial and field implementation support from private builders/ promoters.

CBRI may have collaborations with different organizations and other stake holders for planned extension and promotional activities in different parts of country. CBRI may provide technical back up for regular trainings, demonstrations and technical guidance for field implementation of newer technologies and establishment of production centers/ entrepreneurs using latest IT facilities.

CBRI Foundation Day

The institute celebrated its 64th Foundation Day on 10th February 2010. Three eminent professionals and VIP's namely Prof. S.C. Saxena, Director, IIT, Roorkee, Prof. P.B. Sharma, Vice Chancellor, Delhi Technological University, Delhi and Dr. M.O. Garg, Director, IIP, Dehradun were the Chief Guest, Guest of Honor and Special Guest respectively, graced the occasion, while Prof. S.K. Bhattacharyya, Director, CBRI, Roorkee, presided over the function. Shri S.G. Dave, Scientist 'G' while welcoming the guests briefed on the history of the institute, highlighting its main R&D achievements and professional & societal contribution of CBRI in resolving and overcoming the problems of durable, safe and economical housing for the people of the country. He also introduced the guests to the audience. Prof. S.K. Bhattarcharyya, Director highlighted a new vision and the thrust of the forthcoming R&D programmes, of the Institute. He informed about initiation of a PG programme at CBRI and collaboration & MOU with IIT and other academic or housing institutions of the country for planning of appropriate HRD programmes and focused R&D work.

Prof S.C. Saxena, Director, IIT, Roorkee, the Chief Guest, stressed on the need of immediate R&D on energy efficient, cleaner processes and cost effective building materials, required for mass construction activities. He appreciated the efforts of CBRI in this direction and advised scientists to engage actively in newer frontier areas like green housing, intelligent buildings, sustainable & affordable housing, nano technology etc. Prof. S.C. Saxena, Director IIT, Roorkee subsequently delivered a special Foundation Day lecture on "Green and Intelligent Buildings". He stressed on the need of taking R&D initiatives by CBRI highlighting its necessity, importance and relevance in the global scenario. Prof. P.B. Sharma, founder Vice Chancellor of Delhi Technological University, Delhi, and the Guest of Honour of the function in his address highlighted importance of need of taking lab research to the ultimate user at appropriate time. He said that it is a joint effort and equated extension responsibility like a Panchamrit i.e.

involvement of R&D Institutions, Academic Institution, Industries, Society and Government for the overall integrated development of the country. He also informed on his vision of Building Technology Park, which he intends to establish first at Delhi Technological University and subsequently in each state. These technology parks may serve a useful platform for creating green future by arranging mass awareness and generating technical understanding among the professionals & enthusiasm among general public. Dr. M.O. Garg, Director, IIP, Dehradun, special guest on the occasion shared his experiences while heading both the institutes IIP and CBRI simultaneously and mentioned about the enormous potential and unique position that the CBRI has because of its availability of multidisciplinary diversified expertise in all areas related to housing spectrum.

On this occasion, Diamond Jubilee Director's award specially instituted for development of best technology/innovation/ know-how having maximum societal impact for the year 2009-10 was given jointly to Dr. B. Singh and Dr. Manorama Gupta, Scientists for their work on "Development of manufacturing know-how on Rice Husk Plastic Wood". The award comprises of a citation and cash award of Rs. 5000/-. The technology know how was recently transferred to the industrialist who intends to set up a manufacturing plant at Gwalior, Madhya Pradesh. The foundation day function was also marked with the release of the CBRI Annual Report 2008-09, Logo of CBRI and New Website of the institute (www.cbri.res.in) at the hands of the chief guest and other guests.

National Science Day

The Institute celebrated National Science Day on 28th February, 2010 to commemorate Raman Effect of the Nobel Laureate Sir C.V. Raman. The day celebration offered an opportunity to bring issues of science in the centre stage and provide awareness to the public of immediate concern. This results into purposeful interaction between the science fraternity and the common people for mutual benefit. Prof. S.K. Bhattacharyya, Director, CBRI narrated the contribution of Sir C.V. Raman in the field of Spectroscopy for a wide range of scientific investigations and industrial applications. He stressed the role of National Science Day's objectives in transforming our society under the theme of "Gender equality for prosperity and peace". CBRI is pursuing faculty training and motivation for School and College faculty and students - A programme of CSIR to create interest, excitement and excellence in science education at the school and undergraduate level to raise the standard of science education and capabilities. He felt that it is an opportunity to take stock on the status of science in India. Such introspection is necessary as science and technology have become the most important drivers of the economy of the country.

On this occasion, Prof. I.S. Tyagi, Department of Physics, IIT, Roorkee has delivered National Science Day lecture on "Fascinating World of Quantum Physics and Nanotechnology". His lecture contents such as Basics of Raman Effect, Essentials of Quantum Mechanics, Carbon Nanotubes, High-Tech Superconductors and Structure of Semiconductors have been widely appreciated by

the scientists and college students. He has interacted with college students along with Prof. S.K. Bhattacharyya on the models and charts prepared by them at CBRI during training.

Technologies Transferred/ MoU Signed/ Patent Filed

Name of Technology	Name of Licensee
Brick Cutting Table	M/s KSB Engineering Works, Yamunanagar
Brick Making Machine (Extrusion type)	M/s KSB Engineering Works, Yamunanagar
Rice Husk Plastic Composites	M/s Shivaye Namah Manfacturing Co. Pvt. Ltd., Bhind (MP)

MoU Signed with IIT, Roorkee

An MoU has been executed between CBRI and IIT, Roorkee on 17th February 2010. In order to steer the R&D activities and common goals of both the organizations in the area of Building Science & Technology. The MoU covers the modalities and general conditions regarding availability of highly qualified manpower in the area of Civil Engineering, Building Science & Technology, Engineering Geology and Architecture & Planning and other areas of Engineering. The MoU also covers exchange of personnel through deputation for limited period on mutually agreed terms and conditions, organization of joint conferences and seminars, training of IIT students at CBRI, admission of CBRI S&T staff to the Postgraduate programmes at IIT, Roorkee.

Foreign Collaboration

An MoU has been signed between CBRI and M/s Meta Dynamics, South Africa to formulate the super sulphated cement from fluorogypsum on March 15, 2010.

CBRI, Roorkee have taken an initiative of joining hands with a private company named M/s Meta Dynamics of South Africa for collaborative research project and to translate R& D efforts into useful venture. A project entitled "Formulation of Supersulphated Cement from Fluorogypsum" has been sponsored by M/s Metadynamics, South Africa. The tasks assigned to CBRI are Development of process know how for Formulation of Super Sulphated Cement and Evaluation of Super Sulphated Cement as per Indian Standards. The programme would lead to exchange of R&D efforts between CBRI Roorkee and M/s Meta Dynamics South Africa.

Patent Filed

A process for the manufacture of pine needle isocyanate prepolymer composite boards and products thereof (0023NF 2010), B. Singh and M. Gupta

CBRI FAMILY
(AS ON 31.03.2010)

Group-IV-Scientific Staff

Sl. No.	NAME	DESIGNATION
1.	Prof. S.K. Bhattacharya	Director
2.	Shri M.P.Singh	Scientist G
3.	Shri S.G.Dave	Scientist G
4.	Dr.B.Kameshwara Rao	Scientist G
5.	Shri A.Ghosh	Scientist G
6.	Dr.Sunil Kumar Sharma	Scientist G
7.	Dr. (Ms.) Manju Mittal	Scientist F
8.	Shri R.K.Garg	Scientist F
9.	Shri Shree Kumar	Scientist F
10.	Dr. S.P.Agarwal	Scientist F
11.	Shri V.K.Sharma	Scientist F
12.	Dr. S.K.Saini	Scientist F
13.	Shri Y.Pandey	Scientist F
14.	Shri P.K.Bhargava	Scientist F
15.	Dr.(Ms.)Abha Mittal	Scientist F
16.	Dr.A.K.Minocha	Scientist F
17.	Shri D.K.Gautam	Scientist F
18.	Shri R.S.Chimote	Scientist F
19.	Dr.Brajeshwar Singh	Scientist F
20.	Shri Suvir Singh	Scientist F
21.	Dr.S.K.Agarwal	Scientist E-II
22.	Ms. Neeta S. Mittal	Scientist E-II
23.	Dr.A.K. Pandey	Scientist E-II
24.	Dr.N.K.Saxena	Scientist E-II
25.	Dr.Harpal Singh	Scientist E-II
26.	Shri Ashok Kumar	Scientist E-II
27.	Shri Surender Kumar Negi	Scientist E-II
28.	Dr.Shantanu Sarkar	Scientist E-II
29.	Dr.(Ms.) Mridul Garg	Scientist E-II
30.	Dr.Pradeep Kumar-I	Scientist E-II
31.	Dr.(Ms.)Manorama Gupta	Scientist E-II
32.	Dr.Atul Kumar Agarwal	Scientist E-II
33.	Shri A.K. Sharma-I	Scientist E-II
34.	Shri Rajendra Kumar	Scientist E-II
35.	Shri A.A.Ansari	Scientist E-II
36.	Dr.Pradeep Kumar-II	Scientist E-I
37.	Shri Nadeem Ahmad	Scientist E-I
38.	Dr.(Ms.) Rajni Lakhani	Scientist E-I
39.	Dr.Rajesh Deoliya	Scientist E-I
40.	Dr.Achal Kumar Mittal	Scientist E-I
41.	Dr.Sujit Kr.Saran	Scientist E-I
42.	Dr.Navjeev Saxena	Scientist E-I
43.	Shri S.K.Jain	Scientist E-I
44.	Dr.D.P.Kanungo	Scientist E-I
45.	Dr.S. Karthigeyan	Scientist E-I
46.	Dr.Sukhdeo Rao Karade	Scientist E-I
47.	Dr.B.S.Rawat	Scientist E-I
48.	Shri A.P.Chourasia	Scientist E-I
49.	Dr.P.C. Thapliyal	Scientist E-I
50.	Dr.Rajesh Kumar Verma	Scientist E-I
51.	Shri Shorab Jain	Scientist E-I
52.	Shri Saroj Kumar Panigrahi	Scientist E-I
53.	Shri V.Srinivasan	Scientist C
54.	Shri S.K. Singh	Scientist C
55.	Dr. (Ms.) Leena Chourasia	Scientist C
56.	Dr. P.K.S. Chauhan	Scientist C
57.	Shri H.C.Arora	Scientist C
58.	Dr. Lok Pratap Singh	Scientist C
59.	Dr. Neeraj Jain	Scientist C

Group-III-Technical Staff

60.	Dr. Rajiv Kumar	Mech.Engr-E-II
61.	Shri H.K.Jain	T.O. E-II
62.	Shri Ajay Singh	T.O. E-II
63.	Shri K.L.Chhabra	T.O. E-II

Sl. No.	NAME	DESIGNATION
64.	Shri Ramesh Chandra	T.O. E-II
65.	Shri Deepak Kumar Sehgal	T.O. E-II
66.	Shri N.S.Tyagi	T.O. E-II
67.	Shri S.K.Srivastava	T.O. E-II
68.	Shri Chandra Prakash	T.O. E-II
69.	Shri Sudhir Sharma	T.O. E-II
70.	Shri Ashok Kr.Sharma-II	T.O. E-II
71.	Shri Suresh Kumar	T.O. E-II
72.	Shri R.K.Yadav	T.O. E-II
73.	Shri Rajesh Kumar	T.O. E-I
74.	Shri Narendra Kumar	T.O. E-I
75.	Dr.B.M.Suman	T.O. E-I
76.	Shri Prakash Chand	T.O. E-I
77.	Shri Rajeev	T.O. E-I
78.	Shri Jaswinder Singh	T.O. E-I
79.	Dr.P.K.Yadav	T.O. E-I
80.	Shri Bhupal Singh	T.O. E-I
81.	Shri Dalip Kumar	T.O. C
82.	Shri S.K.Senapati	Library Officer Gr.III(6)
83.	Shri S.K.Gupta	Ex.Er.Gr.V (5)
84.	Shri Sushil Kumar	T.O. C
85.	Shri Rajeev Kumar Sharma	T.O. C
86.	Shri A.K.Jain (SE)	T.O. B
87.	Shri Zamir Ahmad	T.O. B
88.	Dr.M.K.Sinha	Medical Officer Gr.III(5)
89.	Shri Rakesh Kumar-II	T. O. B
90.	Shri Vivek Sood	T. O. B
91.	Shri Jalaj Parashar	T. O. B
92.	Shri Naresh Kumar	T. O. B
93.	Shri Ram Ashray Rai	T. O. B
94.	Shri Bharat Bhushan	T. O. B
95.	Shri Rajesh R.Ghadse	T. O. A
96.	Shri Itrat Amin Siddiqui	T. O. A
97.	Shri B.K.Kalra	A.E.Gr.III(3)
98.	Shri Amit Kush	T.O. A
99.	Ms. Deepti Karmakar	STA Gr.III(2)
100.	Shri Ajay Dwivedi	STA Gr.III(2)
101.	Ms. Gayatri Devi	T.A. Gr.III(1)
102.	Shri Sameer	T.A. Gr.III(1)
103.	Shri Deepak Singh Dharmshaktu	T.A. Gr.III(1)

Sl. No.	NAME	DESIGNATION
Group II		
104.	Shri A.P.Sharma	Tech.Gr.II(4)
105.	Shri Prem Lal	Tech.Gr.II(4)
106.	Shri Shiv Kumar	Tech.Gr.II(4)
107.	Shri Virendra Singh	Tech.Gr.II(4)
108.	Shri Shiv Dass (SE)	STA Gr.II(4)
109.	Shri R.P.Gupta (SE)	Tech.Gr.II(4)
110.	Shri Kuldeep Singh	Tech.Gr.II(4)
111.	Shri S.P.Vardhya	Tech.Gr.II(4)
112.	Shri Rizwanul Hasan	Tracer Gr.II(4)
113.	Shri Nawal Singh	Lab Asstt. Gr.II(4)
114.	Shri C.S.Mayal	Tech. Gr.II(4)
115.	Shri Nand Kishore (SE)	Fitter Gr.II(4)
116.	Shri Madan Lal	Carpenter Gr.II(4)
117.	Shri Govind Singh	Mechanic Gr.II(4)
118.	Shri M.K.Nazir	Tech.Gr.II(4)
119.	Shri S.L.Kaushik	Tech.Gr.II(4)
120.	Shri Rajender Kumar	Tech.Gr.II(4)
121.	Shri Kirpal Singh	Electrician Gr.II(4)
122.	Shri Chottey Lal (SE)	Tech. Gr.II(4)
123.	Shri Surendra Kumar (SE)	Tech.Gr.II(4)
124.	Shri Bishan Lal	Tech.Gr.II(4)
125.	Shri Nankanwar Singh	Tech.Gr.II(4)
126.	Shri Gopal Chand	Tech.Gr.II(4)
127.	Shri Har Sagar Sharma	Tech.Gr.II(3)
128.	Shri Jagan Nath	Tech. Gr.II(3)
129.	Shri P.K.Yadav	Tech. Gr.II(3)
130.	Ms. Neelam Gupta	Tech. Gr.II(3)
131.	Shri Prem Singh	Tech. Gr.II(3)
132.	Shri Sheeraj Ahmed	Tech. Gr.II(3)
133.	Ms. Saroj Rani	N/Sister-Gr.II(3)
134.	Ms. Sangeeta Sharma	Tech.Gr.II(3)
135.	Shri Anil Kumar Sharma	Mechanic Gr.II(3)
136.	Shri Rishi Pal Singh	W/Man Gr.II(3)
137.	Shri Sushil Kumar	Tech. Gr.II(3)
138.	Shri Himanshu Sharma	Tech. Gr.II(3)
139.	Shri Manmeet Singh	Tech. Gr.II(3)

Sl. No.	NAME	DESIGNATION
140.	Ms. Urmila Kotnala	Pharmacist Gr.II(3)
141.	Shri Manoj Kumar Tyagi	Tech. Gr.II(2)
142.	Shri Amar Singh	Tech. Gr.II(2)
143.	Shri D.K.Chopra	Tech. Gr.II(2)
144.	Shri Kedar Nath	Tech. Gr.II(2)
145.	Shri Santosh Kumar Mishra	Tech. Gr.II(2)
146.	Shri Rajeev Bansal	Tech. Gr.II(2)
147.	Shri Pradeep Kumar Kapooria	Tech. Gr.II(2)
148.	Shri Arvind Saini	Tech. Gr.II(2)
149.	Shri Ashwini Kumar Mishra	Tech. Gr.II(2)
150.	Shri Harish Kumar	Tech. Gr.II(2)
151.	Shri Sukhbir Sharma	Tech. Gr.II(2)
152.	Shri Arvind Kumar	Pharmacist-Gr.II(2)
153.	Shri Sharad Kumar	Tech. Gr.II(2)
154.	Shri Mam Chand Agarwal	Tech. Gr.II(2)
155.	Shri Arvind Kumar Sharma	Tech. Gr.II(2)
156.	Shri Tahir Hussain	Tech. Gr.II(2)
157.	Shri Ghanshyam Mittal	Tech. Gr.II(2)
158.	Shri Francis Charles	Tech. Gr.II(2)
159.	Shri Jai Pal	Tech. Gr.II(2)
160.	Shri Iqbal Ahmad	Tech. Gr.II(2)
161.	Shri Jameel Hasan	Tech. Gr.II(2)
162.	Shri Umesh Chandra Bhatnagar	Tech. Gr.II(2)
163.	Shiv Prakash Tyagi (SE)	Tech. Gr.II(2)
164.	Shri B.S.Bisht (SE)	Tech. Gr.II(2)
165.	Shri Sohrab Khan (SE)	Tech. Gr.II(2)

Group-I Supporting Staff

166.	Shri Hamir Dass	Tech.Gr.I(4)
167.	Shri R.P.Singh	Tech.Gr.I(4)
168.	Shri Harpal Singh	Tech.Gr.I(4)
169.	Shri Hari Singh (SE)	Tech.Gr.I(4)
170.	Shri D.P.Yadav	Tech.Gr.I(4)
171.	Shri Janeshwar Prasad	Tech.Gr.I(4)
172.	Shri Akhtar	Tech.Gr.I(4)
173.	Shri Sita Ram	Tech.Gr.I(4)
174.	Shri Yakub Ali	Tech.Gr.I(4)
175.	Shri Deepak Singh	Tech.Gr.I(4)
176.	Shri Guru Charan Singh	Helper-Gr.I(4)
177.	Shri Rajeshwar	Helper-Gr.I(4)
178.	Shri Amar Singh (SE)	Tech.Gr.I(4)
179.	Shri Vijay Kumar (SE)	Tech.Gr.I(4)
180.	Shri Shyam Lal (SE)	Tech.Gr.I(4)
181.	Shri Shiv Kumar	Helper-Gr.I(4)
182.	Shri Vijay Kumar	Helper-Gr.I(4)
183.	Shri Jai Pal Singh	Helper-Gr.I(4)
184.	Shri Rishi Pal (SE)	Helper-Gr.I(4)
185.	Shri Shiv Kumar	Helper-Gr.I(4)
186.	Shri Vishwas Kumar	Helper-Gr.I(4)
187.	Shri Abhay Dass	Helper-Gr.I(4)
188.	Shri Jagdish Pal	Helper-Gr.I(4)
189.	Shri Deepak Kumar	Helper-Gr.I(4)
190.	Shri Bharat Singh	Helper-Gr.I(4)
191.	Shri Hira Lal	Helper-Gr.I(4)
192.	Shri Subhash Chand (SE)	Helper-Gr.I(4)
193.	Shri Shyam Bir (SE)	Helper-Gr.I(4)
194.	Shri Rajendra Kumar Arya	Helper-Gr.I(3)
195.	Shri Rajesh Kumar	Helper-Gr.I(3)

House-Keeping/Administrative Staff

Group-A

196.	Shri S.C. Tyagi	C.O.A.
197.	Shri Anil Kumar	A.O.
198.	Shri Ramesh Chandra	S&PO
199.	Shri R.K. Raina	F&AO
200.	Shri Rajesh Chandra Saxena	Sr.Hindi Adhikari

Group-B

201.	Shri Md.Salaudin Ansari	S.O.(S&P)
202.	Shri J.K. Chourasia	S.O.(F&A)
203.	Shri Babu Ram (SE)	S.O.(F&A)
204.	Shri Avnish Kumar	S.O.(F&A)
205.	Shri Alok Sharma	S.O.(G)
206.	Shri S.K. Jakhwal	S.O.(G)
207.	Shri Y.P.Singh	S.O.(G)
208.	Shri S.P. Kapil	P.S.
209.	Shri A.K.Jain	P.S.
210.	Shri B.K. Sharma	Security Officer

Sl. No.	NAME	DESIGNATION
211.	Shri V.P.S. Rawat	Security Officer
212.	Shri Sanjeev Bansal	Asstt(S&P)Gr.I
213.	Shri Arpan Maheshwari	Asstt(S&P)Gr.I
214.	Ms. Anju Rani Simon	Asstt(S&P)Gr.I
215.	Shri Virendra Singh (SE)	Asstt(F&A)Gr.I
216.	Shri Aman Kumar	Asstt(F&A)Gr.I
217.	Shri Constan Kujur	Asstt(G) Gr.I(ACP)
218.	Shri R.K. Sharma	Asstt(G)Gr.I
219.	Shri V.K.Sharma	Asstt(G)Gr.I
220.	Shri H.C.Madan	Asstt(G)Gr.I
221.	Ms. Nisha Tyagi	Asstt(G)Gr.I
222.	Ms. Saroj Sethi	Asstt(G)Gr.I
223.	Ms. Sarita Khanna	Asstt(G)Gr.I
224.	Shri Neeraj Kumar	Asstt(G)Gr.I
225.	Shri B.B.Dimri	Asstt(G)Gr.I
226.	Ms. Sheema Farhat	Asstt(G)Gr.I
227.	Shri Kalam Singh Chauhan	Asstt(S&P)Gr.I
228.	Shri Vipin Kumar Sharma (SE)	Asstt(F&A)Gr.I
229.	Shri Sudhir Kumar	Asstt(G)Gr.I
230.	Shri Surinder Singh	Sr.Steno(ACP)
231.	Shri Khushpendra Arora	Sr.Steno(ACP)
232.	Shri Suresh Giri	Sr.Steno(ACP)
233.	Shri Naresh Yadav	Sr.Steno(ACP)
234.	Shri D.K. Gulshan(SE)	Sr. Steno(ACP)
235.	Shri Satya Pal	Sr.Steno
236.	Shri Rajinder Kumar	Sr.Steno
237.	Ms. Archana	Sr.Steno
238.	Shri Arvind Kumar	Sr.Steno
239.	Shri Dalpat Singh	Sr.Steno
240.	Shri Mehar Singh	Sr.Translator
241.	Shri Suba Singh	Sr.Translator
Group-C		
242.	Shri Vishwas Tyagi	Asstt(S&P)Gr.II
243.	Shri Suraj Pal Singh	Asstt(F&A) Gr.II
244.	Shri R.K.Johar	Asstt(G)Gr.II
245.	Shri Yogesh Kumar	Asstt(G)Gr.II
246.	Ms. Sunita	Asstt(G)Gr.II
247.	Shri Dharam Pal Singh	Asstt(G)Gr.II
248.	Ms. Arun Lata	Asstt(G)Gr.II

Sl. No.	NAME	DESIGNATION
249.	Shri Shiv Kumar	Asstt(G)Gr.II
250.	Shri Sushil Kumar	Asstt(G)Gr.II
251.	Ms. Mamta Sharma	Asstt(G)Gr.II
252.	Ms. Rubina Zaidi	Asstt(G)Gr.II
253.	Shri Satyarth Prakash	Asstt(G)Gr.II
254.	Shri Sanjay Kr.Tyagi	Asstt(G)Gr.II
255.	Shri Ravindra Kumar	Asstt(G)Gr.II
256.	Ms. Seema Ahuja	Asstt(G)Gr.II
257.	Shri K.K.Murthy	Jr.Steno
258.	Shri C.P.Tyagi	Jr.Steno
259.	Shri Dharam Singh Negi	Jr.Steno
260.	Shri Rajendra Singh	Driver
261.	Shri Radhey Shyam Goswamy	Driver Gr.II(2)
262.	Shri Sushil Kumar	Driver
263.	Shri M.Ramakrishna	Driver
264.	Shri Vijay Kumar-II	Driver
265.	Shri Naresh Chand Yadav (SE)	Daftri Cum R/Keeper
266.	Shri Suresh Pal	Safaiwala ACP)-Gr.B
267.	Shri Kamalbir Singh	Sr.Sec.Guard
268.	Shri Baljeet Singh	Counter Clerk(ACP)
269.	Shri Satya Pal	Daftri-Cum-R.Keeper
270.	Shri Vikram Pal	Daftari-Gr.B
271.	Shri Sant Ram (SE)	Farrash-Gr.B
272.	Shri Naresh (SE)	Safaiwala(ACP)
273.	Shri Nanak Chand (SE)	Safaiwala-Gr.B
274.	Shri Ram Samaj	J.S.G.-Gr.B
275.	Shri Raj Kumar	J.S.G.-Gr.B
276.	Shri Lakhmi Chand (SE)	Chowkidar-Gr.B
277.	Shri Kailash Chand	Peon-Gr.B
278.	Shri Inderpal	Peon-Gr.A
279.	Shri Mukesh Kumar	Peon-Gr.A
280.	Ms. Kusum Lata	Peon-Gr.A
281.	Shri Desh Raj	Peon-Gr.A
282.	Shri Rakesh Kumar	Peon-Gr.A
283.	Shri Ramesh Kumar	Peon-Gr.A
284.	Shri Shiv Kumar	Peon-Gr.A
285.	Shri Santosh Kumar	Peon-Gr.A

Sl. No.	NAME	DESIGNATION
286.	Shri Jagdish Chand	Peon-Gr.A
287.	Shri Rakesh Kumar-III	Peon-Gr.A
288.	Shri Krishna Gopal Thakur	Peon-Gr.A
289.	Shri Mani Ram	Peon-Gr.A
290.	Shri Rohitash Kumar	Peon-Gr.A
291.	Shri Subhash Chand (SE)	Peon-Gr.A
292.	Shri Mohd. Naeem (SE)	Peon-Gr.A
293.	Shri Radhey Shyam (SE)	Peon-Gr.A
294.	Shri Sushil Kumar	Farrash-Gr.B
295.	Shri Shyam Narain	Farrash-Gr.B
296.	Ms. Usha	Farrash-Gr.B
297.	Shri Devendra Kumar	Farrash-Gr.A
298.	Ms. Prakash Kaur	Farrash-Gr.A
299.	Ms. Anju	Farrash-Gr.A
300.	Ms. Bala	Safaiwala-Gr.A
301.	Shri Khalil Ahmed	Farrash-Gr.A
302.	Shri Ranbir Singh	Peon-Gr.A
303.	Shri Subhan Singh	Peon-Gr.A
304.	Shri Anit Kumar Pal	Peon-Gr.A
305.	Shri Maharaj Deen Khan	Peon-Gr.A
306.	Shri Pritam Giri	Peon-Gr.A
307.	Shri Pooranwasi	Farrash
308.	Shri Kiran Pal	OPS Group-D (NT)
309.	Shri Kirat Pal	OPS Group-D (NT)
310.	Shri Rajesh Kr. Yadav	OPS Group-D (NT)
311.	Shri Jai Prakash	OPS Group-D (NT)
312.	Shri Ranjeet Singh	OPS Group-D (NT)
313.	Shri Satya Pal	OPS Group-D (NT)
314.	Shri Sunil Kumar	OPS Group-D (NT)
315.	Shri Dharam Singh	OPS Group-D (NT)
316.	Shri Satya Pal Singh	OPS Group-D (NT)
317.	Shri Dharam Pal	OPS Group-D (NT)

Canteen Staff

318.	Shri Rakesh	Tea Maker-ACP
319.	Shri Arun Kumar	Bearer-ACP
320.	Shri Ravindra Nath	Bearer-ACP
321.	Shri Dil Bahadur	Bearer-ACP
322.	Shri Rajender Pal	Bearer-ACP
323.	Shri Pooran	Wash Boy-ACP
324.	Shri Dheer Singh	Wash Boy-ACP

Retirements

Sl. No.	Name	Designation	Date of Supperannuation
	P.K. Gangopadhyay	Scientist 'E-II'	30.04.2009
	T.D. Joshi	Tech. Gr.I (4)	31.05.2009
	Dinesh Kumar	Tech. Gr.I (4)	31.07.2009
	Shree Ram	Lab. Asstt. Gr.II (4)	31.07.2009
	R.L. Dhabal	Scientist 'F'	31.08.2009
	B.B. Lal	Scientist 'F'	30.09.2009
	Vinod Kumar	Scientist 'F'	31.10.2009
	R.K. Lamba	Asstt.(G)Gr.I	31.10.2009
	Smt. Attri Devi	Gr.I(4)	30.11.2009
	R.K. Srivastava	Scientist 'F'	30.11.2009
	Ashok Mishra	Receptionist	30.11.2009
	R.N. Bhatt	Asstt. (G)Gr.I	30.11.2009
	Ram Pal Singh	Tech. Gr.II(3)	30.11.2009
	R.D. Singh	Scientist 'F'	31.12.2009
	Brij Lal	Asstt.(G)Gr.I	31.12.2009
	Raghuvir Singh	Asstt Manager	31.12.2009
	Suredndra Kumar	Sr. Steno (ACP)	31.12.2009
	Lokeshwar Prasad	J.S.G.Gr.B	31.01.2010
	Ami Chand	Tech. Gr II (4)	31.01.2010
	Mam Chand	Lab Asstt. Gr. II (4)	31.01.2010
	D.K. Gautam	Scientist 'F'	31.03.2010
	R.K. Sharma	Asstt.(G) Gr.I	31.03.2010
	D.K. Gulshan	Sr.Steno (ACP)	31.03.2010
	Madan Lal	Carpenter Gr. II(4)	31.03.2010

Appointment

Prof. S.K. Bhattacharyya	Director	05.08.2009

Obituary

It is placed on record the sad and untimely demise of Shri Ram Lal Sharma, Technician on 18.12.2009 and Shri Vijay Kumar-I, Driver on 14.02.2010.

Glimpses of Activities

Children participating in drawing competition on 22 April 2009 on Earth Day

A view of dias on CSIR Foundation Day, 26 September 2009

Dignitories inaugurating the Hindi Week

Shri S.C. Tyagi, CoA, addressing the CBRI staff on Vigilance Awareness Week

Interaction of CBRI staff with students during laboratory visit

Glimpse of a cricket match on 26 January 2010

A view of Technology transfer meeting

Prof. S.K. Bhattacharyya, Director, CBRI presenting Know-How documents and products to Mr. Bhupesh Khanna, Director of M/s Shivaye Namah Manufacturing Pvt. Ltd. Bhind (M.P.)

Workshop on "Extension Strategy for Innovative Housing Technologies" on 9 Feb 2010

Release of CBRI Annual Report on CBRI Foundation Day 10 Feb 2010

Prof. I.S. Tyagi, IIT Roorkee & Prof. S.K. Bhattacharyya, Director CBRI discussing with students on National Science Day on 28 Feb 2010

Exchange of MoU documents between Mr. Gavin Coulson, M/s Meta Dynamics, South Africa and Prof. S.K. Bhattacharyya, Director CBRI on 15 March 2010

Appendices

Appendices

Appendix I

Research Council

Chairman
Prof. S.K. Khanna
Former Chairman, AICTE & Adviser, ID
JIIT Campus, A-10 Sector-62
NOIDA - 201 307 (U.P.)

Members

Dr. K.C. Narang
Adviser (R&D)
Dalmia Cements (Bharat) Ltd.,
11th Floor, Hansalaya Building
15, Barakhamba Road, New Delhi - 110 001

Dr. Nagesh R. Iyer
Acting Director
Structural Engg. Research Centre,
CSIR Campus, Post Office TTTI Taramani
PB No. 8287, Chennai - 600 113

Dr. N. Lakshmanan
Former Director
Structural Engg. Research Centre,
CSIR Campus, Post Office TTTI Taramani
P.B. No. 8287, Chennai - 600 113

Prof. S.K. Bhattacharyya
Director
Central Building Research Institute,
Roorkee - 247 667

Head or his representative
R&D Planning Division
CSIR, Anusandhan Bhawan
2, Rafi Marg, New Delhi - 110 001

Dr. Shailesh Kr. Agarwal
Executive Director, BMTPC
Core 5-A, First Floor,
India Habitat Centre,
Lodhi Road, New Delhi - 110 003

Shri O.P. Puranmalka
Group Executive President
(Mktg. & Strategy), Grasim Industries Ltd.,
Anura Centre, 1st Floor, Mahakali Caves Road,
Andheri (East), Mumbai-400 093

Shri Nirmaljit Singh
Member (Technical)
National Highway Authority of India,
G-5 & 6, Sector - 10,
Dwarka, New Delhi - 110 075

Dr. Ramesh Kapur
Managing Director
Radisson Hotel Delhi,
National Highway No.8, New Delhi - 110 037

Prof M.N. Viladkar
Professor
Deptt. of Civil Engg., IIT,
Roorkee - 247 667

Shri R.K. Garg
Secretary
Scientist 'F' & Head, H&P, Division
Central Building Research Institute, Roorkee-247 667

Management Council

Chairman
Prof. S.K. Bhattacharyya
Director,
Central Building Research Institute,
Roorkee - 247 667

Members

Dr. S. Gangopadhyay
Director
Central Road Research Institute,
Delhi-Mathura Road,
New Delhi -110 020

Shri P.K. Bhargava
Scientist 'F' &
Head, PME & RPBD,
Central Building Research Institute,
Roorkee - 247 667

Dr. Shantanu Sarkar
Scientist 'E-II',
Geotechnical Engg. Division,
Central Building Research Institute,
Roorkee - 247 667

Dr. L.P. Singh
Scientist 'C',
EST Division,
Central Building Research Institute
Roorkee - 247 667

Dr. B. Singh
Scientist 'F',
PPC Division,
Central Building Research Institute,
Roorkee - 247 667

Dr. (Mrs.) Manorama Gupta
Scientist 'E-II',
PPC Division,
Central Building Research Institute,
Roorkee - 247 667

Shri Narendra Kumar
Technical Officer 'E-I',
Fire Research Division,
Central Building Research Institute,
Roorkee - 247 667

Finance & Accounts Officer
Central Building Research Institute,
Roorkee - 247 667

Secretary
Controller of Administration,
Central Building Research Institute,
Roorkee - 247 667

Appendix II

List of R&D Projects and Support Activities (2009–2010)

IN HOUSE R&D PROJECTS

Sl No	Principal Investigator	Divn.	Project No.	Duration	Title of the Project
1.	Sh. D.K. Gautam	BPPP	OLP-294	01-2008 to 03-2010	Development of boring machine for making horizontal bores under the ground - a trenchless technology.
2.	Ms Neeta Mittal	E&HB	OLP-296	01-2008 to 03-2010	Review and upgradation of space norms for inclusive education in educational buildings up to secondary level.
3.	Sh. Shree Kumar	EB	OLP-297	01-2008 to 03-2010	Development of solid state lighting system for interiors.
4.	Sh. R.K. Srivastava	EB	OLP-298	01-2008 to 03-2010	Development of design guidelines for overall comfort in MIG type of houses.
5.	Dr. Manjit Singh	EST	OLP-299	01-2008 to 03-2010	Studies on dehydrating agents and strength enhancers in making gypsum plaster for use in weather resistant binders, boards and blocks.
6.	Dr. A.K. Minocha	EST	OLP-300	01-2008 to 03-2010	Improved pollution control technology for brick kilns.
7.	Dr.S.K. Agrawal	EST	OLP-301	01-2008 to 03-2010	Studies of the reactivity of fly ash from different fields of an ESP.
8.	Dr. B.S. Rawat	EST	OLP-302	01-2008 to 03-2010	Evaluation of plant extractives for termite and pest management in buildings.
9.	Dr. R.K. Verma	EST	OLP-303	01-2008 to 03-2010	Studies on building fungi and their control with selected phytochemicals.
10.	Dr.Sunil Kr.Sharma	FR	OLP-304	01-2008 to 03-2010	Development of fire retardant formulations for lining materials
11.	Sh. M.P. Singh	FR	OLP-305	01-2008 to 03-2010	Studies on visibility of fire exit signs in fire smoke
12.	Dr. S.K. Saini	FR	OLP-306	01-2008 to 03-2010	High capacity gypsum calcinator for small scale industries
13.	Sh. Suvir Singh	FR	OLP-307	01-2008 to 03-2010	Determination of real fire severity in fire damage buildings by studying the effect of standard fire exposure on building elements.
14.	Sh. Shorabh Jain	FR	OLP-308	01-2008 to 03-2010	CFD modeling of fire in building corridor.
15.	Dr. Rajiv Kumar	FR	OLP-309	01-2008 to 03-2010	Studies on species concentration in enclosure fire.
16.	Dr. Harpal Singh	FR	OLP-310	01-2008 to 03-2010	Studies on environment friendly fire retardant rigid polyurethane foam.

Sl No	Principal Investigator	Divn.	Project No.	Duration	Title of the Project
17.	Sh. R.S. Chimote	FR	OLP-311	01-2008 to 03-2010	Studies on water mist fire extinguishing system.
18.	Sh. A.A. Ansari	FR	OLP-312	01-2008 to 03-2010	Development of barrier for improvement of flame retardancy of wood base lining materials and their fire behaviour studies.
19.	Sh. A.K. Sharma	GE	OLP-313	01-2008 to 03-2010	Behaviour of in filled discontinuities with gouge materials.
20.	Dr. S. Karthigeyan	GE	OLP-314	01-2008 to 03-2010	Numerical investigation of the lateral response of pile groups under combined loading.
21.	Sh. A. Ghosh	GE	OLP-315	01-2008 to 03-2010	Geotechnical properties of stabilized fly-ash for development of appropriate foundation.
22.	Dr. S. Sarkar	GE	OLP-316	01-2008 to 03-2010	Evaluation of rock slops parameters for in-stability assessment.
23.	Dr. Pradeep Kumar	GE	OLP-317	01-2008 to 03-2010	Evaluation of geotechnical parameters for analysis of unstable slops.
24.	Dr. P.K.S. Chauhan	GE	OLP-318	01-2008 to 03-2010	Seismic studies using SMAs in Delhi.
25.	Dr. Abha Mittal	GE	OLP-319	01-2008 to 03-2010	Evaluation of seismic ground motion parameters based on site characterization in Dehradun region.
26.	Dr. Pradeep Kumar II	GE	OLP-320	01-2008 to 03-2010	Geological investigation, GPR and resistivity survey for characterization of hill slopes along highway in Yamuna valley, Uttarakhand, Himalaya for landslide risk assessment mapping and building construction on hilly regions.
27.	Dr. S.K. Saran	GE	OLP-321	01-2008 to 03-2010	Behaviour of shallow foundations on randomly distributed fiber reinforced soil.
28.	Sh. R.D. Singh	H&P	OLP-322	01-2008 to 03-2010	Design & development of standardized housing units with prefabricated components for low rise building
29.	Sh. R.K. Garg	H&P	OLP-323	01-2008 to 03-2010	Development of methodology for eco-friendly and energy efficient buildings in National Capital Regions (NCR).
30.	Dr.S.P. Agrawal	OBM	OLP-324	01-2008 to 03-2010	Development of new composite material for building application using ply-wood/veneer and vermiculite wastes.
31.	Dr. P.C. Thapliyal	OBM	OLP-325	01-2008 to 03-2010	Development of coating system on modified epoxy resins for fertilizer industry.
32.	Dr. S.R. Karade	OBM	OLP-326	01-2008 to 03-2010	Development of high performance polymer based repair materials.

NETWORK PROJECTS (CBRI AS PARTICIPATING LAB.)

Sl. No	Principal Investigator	Divn.	Project No.	Title of the Project
1.	Sh. A. Ghosh	GE	NWP-39	Engineering of structures against natural and other disasters
2.	Sh. S.G. Dave	DC&E	RSP-03	Dissemination, training and demonstration of appropriate rural housing technologies

SUPRA INSTITUTIONAL PROJECT

1.	Dr. B. Singh	OBM	SIP-29	High performance materials and construction technologies for sustainable built space

R&D SUPPORT ACTIVITIES (DECISION UNIT 06)

Sl. No	Activity Number	Title of the Activity	Activity Coordinator
1	STS 0001	LIBRARY SERVICES	Dr. Sunil Kr. Sharma
		Library and Documentation	Sh. S.K. Senapati
2	STS 0002	PLANNING MONITORING & EVALUATION	Sh. P.K. Bhargava
		RC Agenda (R&D), Deployment of Manpower for APAR, Project Costing, Accounting & Budgeting, Expert Panel, Research Utilization Data, Quarterly Progress Report, Monthly Progress Report.	Sh. R.K.Yadav
		Externally Funded Projects, Service Tax & MC Agenda	
3	STS 0003	RESEARCH PLANNING & BUSINESS DEVELOPMENT	Sh. P.K. Bhargava
		Technology Transfer (Licensing, Patents etc.) and Trend Assessment including Feedback, Marketing Survey & Other Industrial Liaison.	Dr. P.K.Yadav
4	STS 0004	TECHNOLOGY DISSEMINATION (DC&E)	Sh. S.G. Dave
		Inland Liaison including Exhibition, Displays, Training, Special Function & Visitors.	Sh. H.K.Jain
		Development, Technical Guidance/ Aid Film	
		Demonstration, Constrictions Feedback & Documentation	
5	STS 0005	EXTENSION CENTER (DELHI)	Sh. Rajendra Kumar
6	STS 0006	PABX	Sh. D.K. Sehgal
7	STS 0007	PUBLICATION & PUBLICITY	Dr. Atul Kr. Agarwal
8	STS 0008	HR MANAGEMENT & INFORMATION DISSEMINATION	Sh. S.G. Dave
		Photography & Audio System	
9	STS 0009	COMPUTER FACILITIES & SERVICES	Dr. S.K. Saini
10	STS 0010	IT SUPPORT PROFESSIONAL SERVICES	Nodal Officer ICT/NKN

ADMINISTRATIVE SUPPORT (DECISION UNIT 08)

	General Administration & House Keeping	**DIRECTOR**
Infra 0001	1. ADMINISTRATION	CoA/AO
Infra 0002	2. FINANCE & ACCOUNTS	F&AO
Infra 0003	3. STORES & PURCHASE	S&PO
Infra 0004	4. SECURITY	Security Officer
Infra 0005	5. HEALTH SERVICES (DISPENSARY)	Medical Officer
Infra 0006	6. ESTATE & TECHNICAL SERVICES	
	i. Civil Work, New Construction, Maintenance, Horticulture Services, Cleaning & Sanitation, Water Supply and Maintenance of Vehicles.	Sh. Ajay Singh
	ii. Electrical & Air Conditioning Services.	Sh. D.K. Sehgal
Infra 0007	1. DIRECTOR'S TECHNICAL SECRETARIATE (DTS)	Director

Appendix III

Consultancy and Sponsored Projects (2009-2010)

Project No	Project Title	PI/Co-PI	Sponsoring Agency
CNP Projects			
CNP0179	Advice on structural design and drawings of Nagar Palika parishad building in Haldwani.	A. K. Mittal/ B.K. Rao	Executive Officer, Nagar Palika Parishad, Haldwani (Kathgodam).
CNP0338	Construction of 5552 houses at Baprola, using CBRI technology in roofing (RCPLANK and JOIST)	Rajindra Kumar/ Chandra Prakash	M/S Adlakha Associate Pvt. Ltd., F-70, Bhagat Singh Market, NewDelhi-1
CNP0799	Proof checking of concrete structure supporting roof of aquatic stadium.	A. K Mittal/ Rajeev Kumar	Shri Ashish Jain, Managing Partner, Architects Bureau, 13A, Palam Marg, Vasant Vihar, New Delhi
CNP0839	Condition survey and suggestions for retrofitting of Vigyan Bhawan annexe, New Delhi	B. K. Rao/ B. Singh	Chief Engineer, CPWD, Room No. 370, II Floor, Vigyan Bhawan Annexe, Molana Azad Road, New Delhi
CNP6317	Third party quality assurance of civil construction work of Doon University Dehradun at its Kedarpuram site	A. K. Pandey/ Rajesh Deoliya	Project Manager, UPRNN Ltd., Nirman Unit, Nehru Colony, Dehradun
CNP6327	Inspection & quality control monitoring of construction works of HRDI at Mandal Gopeshwar	A.P. Chourasia/ S.K. Agrawal	Director, Herbal Research & Development Institute, Gopeshwar.

Grant-in-Aid (GAP) Projects

GAP0069	Investigation, characterization and slope stability analysis of landslide on Chamoli Joshimath road for development of early warning system (EWS)	Y. Pandey/ D.P. Kanungo/ P.K.S. Chauhan	Defence Terrain Research Laboratory, DRDO, Ministry of Defence, Metcalfe House, Delhi
GAP0509	Cost effective value added thermal insulation tiles for insulation purpose.	Rajni Lakhani/ S.P. Agarwal	BMTPC, Core 5A, Ist Floor, India Habitat Centre, Lodhi Road, New Delhi-110003
GAP0518	Utilization of industrial waste materials as inexpensive adsorbments having applications in building materials	Mridul Garg/ A.K. Minocha	BMTPC, Core 5A, Ist Floor, India Habitat Centre, Lodhi Road, New Delhi-110003
GAP0529	Development of building components from sponge iron waste.	L.P. Singh/ A.K. Minocha	BMTPC, Core 5A, Ist Floor, India Habitat Centre, Lodhi Road, New Delhi-110003
GAP0579	Development of technology for bio-degradable nursery pots	S. P. Agarwal/ Rajni Lakhani	Advisor (RE), Ministry of Environment and Forest (RE Division), Govt of India, Paryavaran Bhawan, Lodhi Road, New Delhi-110003
GAP0789	Gypsum and gypsum products, their science and technology.	Manjit Singh	Department of Science and Technology (DST), Technology Bhavan, New Mehrauli Road, New Delhi-110016
GAP3017	Synthesis and characterization of nano-silica and its subsequent use in calcium silicate hydrate system	L. P. Singh/ S. K. Agarwal	Uttarakhand State Council for Science & Technology, Dehradun
GAP5027	Development of polymer modified cementitious systems for repair applications	Anupam Singh/ Rajni Lakhani	Department of Science and Technology (DST), Technology Bhavan, New Mehrauli Road, New Delhi-110016

SSP0039	Performance evaluation of steel fiber reinforced shotcrete	S. R. Karade/ B. K. Rao	Mr. Rajesh Gupta (Senior Manager-FQA) LPHPP, NTPC Ltd., Bhatwari, Uttarakhand-249135
SSP0049	Fire performance assessment of fire rated door	Suvir Singh/ N. K. Saxena	M/S Sukri Paints & Chemicals Pvt Ltd., 380. 3rd Floor, Chirag Delhi, New Delhi-110017
SSP0059	Fire performance assessment of wooden door	Suvir Singh/ N. K. Saxena	M/S Tripti Engineering Services Pvt. Ltd, 22 Ashutosh Chowdhary Avenue , Kolkata-700019
SSP0068	Study the effect of rising temperature on thermal transmission through resin bonded fiber glass product	B. M. Suman/ R. K. Srivastava	M/S U.P. Twiga Fiber Glass Ltd., Twiga House, 3, Community Centre, East Of Kailash, New Delhi-110 065
SSP0077	Active fire protection measures for Lucknow Development Authority, Pradhikaran Bhavan	R. S. Chimote	Chief Engineer, Lucknow Developement Authority Zone 9, Vipin Khand, Gomti Nagar, Lucknow-226001 (UP)
SSP0078	3rd party quality assurance of civil construction work of nurses college, Mahila ITI and Sainik Kaliyan Directorate buildings at Dehradun	Rajesh Deoliya/ A.K. Pandey	S.A.Sharma, Add. Project Manager, UPRNN Ltd., Camp Office, Coronation Hospital, Dalan Wala, Dehradun
SSP0079	Third party quality assurance of construction of government allopathic medical college at Saharanpur.	B. K. Rao/ Ajay chourasia	Shri. P.K Aggarwal, Zonal Manager, UPRNN,130, Vasant Vihar, Phase II, Dehradun
SSP0087	Fire engg. expertise based technical inputs for design and improvement in existing active fire fighting system of Sanjay Gandhi post graduate institute of medical sciences (SGPGIMS)	R. S. Chimote	Prof. A. K. Mahapatra, Director, Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGIMS), Rai Bareli Road, Lucknow-226014 (UP)

SSP0088	Investigation for distress at Rashtrapati Nivas and rehabilitation measures, Shimla	A. Ghosh/ A. K. Pandey	Mr Kundan Lal Sharma, Estate Supervisor, Indian Institute of Advanced Studies, Rashtrapati Nivas, Shimla-171005
SSP0089	Wokshed scheme for khadi artisans	Neeta Mittal/ R.K Garg	S.K Sinha, Director (Khadi Cordination), Khadi & Village Industries Commision, Ministry Of Micro, Small & Nedi Enterprises, Govt of India, Gramodaya, 3 Iria Road, Vile Parle (West), Mumbai-400056
SSP0099	Toxicity studies on MFMB	Sunil Sharma/ N.K Saxena	UP Twiga Fiberglass Limited, Twiga House, 3 Community House, East of Kailash, New Delhi-110065
SSP0109	Fire performance assessment of fire damper	Suvir singh/ N. K. Saxena	M/S Dynacraft Air Controls, EI, Nanddhham Ind. Estate, Marol, Andheri(East), Mumbai-400059
SSP0118	Burglary resistance performance assessment of Guardwel safe	Suvir Singh/ Suresh Kumar	M/S Guardwel Industries Pvt. Ltd., Rajhans Industrial Complex, Chinchpada Gokhivare, Vasai (E), Mumbai - 401 208
SSP0128	Fire & horse stream evaluation of Guardwel strong room door	Suvir Singh/ Suresh Kumar	M/S Guardwel Industries Pvt. Ltd., Rajhans Industrial Complex, Chinchpada Gokhivare, Vasai (E), Mumbai - 401 208
SSP0129	Construction of 1272 houses at Bhorgarh using CBRI technology of RC plank & joist in roofing	Rajindra Kumar/ Chandra Prakash	Mr. Pramod Adlakha, M/S Adlakha Associate Pvt. Ltd. F-70, Bhagat Singh Mkt, New Delhi-1
SSP0138	Proof checking of structural drawings & third party quality assurance of university buildings at Srinagar, Chouras, New Tehri and Pauri	S. K. Singh/ Ajay Chourasia	Dr. H.B Thapliyal, Registrar, Hemwati Nandan Bahuguna Garhwal University, Srinagar (Garhwal)

SSP0148	Fire resistance evaluation of Gunnebo strong room door and safes	Suvir Singh/ Suresh Kumar	M/S Gunnebo India Ltd., 1305-1306, GIDC Industrial Estate, Halol, Distt Panchmahals, Gujrat-389350
SSP0149	Structural soundness of ONGC buildings at Dehradun with respect to earthquake sustainability	A. P. Chourasia/ Jalaj Parasar	Shri. M.K Vedi, Chief Engineer(Civil) INGC, Shed No 32, Tel Bhavan, Dehradun
SSP0158	Third party quality assurance of construction of residential apartments in commonwealth games village , New Delhi	B. K. Rao	The Executive Engineer, Commonwealth Games Division-1, Seed Bed Part, School Block , Shakarpur, Delhi-110902
SSP0159	Fire performance assessment of fire door	Suvir Singh/ Suresh Kumar	The Exceutive Engineer, PWD, Building Projects Div, B 111, District Court Complex, Saket, New Delhi-110017
SSP0168	Health assessment of cooling towers and chimneys	A K Mittal/ S. R. Karade	General Manager(E), Vaishali Power Generating Co. Ltd., MTPS, Kanti, Muzaffarnagar
SSP0177	Fire safety research expertise based inputs for establishing the probable cause of fire in paper board reels and remedial fire protection measures thereof at ITC Bhadrachalam paper board mill, Sarapaka (A.P.)	R. S. Chimote	Sh. R. S. Phatak, Divisional EHS Coordinator, Paper Boards and Specialty Paper Division ITC Ltd., ITC Bhadrachalam House, 106, S.P. Road, Hyderabad - 500 003 (AP)
SSP0188	Studies on microbial formulation (Metarizium Spps) for termite management in buildings	B. S. Rawat	Dr. D. K. Mishra, GM-Technical, International Pannacea Ltd., E-34, Cannaught Circus, New Delhi-110001
SSP0189	Fire resistance evaluation of fire doors and false ceiling	Suvir Singh/ Suresh kumar	The Executive Engineer, Rehabilitation & Retrofitting Division, CW 131, S-11/13-14, Kidwai Nagar (East), New Delhi

SSP0208	Fire performance studies of Aska-HNE water mist cum compresses air foam system (CAFS) based fire fighting equipment as per DIN EN3 standard for class A and class B Fires	R. S. Chimote	Mr. Ashok Garg, Managing Director, M/S Asaka Equipments Ltd., 193, Deepali, Deepali Chowk, Pitam Pura, New Delhi - 110 034
SSP0228	Third party quality assurance of civil construction work of various buildings at Dehradun & Rishikesh	A. K. Pandey/ Rajesh Deoliya	Er. S.A. Sharma, Additional Project Manager, UPRNN Ltd., Camp Office, Coronation Hospital, Dalanwala, Dehradun (U.K)
SSP0229	Reaction to fire characteristics of V panel	A. A. Ansari/ B. B. Lal	Visaka Industries Limited, 'Visaka Towers', 1-8303/69/3, S.P Road, Secunderabad-500003
SSP0238	Fire resistance testing of fire door	Suvir Singh/ Suresh Kumar	M/S MPP Technologies Pvt. Ltd., 487/C, 14th Cross, 4th Phase, Peenya Industrial Area, Bangalore-560 048
SSP0239	Toxicity and oxygen index studies on V panel.	S K Sharma/ N. K. Saxena	Visaka Indsutries Limited, Visaka Towers, 1-8-303/69/3, S.P. Road, Secunderabad 500003
SSP0248	Fire resistance evaluation of fire door	Suvir Singh/ Suresh Kumar	M/S GM Partitions Pvt. Ltd., Bldg. No. 14, CTS No. 82, 82(1 To 17), L.B.S. Marg, Vikhroli (W), Mumbai-400 083
SSP0249	Utilization of sludge	S. K. Agarwal/ L.P Singh	Mohan G Deshmukh, CEO, Reshmika Minerals and Chemicals Pvt. Ltd., C-601 Pune, IT Park, 34 Aundh Road, Bhau Patil Marg, Pune - 411020
SSP0258	Fire performance assessment of fire dampers	Suvir Singh/ Suresh Kumar	M/S Cosmic Equipment (I) Pvt. Ltd., No. 9-A, Kalaivani Street Extn., Keelkattalai, Chennai - 600 017

SSP0268	Proof checking of design drawings and quality inspection of SIEMAT building	A K Mittal	State Project Director, Sarva Sikhsha Abhiyan, Dehradun, Uttarakhand
SSP0278	Fire and burglary resistance assessment of Nantra BMS products	Suvir Singh	M/S Nantra Secequip Co., G-12, Bhumi Est., Sarkhej-Sanand Cross Road, Opp Shreeji Bridge, Sarkhej, Ahmedabad - 382210
SSP0288	Post fire investigations of damaged area of Indian Oil Bhawan at Noida and remedial measures	Suvir Singh/ S. K. Singh	Shri. U.K Pal, Dy. General Mananger (Pi-Civil) Pipelines Division, Indian Oil Corporation Limited, A-1, Udyog Marg, Sector-1, Noida-201301
SSP0298	Structural conditional assessment of digesters and gas holding tanks in existing sewage treatment plant	A K Mittal	M/S VA Tech WABAG Ltd. 11, Murray's Gate Road, Alwarpet, Chennai-600018
SSP0299	Performance evaluation of V panel for thermal resistance and thermal transmission.	B. M. Suman/ Shree kumar	Mr. D.S Rayudu, M/S Visaka Industries Ltd. Visaka Towers, 1-8-303/69/3, S.P Road, Secunderabad
SSP0308	Third party quality inspection of civil construction work of CGEWHO housing project at Meerut	A K Mittal	Chief Executive Officer , Central Government Employees Welfare Housing Organization, 6th Floor, 'A' Wing, Janpath Bhawan , Janpath , New Delhi-110001
SSP0318	Fire resistance evaluation of fire door	Suvir Singh	Executive Engineer, PWD Buliding Projects Division, 232 GNCTD, Opp. District Courts Sector 9, Dwarka, New Delhi
SSP0329	Fire performance assessment of fire door.	Suvir Singh/ Suresh Kumar	M/S M M Sejpal & Others, Estate Building No. A, NH No 8, Near Arihant , Opp Highway Ind Estate, Sativali Village , Vasai (E)

SSP0349	Value added building materials from fluorogypsum	Mridul Garg/ A.K Minocha	M/S Tanfac Industries Ltd. 14, Sipcot,Industrial Complex Cuddalore -607005, TN
SSP0359	Fire performance assessment of wooden and steel composite fire doors.	Suvir Singh/ Suresh Kumar	M/S Indian Fire Equipment Systems, D-25, Ground Floor, near Arya Samaj Mandir, Vikas Puri, New Delhi-1110018
SSP0368	Third party quality assurance of civil construction works of Uttarakhand Sanskrit Academy Residences, Haridwar	H. C. Arora	Project Manager, UPRNN, Haridwar
SSP0379	Geotechnical investigation for proposed office building at 132 KVA sub station at Majra.	A. K. Sharma-I/ A. Ghosh	Shri Pankaj Prakash, Secretary UERC , near ISBT Majra, Saharanpur Road, Dehradun
SSP0399	Evaluation of continuous sandwich panels.	Manorama Gupta/ Rajesh Kumar	M/S Sintex Industries Ltd., Plastic Division, A-38, 2nd Floor, Mohan Cooperative Industrial Estate, Main Mathura Road, New Delhi-110044.
SSP0408	Site feasibility study of a proposed real estate at Dehradun	P. K. S. Chauhan/ A. Ghosh	Ms Ats Infrastructure Ltd, Noida
SSP0409	Investigation of cracks appeared in the structural members of petroleum product testing laboratory building and suggestions for rehabilitation measures.	Rajesh Deoliya/ A. K. Pandey	Sri C.K Jain Vice President (Projects), Bharat Oman Gas Refineries Ltd. , Agasod, Bina, Distt. Sagar
SSP0418	Fire resistance evaluation of fire door	Suvir Singh/ Suresh Kumar	M/S Chempharm Industries(I) Pvt. Ltd., Darya Ganj, Dayanand Marg, New Delhi-110002
SSP0419	Impact and reaction to fire characteristic studies on sandwich panel of ppgi + puf.	A. A. Ansari/ Rakesh Kumar	Nilkamal Limited, Nilkamal House, Street No 14, M.I.D.C, Andheri (East), Mumbai-400093

SSP0438	Investigation and design of embankment for red mud storage at Renukut	Shantanu Sarkar/ A. Ghosh	Ms Hindalco Industries Renukut
SSP0439	Determination of temperature profile and energy load on computer model for three composite buildings and validation of thermal properties (K,R& U-values)of BASF products.	B. M. Suman/ Shree Kumar	Mr. Deepak Thuse, M/S BASF India Limited, Thane Belapur Road, Turbhe , Navi Mumbai-400705.
SSP0448	Evaluation of perlite blocks and expanded perlite for thermal conductivity	B. M. Suman/ Shree Kumar	Mr. V.N Pangal, Director (O), Keltech Energies Ltd. Bangalore-560001,
SSP0449	Impact and reaction to fire characteristic studies on continuous sandwich panel.	A. A. Ansari/ Rakesh Kumar	Chief Engineer (Project), Maharashtra Prathamik Shikshan Parishad, Jawahar Bal Bhawan, Netaji Subhash Marg Charni Road, Mumbai-400064.
SSP0458	Fire performance assessment of methodox fire safe	Suvir Singh	M/S Methodox Systems Ltd.,35-A, Front Industrial Estate, Indore-452006
SSP0459	Characterization of steel fibers and fiber reinforced shotcrete.	S. R. Karade	Shri PK Shakya, (Senior Manager-FQA) Tapovan Vishnugad Hydroelctric Project, NTPC Ltd, Kagbhusandi Office, Badrinath Road, Joshimath-246443 (Uttarakhand)
SSP0468	Third party evaluation and quality inspection of school buildings under construction during 2007-08 and 2008-09 under Sarva Shiksha Abhiyan.	A K Mittal/ S.K. Negi	State Project Office, Sarva Shiksha Abhiyan, Dehradun, Uttarakhand
SSP0469	Geophysical investigation for PGF site, Dehradun.	P. K. S. Chauhan/ A. Ghosh	Ms PGF Ltd. , New Delhi

SSP0478	Remaining life assessment studies of EWS and LIG house of Noida	Rajesh Deoliya/ H. C. Arora	Shri. L.K Gupta, Senior Project Engineer-I, Noida, Main Administrative Building, Sector-6, Noida-201301
SSP0479	Assessment of residual strength in basement columns & raft foundation of mega housing project at Basant Kunj, New Delhi & suggesting strengthening measures.	A.K. Pandey	Superintending Engineer, CC-15, Delhi Development Authority (DDA), Sarita Vihar, New Delhi
SSP0488	Fire resistance evaluation of M.S Fire doors	Suvir Singh/ Suresh Kumar	M/S Kutty Flush Doors & Furniture Co. Pvt. Ltd. 1167, Poonamallee High Road, Koyambedu, Chennai
SSP0489	Technical inspection and post fire investigations of damaged structures and suggesting rehabilitation measures.	S. K. Singh/ Suvir Singh	General Manager (Technical), Assam Oil Division, Indian Oil Corporation Limited, Digboi-786171
SSP0498	Health assessment of structures at CFCL Gadepan, Kota	B. K. Rao/ A. P. Chourasia	Mr. N. Kumar, Manager(Civil), Chambal Fertilizer & Chemicals Ltd. , Gadepan, Distt. Kota
SSP0499	Monitoring and termite resistance test of item secure technology for termite management in buildings.	B. S. Rawat	Mr. Kaplesh Joshi , MD , Item Secure Pvt. Ltd. 601-602, Ivory Terrace Alkapuri, Baroda -07
SSP0508	Evalutaion of water repellent treatments	Rajni Lakhani/ S. P. Agarwal	M/S Remmers India Pvt. Ltd. 312 A, Centrum Plaza, Golf Course Plaza Road Sec-53 , Gurgaon-122002
SSP0538	Proof checking of structural design and drawings of MES structures.	A K Mittal/ B. K. Rao	M/S Gupta Consultancy Services, R-113,1st Floor, Sector-14, Ghaziabad-201002
SSP0539	Distress diagnosis of Janak Setu Flyover of MCD at Delhi and suggesting rehabilitation & strengthening measures.	S. K. Singh/ A. P. Chourasia	Executive Engineer (Proj. -II) WZ, Municipal Corporation of Delhi, Office of E.E (Prj-II) WZ, Zakhira, Delhi

SSP0548	Scientific study on revision of unit cost under Indira Avas Yojana (IAY) in various geo-climatic zones of the country.	R. K. Garg/ Neeta Mittal	Ms Sunita H. Khurana, Director (RH), Ministry of Rural Development Krishi Bhawan, New Delhi-110001
SSP0549	Distress diagnosis of Zakhira & Ashok Vihar Flyovers of MCD at Delhi and suggesting rehabilitation & strengthening measures.	A. P. Chourasia/ S. K. Singh	Executive Engineer (Proj), KBZ Municipal Corporation of Delhi, Office of E.E (Prj.), WZ. Karol Bagh Zone, Block 52, Old Rajinder Nagar, Delhi.
SSP0558	Fire resistance evaluation of fire door	Suvir Singh/ Suresh Kumar	M/S Ahlada Engineers Pvt Ltd, SY#,Bahadurpally, Qutbullapur Mandal, R.R Dist Hyderabad-500043
SSP0559	Distress diagnosis of Sarai Rohilla flyover of MCD at Delhi and suggesting rehabilitation & strengthening measures.	S. K. Singh/ A. P. Chourasia	Executive Engineer(Proj.), KBZ Municipal Corporation at Delhi, Office of E.E. (Prj.).WZ, Karol Bagh Zone, Block 52, Old Rajinder Nagar, Delhi.
SSP0568	Evaluation of polypropylene random copolymer pipes for hot and cold water plumbing system	Manorama Gupta/ Rajesh Kumar	Mr. J.H Bhatt, M/S Prime Tele-Extrusions Ltd, , 30/13th Cross, Wilson Garden, Bangalore-560027
SSP0569	Distress diagnosis of Sahadra Flyover of MCD at Delhi and suggesting rehabilitation & strengthening measures.	A. K. Pandey/ A. P. Chourasia	Executive Engineer (Proj.), Shahadra(North)-I, Municipal Corporation of Delhi, Office of E.E(Prj.), Shahadra North Zone-I, Block-5, Geeta Colony, Delhi-110031
SSP0599	Post fire damage assessment & repair/rehabiliation of adminis-trative block of ALTTC , Ghaziabad.	Ajay Chourasia/ Jalaj parashar	Shri V.P Singh, Executive Engineer(Civil), BSNL, Civil Division, ALTTC, Ghaziabad
SSP0659	Non destructive testing and investigations of raft foundation in oil and gas block, Jairampur (Arunachal Pradesh).	B. K. Rao/ Jalaj Parashar	Shri Sarit Maheshwari, Sr. Manager, NTPC , Noida

SSP0779	Fire performance assessment of fire door.	Suvir Singh/ Suresh Kumar	M/S Febtech International Pvt. Ltd. , 615, Janki Centre, Off. Veera Desai Road, Andheri (W), Mumbai
SSP0879	Studies of fire characteristics of MFMB.	S K Sharma/ A. A. Ansari	U.P Twiga Fiberglass Limited, Twiga House, 3 Community House, East of Kailash, New Delhi- 110065
SSP0899	Health assessment & repair of chimneys at TTPS, Talcher (Orrisa).	S. R. Karade/ A K Mittal	Shri R.N.P Verma, Manager (Civil), Talcher Thermal Power Station, Talcher, Distt. Angul- 759101, Orissa
SSP1017	Stability Analysis of main dam, new ash dyke at Renusagar	A. Ghosh/ P. K. S. Chauhan	Mr. G. M. Pandey, Sr. Vice President (Maint.), Hindalco Industries Ltd., Renusagar (UP)
SSP1027	Assessment of monitoring of distress and remedial measures for ancient temples in Uttarakhand	Y. Pandey/ Shantanu Sarkar	Suprintending Archaeologist., Archaeological Survey Of India, Dehradun Circle, Dharohar, Tyagi Road, Dehradun-248001
SSP6337	Third party quality assurance load test on slabs	A K Mittal	Delhi Development Authority, Office of the Executive Engineer, South Western Division No. 6, Central Nursery, Sector-5, Dwarka, New Delhi-75
SSP6407	Architectural planning and structural design of three models of KGBVs and quality inspection of the above school sites	A K Mittal/ B.K. Rao	State Project Office, Sarva Shiksha Abhiyan, Dehradun
SSP6417	3rd party quality assurance of civil construction work at Sanskrit University campus, Haridwar	B. K. Rao/ Rajesh Deolia	Sh. J. S. Prasad, Project Manager, UPRNN Ltd., New District Headquarter, Roshnabad, Haridwar

SSP6717	Evaluation of chlorfluazuron 0.1% termite bait (Requiem) for termite management in buildings	B. S. Rawat	Mr. S. Surkund, Sr. V.P., Pest Control (India) Pvt. Ltd, 36 Yusuf Building, M.G. Road, P.B. No. 1510, Mumbai-01
TSP0029	Fire performance assessment of FIREX EC-43 fire protection coating for fire resisting characteristics.	Suvir Singh/ N.K Saxena	M/S Superon Schweiss technik India Ltd. M 15-16, Old Sewa Nagar Karket, P.O Lodhi Road, New Delhi-110003
TSP0139	Evaluation of surface spread of flame classification of MFMB & MFRB	A. A. Ansari/ B.B. Lal	M/S U.P Twiga Fiberglass Limited, Twiga House, 5, Community Centre, East of Kailash, New Delhi-110065
TSP0198	Construction of 1892 houses at Narela ,using CBRI Technology (Technical Back-up)	Rajindra Kumar/ Chandra Prakash	M/S Adlakha Associate Pvt. Lts., F-70, Bhagwat Singh Market, New Delhi-110001
TSP0259	Fire performance assessment of lift landing door.	Suvir Singh/ Suresh Kumar	M/S Escon Elevators Pvt. Ltd., 215, Laxminagar District Centre, New Delhi
TSP0269	Fire performance assessment of steel beam protected by vermiculate cementatious materials.	Suvir Singh/ Suresh Kumar	M/S Larson & Toubro Ltd. House No 620, Sec 13-17, Panipat.
TSP0289	Evaluation of glass wool slab for non-combustibility	A. A. Ansari/ B. B. Lal	Assistant Engineer-I, CWG- IVC, CPWD, I.G Stadium, New Delhi
TSP0319	Fire performance assessment of partition.	Suvir Singh/ Suresh Kumar	M/S Visaka Industries Ltd. , "VISAKA TOWER", 1-8-303/69/3, S.P Road, Secunderabad-500003
TSP0348	Evaluation of INSUSHIELD - FR closed cell chemically cross linked polyethylene	S. P. Agarwal	M/S The Supreme Industries Ltd., 22 Deepak Building, 13 Nehru Place, New Delhi
TSP0358	Reaction to fire characteristics studies on FR closed cell cross linked polyethylene	B.B Lal/ A. A. Ansari	M/S The Supreme Industries Ltd. 22, Deepak Building, 13, Nehru Place, New Delhi

TSP0369	Fire performance assessment of fire door	Suvir Singh/ Suresh Kumar	M/S P.D Agarwal, Engineers & Contractors, 2nd Floor, Dhilon Complex, Jawahar Nagar, Raipur-492001,
TSP0378	Reaction to fire characteristics studies on in sunshield laminated with Al-foil & Glass cloth on one side	B.B Lal/ A. A. Ansari	M/S The Supreme Industries Ltd. 22, Deepak Building, 13, Nehru Place, New Delhi-110019
TSP0388	Reaction to fire characteristic studies of NEROMASTIC 400 NPK on steel and concrete panels	A. A. Ansari/ B.B Lal	M/S Kansal Nerolac Paints Limited, P.B No. 16322, Nerolac House, Ganpat Rao Kadam Marg, Lower Parel, Mumbai-400013
TSP0389	Fire performance assessment of flush door.	Suvir Singh/ Suresh Kumar	M/S Central Public Works Department, Office of The Executive Engineer, Mumbai Central Division No III, Flat No 954-956, Sector-7, C.G.S, Colony, Antop Hill, Mumbai-400037
TSP0589	Impact and reaction to fire characteristic studies on PUF insulated sandwich panel.	A. A. Ansari/ Rakesh Kumar	Metechno India Private Limited No. 138/30, 2nd Floor, Florida Towers, Nelson Manickam Road, Chennai-600029
TSP0629	Reaction to fire characteristic studies on gypsum board, GYPROC fire line board and gypsum moisture resistant board.	A. A. Ansari/ Rakesh Kumar	M/S St. Gobain Gyproc India Ltd., Logix Eutopia, A-6,Sector-16, Noida-1-201301
TSP0639	Fire performance assessment of partitions and false ceiling.	Suvir Singh/ Suresh Kumar	Lafarage Boral Gypsum India Pvt. Ltd., Plot No. 33B, Sector 32,Gurgaon, Haryana-122001
TSP0699	Fire performance assessment of fully gazed door.	Suvir Singh/ Suresh Kumar	M/S Saint Gobain Glass India Pvt. Ltd., Plot No A-1, Sipcot Industrial Park, Sriperumbudur - 602105, Kanchipuram District, TN

TSP0729	Fire performance assessment of steel tech fire door.	Suvir Singh/ Suresh Kumar	M/S Steel Tech Industries, No. 36, 2nd Floor, 7th Avenue, Ashoka Nagar, Chennai - 600083
TSP0739	Fire performance assessment of fire stop systems.	Suvir Singh/ Suresh Kumar	M/S LLOYD Insulations (INDIA) Ltd., Kalkaji Industrial Area, New Delhi-110019
TSP0759	Evaluation of IPN polymer paints.	P. C. Thapliyal/ S. R. Karade	M.R. V.K Jose, M/S United Construction Company, VMC Complex, Wadakkanchery (Post), Thrissur (Dist). Kerala-680582
TSP0809	Fire performance assessment of fire door	Suvir Singh/ Suresh Kumar	M/S Cosmic Equipment (India) Ltd. No. 9-A, Kalavani Street Extn. Keelkattalal, Chennai-600117
TSP0829	Fire performance assessment of fire door.	Suvir Singh/ Suresh Kumar	The Executive Engineer, Commonwealth Games, Div-V, CPWD, MDC National Satdium, New Delhi
TSP0869	Determination of non combustibility and smoke density of fibercrete woodwool insulation board.	A. A. Ansari/ Rakesh Kumar	Fibretex Industries (India). Plot No.89, Sector-6, Faridabad-121006 (Haryana)
TSP0909	Fire performance assessment of fire doors.	Suvir Singh/ Suresh Kumar	M/S Godrej & Boyce Mfg. Co. Ltd., Pirojshnagar Vikhroli, Mumbai- 400 079
TSP0959	Fire performance assessment of cable fire barrier.	Suvir Singh/ Suresh Kumar	M/S Hiliti India Pvt. Ltd., F-90/4, Okhla Industrial Area, Phase-I, New Delhi

Testing (TST) Projects

TST0169	Evaluation of clear intumescent coating (Fiex -CIC 4767) on wooden surface for surface spread of flame	A. A. Ansari/ B. B. Lal	Superon Schweisstechnik India Ltd., 15-16, Old Sewa Nagar Market, Lodhi Road, New Delhi-110003

TST0199	Evaluation of rockwool slab for non- combustibility	A. A. Ansari/ B.B Lal	Assistant Engineer-I, CWG-IVC, CPWD, I.G Stadium,New Delhi
TST0209	Evaluation of IPNet coating system for tensile strength, elongation, water vapour transmission and bond strength	P. C. Thapliyal	Mr. Rajiv Kumar, M/S RRV Infra Limited No. 6, Prasad Street, Dr. Seethapathi Nagar, Velachary, Chennai-600042
TST0219	Performa for technical assistance (mere testing) to outside agencies	Manorama Gupta/ B. Singh	Office of The Executive Engineer,Rohini Project Division No 8. DDA Avantika More, G-Block, Mangolpuri, New Delhi
TST0279	Testing of Amitex brand HDPE polyethylene water storage tank supplied by DDA, RPD Rohini	Manorama Gupta/ B. Singh	Office of The Executive Engineer, Rohini Project Division No XI, Delhi Development Authority, Community Plaza-3, Rohini, New Delhi
TST0309	Fire performance assessment of MPPP double leaf fire door.	Suvir Singh/ N. K. Saxena	M/S MPP Technologies Pvt. Ltd. 487/C, 14th Cross, 4th Phase, Peenya Industrial Area, Bangalore - 560058,
TST0339	Performa for technical assistance (mere testing) to outside agencies.	Manorama Gupta/ B. Singh	Executive Engineer, Rohini Project Division No XII, Delhi Development Authority, CSC-9, Sec-7, Rohini, New Delhi
TST0429	Performa for technical assistance to outside agencies.	B. B. Lal/ A.A Ansari	M/S Ajay Industrial Corporation, Plot No. 1000-1001, Central Hope Town, Camp Road, Salaqui Industrial Area, Dehradun-248197
TST0519	Fire performance assessment of single leaf wooden door.	Suvir Singh/ N. K. Saxena	Assistant Engineer, M/S Central Public Works Department, CWCD-IV, CPWD, I.G. Stadium, New Delhi

TST0528	Evaluation of FRP panels for surface spread of flame	A. A. Ansari/ B.B Lal	M/S Kemrock Industries and Exports Ltd. Village ASOJ, Halol-Vadodra Express Way 1 A, Waghodia, Distt. Vadodra 591510, Gujrat
TST0609	Fire performance assessment of protected steel beam.	Suvir Singh/ N. K. Saxena	M/S Safex Flameproof Controls (P) Ltd., 31, Tripura Roy Lane, Salkia, Howrah-711106
TST0619	Fire performance assessment of wooden fire check door.	Suvir Singh/ N. K. Saxena	Central Public Works Department, Jawaharlal Nehru Bhawan, Project Site Office, 23- D Maulana Azad Road, New Delhi
TST0649	Fire performance assessment of protected steel beam.	Suvir Singh/ NK Saxena	M/S Jaslonite Konard Hi-Tek Pvt. Ltd., Dharm Complex, Chhokra Nala, G.E Road, Raipur-492001 (C.G)
TST0669	Fire performance assessment of wooden fire door.	Suvir Singh/ NK Saxena	M/S Ases Security Private Limited, 3/1/11, Site-IV, Sahibabad Industrial Area, Ghaziabad, U.P-201010.
TST0679	Fire performance assessment of fire safe box.	Suvir Singh/ NK Saxena	M/S MBM Automation & Robotics, W-220, 'S' Block, M.I.D.C, Bhosari, Pune-411026
TST0709	Fire performance assessment of lift door.	Suvir Singh/ NK Saxena	M/S Johnson Lifys Private Limited, 17, Poonamallee Bye Pass Road, Poonamallee, Chennai-600056
TST0719	Fire resistance evaluation of fire doors.	Suvir Singh/ NK Saxena	M/S Talin Modular Office Furnitu Systems Pvt.Ltd. , No-189 & 190, Kacharakanahalli, 15th Cross 3rd Block, Ist Stage, Kalayananagar Post, H.B.R Layout, Bangalore-560043
TST0749	Fire performance assessment of wooden fire doors.	Suvir Singh/ NK Saxena	M/S Kamruddin & Co, L-I-A-4, Sangam Vihar Near Green Valley Public School, New Delhi-110062

TST0769	Fire performance assessment of fire door.	Suvir Singh/ NK Saxena	M/S MPP Technologies Pvt Ltd, 487/C, 14th Cross , 4th Phase, Peenya Industrial Area, Bangalore-560058
TST0859	Fire performance assessment of fire doors.	Suvir Singh/ Suresh Kumar	M/S Sheth Fabricators Pvt. Ltd., R-676, TTC Indl Area, MIDC, Behind PipeLine, Rebale, Navi Mumbai-400701
TST0949	Fire performance assessment of wooden fire door.	Suvir Singh/ Suresh Kumar	The Executive Engineer, Public Works Department, Building Project Division B-111, District Court Complex, Saket, New Delhi-110077
TST0969	Fire performance assessment of metal fire door.	Suvir Singh/ Suresh Kumar	M/S Delhi Metro Rail Corporation Ltd., Office of The CPM(C) IT Park, Site Office, DELHI

Appendix IV

Research Publication

(a) Journal Publication

A.K. Pandey and D.K. Paul, Damage Evaluation of a Reinforced Concrete Containment Shell Subjected to Blast Loading, **Current Science,** Vol. 97 (3), August, 2009, 336-341.

S.K.Agarwal, Deepak Juneja, I.A.Siddiqui and Avdesh Kumar, Use of Higher Volume Fly Ash in Concrete for Building Sector, **Civil Engineering & Construction Review**, Oct. 2009, 72-90.

Rajni Lakhani, Anupam Singh Shiwach and S.P. Agarwal, Strengthening of Weak Mortar by Polymeric Consolidants, **Civil Engineering & Construction Review**, Vol.22 (4) April 2009, 52-56.

Mridul Garg, Neeraj Jain and Manjit Singh, Development of Alpha Plaster from Phosphogypsum for Cementitious Binder, **Construction & Building Materials**, 23(10), 2009, 3138-3143.

Rajiv Kumar, Sunil K. Sharma and Narendra Kumar, Effect of Toxicity in Compartment Fires. **Fire Engineer,** 7-17, July-September, 2009.

Rajiv Kumar and Sunil K. Sharma, Fire Safety in Buildings - An Engineering Approach, **Vision and Quest:** ISSN 0975-8410, 1(1), 53-61, Jan. 2010.

Mridul Garg and Neeraj Jain, Utilization of by-Product Gypsum and Chalk for Making Value Added Building Material, **Civil Engineering & Construction Review**, Feb. 2010, 56-64.

(b) Publication in Conference Proceedings

6th National Workshop on New Technologies for Rural Development having Potential of Commercialization jointly organized by The Institute of Engineers, MP and Indian Society of Remote Sensing, Bhopal, May 9, 2009.
Low Cost Building Materials from Waste Gypsum
Neeraj Jain

6th Asian Symposium in Polymers in Concrete, Shanghai, China, 29-30 October, 2009
Modification of Cement Mortar using Polymer Blend
Anupam Singh Shiwach and Rajni Lakhani

World CORCON 2009, Mumbai, 29 Sept.-2 Oct. 2009
Performance Studies of Coating Systems based on Cardanol Modified Epoxy for Concrete Structures
P.C. Thapliyal and S.R. Karade

2nd India Disaster Management Congress, 4-6 Nov. 2009
Multi-source Landuse Landcover classification in a Hilly Terrain for Landslide Study
D.P. Kanungo and S. Sarkar

7th Asian-Pacific Conference on Wind Engineering, TAIPEI-TAIWAN, 08-12 Nov. 2009
Design of a Global Frame Based on Wind Forces from a Few International Wind Codes.
Achal Kumar Mittal, Nikhil Agarwal and V.K. Gupta

4th USSTC Promotion and Adoption of Rural Technologies in the State, Pantnagar, 10-12 Nov. 2009
Prediction of Indoor Surface Temperature using Mathematical Model of Periodic Heat Flow through Building
B.M. Suman

GIS based Spatial Prediction of Landslide Potential Zones in Parts of Darjeeling Himalaya using Certainty Factor Approach
D P Kanungo, Shaifaly Sharma and Kumkum Mishra

A study of Seismicity and Earthquake Hazard of Dehradun Region, Uttarakhand - A Probabilistic Approach
Abha Mittal and Gayatri Devi

International Seminar on Waste to Wealth: Green Building Materials & Housing Technologies Using Agricultural and Industrial Wastes, BMTPC, New Delhi, 12-13 Nov. 2009
Jute Composites Properties and End Use in Buildings
M. Gupta, Anamika Randhawa and B. Singh

Environmental Friendly Construction Materials from Waste Gypsum
Mridul Garg and Neeraj Jain

Studies on Unused Coarse Fly Ash as a Supplementary Cementitious Material in Cement Concrete
M. Gupta, Simmi Tyagi, B. Singh and B.K Rao

Plastics Waste Recycling for Making Building Materials
B. Singh and M. Gupta

Indian Geotechnical Conference, Guntur (AP), 16-19 December 2009
Lateral Response of 2x2 Pile Group under Combined Axial and Lateral Loading
S. Karthigeyan

97th Indian Science Congress, University of Kerala, Thiruvaananthapuram, 3-7 January 2010
Batch Studies on Adsorption of As (III) from Drinking Water by Iron-Oxide Coated Sand
Neeraj Jain, Mridul Garg and A K Minocha

International Conference on Challenges and Applications of Mathematics in Science & Technology, NIT Rourkela, 11-13 January 2010
Modeling of Fire in Enclosure with Wall Linings
Rajiv Kumar and Sunil Kumar Sharma

Analytical Science in Energy & Environment, Doon University, 6 February 2010
Lignin: A promising Replacement of Phenol
Amita Kumari and SP Agarwal

International Conference on Advances in Materials Mechanics & Management, Univ. of Trivandrum, 14-16 February 2010
Building Construction on Soils Susceptible to Liquefaction and Uplift
Pradeep Kumar and Prabhat Kumar

3rd Fire Safety and Disaster Management Conference, Lucknow, 19 February 2010
Modeling of Smoke Flow and Assessment of Smoke Management Systems in an Underground Transport Tunnel : A case study
Saurabh Jain

International Conference on Advances in Electron Microscopy and Related Techniques, BARC, Mumbai , 8-10 March 2010
Controlling the Leaching Behavior of Calcium in Cement Hydration using Nano Materials
LP Singh, S K Agarwal, A K Minocha, S K Bhattacharyya and S. Ahlawat

Appendix V

Training/Workshop/Meeting Attended

Dr. Abha Mittal, Scientist 'F' attended a Short term course on **Recent Advances in Optimization Techniques and their Applications** organized by Department of Mathematics and Continuing Education Centre, IIT, Roorkee during April 20-24, 2009.

Dr. Abha Mittal & Dr. Rajni Lakhani, Scientists attended a course on **Capacity Building of Women Managers in Higher Education** under UGC Scheme organized by IWSA, Roorkee Centre and Continuing Education Centre, IIT, Roorkee during May 18-22, 2009.

Dr. Abha Mittal, Scientist 'F' attended CSIR workshop on **Advances and Applications of Mathematical Modelling (AAMM-2009)** organized by C-MMACS, Bangalore at NAL, Bangalore during May 23-25, 2009.

Ms Amita Kumari, RI attended **2nd Rashtriya Yuva Vaigyanik Sammelan 2010,** organized jointly by UCOST, Dehradun and Vijnana Bharati, Dehradun at Doon University, Dehradun during 6-7 February 2010.

Dr. Abha Mittal & Mrs. Neeta Mittal, Scientists attended a Management Development Programme on **Work-life Balance for Women Scientists of CSIR,** organized at HRDC, Ghaziabad, during 3-5 March, 2010.

Dr. Sunil K. Sharma, Scientist G attended a workshop on **IP Protection and Management Issues** organized by HRDC / IPMD (CSIR), and United State Patent and Trademark Office, and Global Intellectual Property Academy, USA at HRDC, Ghaziabad during 22-23 March, 2010.

Appendix VI

Visit Abroad

Dr. M.O. Garg, Director (Additional Charge) CBRI and Dr. A.K. Minocha, Sc.'F', EST Division, CBRI Roorkee visited USA on deputation during June 1 to 5, 2009 to participate in the US-India Workshop on Metrology, Standard and Confirmity Assessment and their use in support of Technical Regulations at NIST Campus in Gaitherburg, M.D., USA.

Dr. M.O. Garg, Director (Additional Charge) CBRI Roorkee gave presentation on :

1. Overview of Indian Institute of Petroleum, Dehradun.
2. Indian Strategies and Programs of IIP, Dehradun.
3. Indian Priorities on Biofuels

Dr. A.K. Minocha, Sc.'F' gave presentation on :

1. Overview of Central Building Research Institute, Roorkee.
2. Development of Certified Reference Building Materials at CBRI, Roorkee

Further discussions on topics of mutual interest were made between NIST, USA and CBRI, Roorkee.

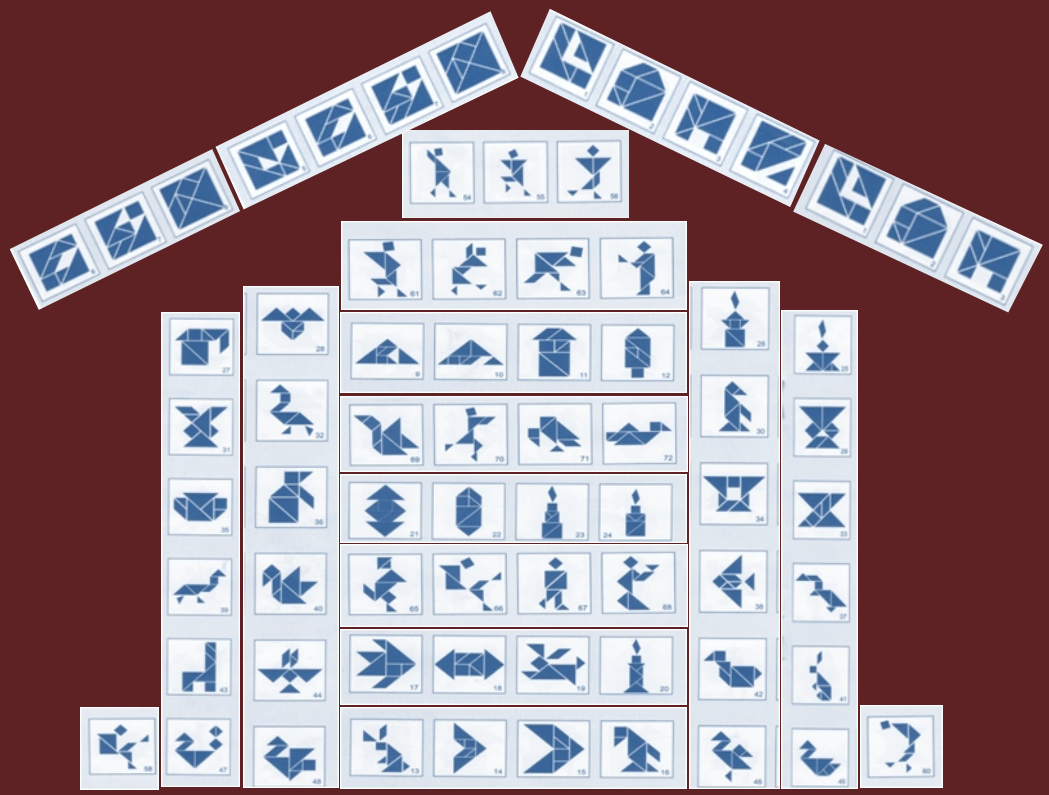
Appendix VII

Honours and Awards

Sri S.P.Agrawal, Scientist F has been awarded Ph.D. degree by IIT Roorkee in Chemical Engineering on "Studies on Polymer Bagasse Fibre Composite for Application as Building Material".

Dr. P. C. Thapliyal and Dr. S. R. Karade, Scientists received the Best Paper Award in International Conference on "World CORCON 2009" for their paper entitled "Performance studies of coating systems based on cardanol modified epoxy for concrete structures" organized in Mumbai during 29 September 2009 to 2 October 2009.

Dr D.P. Kanungo, Scientist E I has been awarded CSIR Raman Research Fellowship for the year 2010-11 to work at Research Centre on Landslides, Disaster Prevention Research Institute, Kyoto University, Japan for 4 months on a topic " Initiation and movement mechanisms of landslides during heavy rainfall".



“Work is a blessing. God has so arranged the world that work is necessary, and HE gives us hands and strength to do it.”

-Elisabeth Elliot