Newsletter

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An Overview of the Evolutionary Pathway of the National Research Council's (NRC) Main Funding programs.

The NRC was founded in 1999 and formally established in 2007 as a special agency under Article 33 of the Constitution by H.E. the President. Its purpose is to assist the government in planning, coordinating, and facilitating research and development in Science and Technology to build a vibrant national scientific and technological community. Cabinet approval was granted to establish the Council as a statutory body by Act No. 11 of Parliament.

The main functions of the NRC are to call for, assess, and fund research proposals, and to develop systems of national recognition and awards for successful research and innovations by Sri Lankan scientists. To achieve these objectives, the NRC has the following programs:

Investigator Driven Research Grant Programme (since 1999): This program funds innovative projects relevant to national development and Science and Technolog-y capacity strengthening. Notably, unlike in the past, there are fewer requests for funding for major equipment, suggesting that most laboratories are now reasonably well-equipped. Further, since 2022, the NRC has encouraged resource sharing and, with that understanding, has funded research projects, without providing funds for major equipment. We therefore, providing funds for major equipment. We therefore, believe that the NRC's policy of funding research infrastructure in our public universities and Research and Development Institutes over the last 25 years has paid dividends.

Private-Public Partnership Programme (since 2012): This program facilitates partnerships between scientists in Public Research & Development Institutions and Universities and the private sector by matching funds (50:50) contributed by the private sector for projects.

To Be Continued...

Some Highlights of Achievements of the NRC Research Projects

Building-SAT-First Whole Building Life Cycle Assessment Tool Framework to Quantity the Global Warming Potential of Buildings in South Asian Region

NRC IDG 19-019

Introduction

Sri Lanka faces growing environmental challenges from rapid urbanization, resource scarcity, and climate vulnerability. The global construction sector is responsible for approximately 37% of energy-related CO_2 emissions, consumes around 50% of the world's raw materials, and generates about 30–40% of global solid waste, highlighting the urgent need for sustainable practices. Building sustainability assessment tools are crucial for enabling data-driven decision-making in the built environment. Assessment of life cycle impacts of built environment helps professionals to design resource-efficient, low-carbon buildings aligned with national sustainability goals and international benchmarks.

In this context, Building-SAT (Sustainability Assessment Tool), an online whole building Life Cycle Assessment (LCA) platform tailored for professionals in the architecture, engineering, and construction industry was developed with the research funding of National Research Council. Standing out from the similar tools available, the newly developed tool enables even users with minimum training to use the same effectively. Building-SAT is the only web-based, freely available WBLCA-ST in Sri Lanka as well as in the South Asian region at present for estimation of Global Warming Potential (GWP) of whole buildings based on a life cycle approach following ISO standards. The tool was added with material, water, electricity, fuel, machinery and transport databases with EPD data from standard and freely available sources, meeting the data quality requirements of ISO 14025, 14040, 14044 and EN 15804 standards. Further, the user can add new material data for use in their projects without the approval of the tool developer. Automated transport distance calculation is another user-friendly feature allowing the user to calculate material sourcing and dumping distances using the integrated distance database. Another unique feature of the tool is the ability to quantify emissions

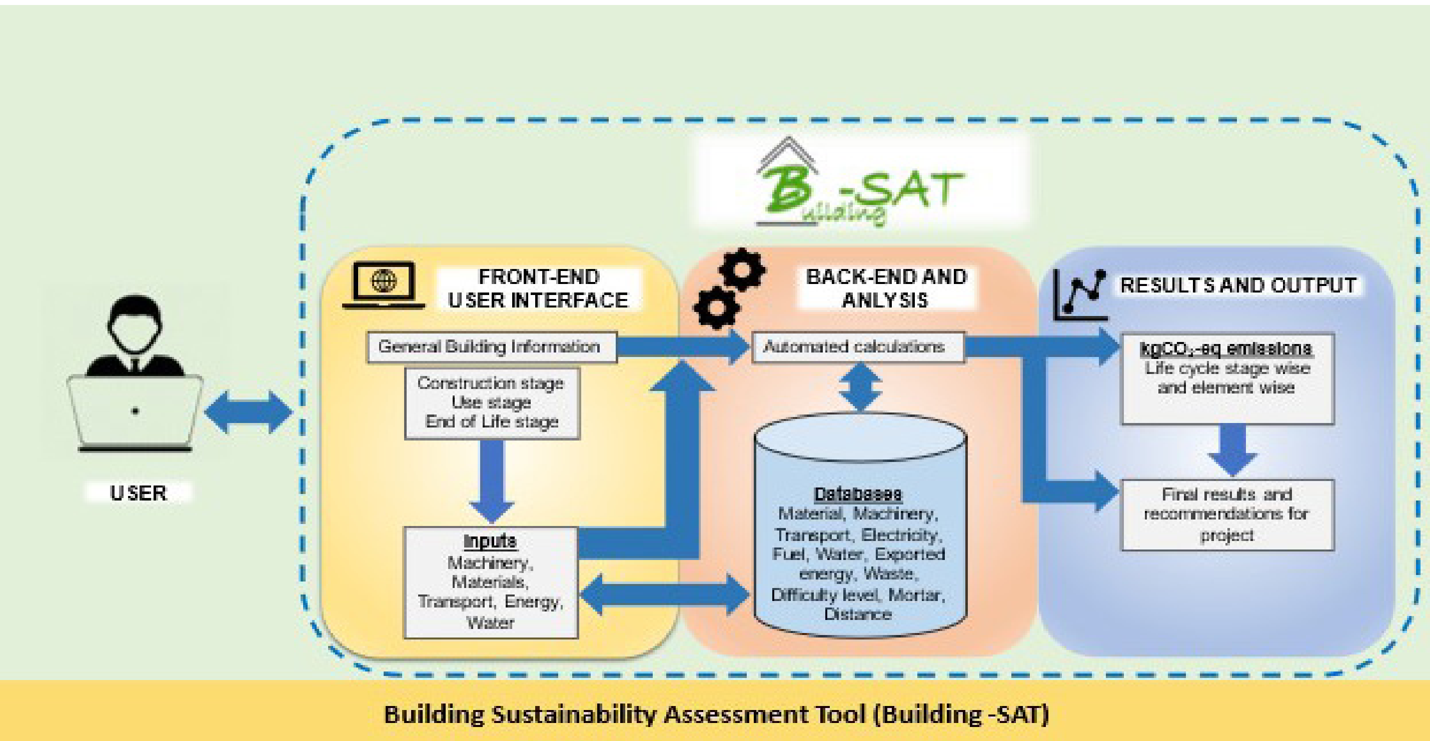

Fig. 1 Building Sustainability Assessment Tool (Building-SAT) operation framework

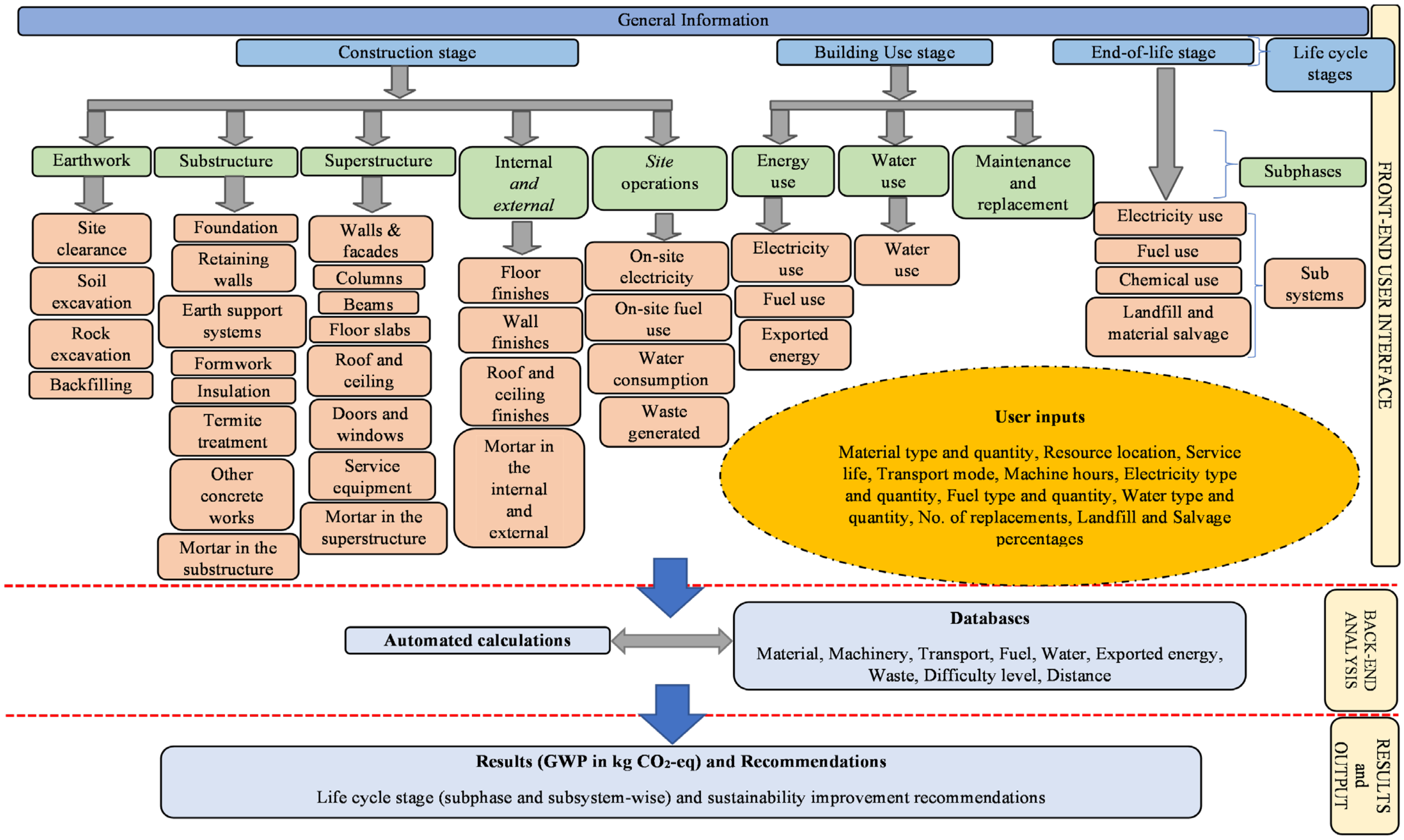

Fig. 2 Building Sustainability Assessment Tool (Building-SAT) framework

due to machinery used during earthworks and other relevant sub activities.

These features will allow professionals, such as civil engineers, LCA practitioners, designers and contractors not only in Sri Lankan building industry but also in the countries of this region to use the tool effectively and to manage and mitigate building life cycle impacts holistically. Many opportunities are also available to use the newly developed freely available tool to conduct benchmark studies of local buildings to move towards a low carbon economy. Building-SAT was released under the MIT open-source license with the hope of making the resource freely available to the scientific community and the industry. Thus, it is expected that this study would promote the development of similar WBLCA-STs and respective national data inventories for construction materials, applicable to the South Asian region. Building-SAT supports compliance with green building standards, promotes circular economy principles, and enhances the resilience of infrastructure. Its localized approach ensures relevance to Sri Lanka's climatic, economic, and regulatory contexts, driving meaningful environmental impact.

Outputs

The Building-SAT research project has successfully produced a functional Life Cycle Assessment (LCA) tool tailored for the Sri Lankan construction sector. The tool enables professionals to evaluate the GWP of buildings across multiple life cycle stages, due to material, energy, water, machines use and transportation. Additionally, the tool has been integrated with region-specific data, ensuring its relevance to local environmental, economic, and regulatory contexts. The output of the project includes a fully developed software prototype, supporting documentation, and training materials for end-users, aimed at promoting sustainable design practices in the built environment.

Outcomes

Today, Building-SAT tool is used by the professionals in the building industry as well as by researchers and students in Sri Lanka. The development of the Building-SAT tool has led to enhanced capacity among built environment professionals in Sri Lanka to assess and reduce the environmental impacts of buildings through a standardized, life cycle-based approach. As a result, the tool has facilitated the integration of sustainability principles into early-stage design and planning, supporting data-driven decision-making and improving compliance with green building standards. Building-SAT has also contributed to greater awareness and adoption of circular economy strategies in the construction sector, ultimately promoting resource efficiency, lowering embodied carbon, and aligning building practices with national climate resilience and sustainability goals.

Way forward

Building on the successful development and initial implementation of the Building-SAT tool, the next phase focuses on expanding its analytical capabilities in collaboration with the National Research Council of Sri Lanka. The enhanced version will incorporate a comprehensive suite of midpoint environmental impact categories—such as acidification, eutrophication, ozone depletion, and human toxicity—enabling a more holistic assessment of building sustainability. Additionally, the tool will integrate the estimation of the Building Circularity Index (BCI) and full Building Life Cycle Cost (LCC), supporting decisions that balance environmental performance with economic feasibility.

This advancement aims to establish Building-SAT as a robust, locally relevant decision-support system for sustainable and circular construction practices in Sri Lanka.

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Pervious Concrete Porosity and Compressive Strength

NRC IDG 19-045

The construction sector shaped and assisted our evolution and comfortable existence. The materials and technologies employed varied across history, while it had significant impact on the immediate environment, including global warming and virgin material depletion. Sustainability is often spoken in contemporary urban designs, that would promote both mitigating environmental impact and sustenance of construction materials for future generations. One such sustainable model that ensures water security is called 'Water Sensitive Urban Design – WSUD' or 'Low Impact Development – LID'. The purpose of this model is to retain the hydrologic characteristics of a catchment prior to urbanization. Pervious concrete is one potential structural solution, that enhances the permeability of urban paved surfaces, and thence contributes to moisture circulation in the micro-environment.

Performance parameters of pervious concrete, predominantly strength and permeability, varies extensively depending on design parameters such as aggregate characteristics, constituent ratios and compaction. The compressive strength varies from 1 MPa to 80 MPa while flexural strength varies between 0.1 – 8 MPa. Porosity is observed to vary from as low as 5% to approximately 50% while permeability varies between zero to well above 2.5 cm/s. The wet density of pervious concrete ranges from 1400 – 2600 kg/m3.

Although its primary application is on permeable pavements, pervious concrete can also be used as non-load-bearing structural walls, retention walls and thermal and sound insulation. The application sought will define the mix design of pervious concrete, typically requiring a prediction model for performance based on design parameters.

Although, pervious concrete is theoretically proven to assist mitigate the impact of urban development on the environment, more specifically on the hydrology of the catchment, implementation of the material in industrial scale production was limited due to two primary challenges. Unlike conventional concrete which is often modeled as a Bingham Plastic fluid, pervious concrete is modeled as discrete binder-coated aggregate particles (discontinuous material). This restricts implementation of the knowledge and prediction models existing for conventional concrete in pervious concrete. Zero compaction and zero workability slump) policy adopted in pervious concrete restricted movement of binder-coated aggregate particles, and thereby leading to unique packing in each casting. This leads to high uncertainty and heterogeneity which hinders mass production of the material for industrial applications that require uniform characteristics in mass productions.

This study assessed the unique characteristics of pervious concrete mix-designs to understand the impact of each mix-design parameter on the porosity distribution and compressive strength, two primary mechanical performance parameters of pervious concrete. The study assessed the performance encompassing the complete range of aggregate to cement ratio, compaction and aggregate size distribution to develop design profile and prediction models using empirical equations and advanced machine learning techniques. The study also investigated thorough statistical assessment of the impact of each parameter, incorporating the experimental uncertainties. Uncertainty propagation assessments were done to define the 95% confidence intervals of the prediction models to compute the constituents ratios for intended application with statistical confidence.

Increase in porosity is required for permeability of the material that simultaneously compromises the compressive strength of the same. Studies in the available literature have often resorted to add admixtures and additives to enhance the compromised compressive strength. It is understood however, typical applications of pervious concrete being paving material substitution which would be laid at a vast expanse of area, would incur significantly higher costs, should the application envisage to enhance compressive strength with chemical additions, making it financially infeasible. This study at last assess the possibility of contriving morphological changes on the aggregates to enhance the compressive through the process of milling. Prediction models have been developed to incorporate the degree of milling as a parameter to assess the mechanical properties of pervious concrete.

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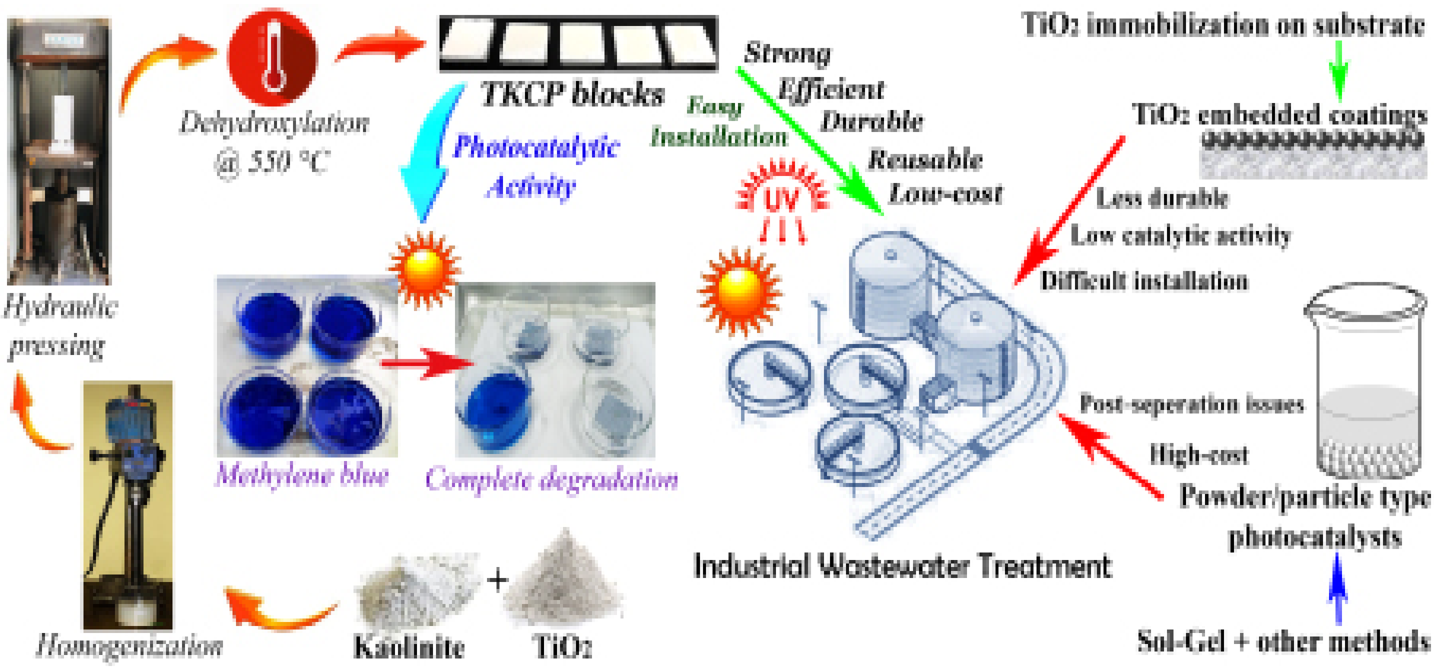
NRC 18-009

A stable composite based on titanium dioxide and clay as an effective photocatalyst for wastewater treatment Characterization

NRC IDG 20-014



Introduction

The industrially feasible TiO2-clay based photocatalysts are essential to overcome the practical barriers that are intrinsic to currently available clay-based photocatalysts. This article demonstrates the fabrication of heterogeneous composite photocatalyst consisting of TiO2 and clay that has shown improved catalytic activity and strength, ensuring industrial viable photocatalyst. The composite photocatalyst is prepared via an economical method, employing mechanical compression and thermal activation, forming TiO2-clay hybrid matrix. Amount of clay primarily determines mechanical strength and photocatalytic efficiency of composite photocatalyst where composite with the lowest clay percentage results in a homogeneous matrix that consists of tiny TiO2 particles embedded clay sheet-like structure. The TiO2 particles embedded clay sheet-like structure is responsible for the high specific surface area and small pore size, increasing the active surface that is available for effective disintegration of organic contaminants. The composite photocatalyst with the largest clay fraction attributes to a considerable amount of surface defects due to large clay fragments and TiO2 agglomerates, which results in low flexural strength and catalytic activity.

Methylene blue degradation on composite photocatalyst with the maximum TiO2 percentage results in the highest rate constant, exhibiting improved photocatalytic activity due to well-organized matrix and high specific surface area. The composite photocatalyst can be obtained in variable sizes and shapes that ensure dynamic wastewater treatment applications. This technology is widely applicable to many industries that need effective wastewater treatment upon heavily flooded organic contaminants. The tailor-made photocatalysts fabrication also minimizes the engineering and technical constraints in upgrading to real commercial wastewater treatment plants. Although this technology is driven under renewable energy source like sunlight, it drastically reduces utilizing fossil fuel and chemicals for wastewater purification that ultimately ensures the user and environment friendly nature. The low capital investment, labor and energy cost that associated with the fabrication process are the key advantages for integrating this technology with commercial level multi-scale applications.

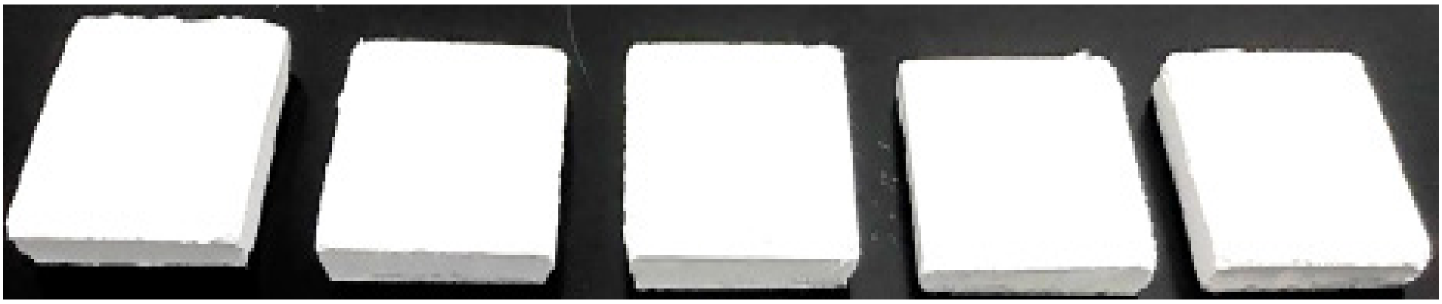
Outputs

In this research an effective and stable TiO2-clay composite photocatalysts to mineralize a broad spectrum of organic pollutants present in wastewater was developed.

Outcomes

A binder-free solid-state composite photocatalyst consists of TiO2-clay for an effective industrial wastewater treatment powered by renewable sunlight or UV-lights

TiO2-clay composite photocatalyst



Way forward

Currently we are in the process of fabricating photocatalysts for the pilot-scale and commercial wastewater treatment, targeting mainly organic contaminants. Taking a step further, we intend to determine the antibacterial property that is clearly being an advantage of obtaining a dual functioning product. The tailor-made product with specified shape and dimension, as we expected to fabricate using different moulds ensure the dynamic commercial applications, minimizing technical constraints related to conventional techniques

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NRC 20-014

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These projects clearly identify the research areas to be addressed and their commercial potential. Through this program, researchers are encouraged to work on research requirements of the industry, ultimately leading to commercialization of research outputs that generate revenue for the country.

Target Oriented Multidisciplinary Research Programme (since 2013): Worth around Rs 50 million each, these projects are awarded for a five-year period and focus on ten areas identified in the National Science and Technology Report where research and development interventions are immediately needed. Five projects funded for 2014/2015 include: improving the dairy industry for self-sufficiency in milk, developing a polyvalent anti-venom for snake bites, community mobilization and integrated vector management for dengue control, an interdisciplinary study on chronic kidney disease of uncertain etiology (CKDu) in the north central region, and ensuring food security through developing climate-smart agriculture techniques. The NRC has not only funded research for the scientific community of Sri Lanka but has also contributed to the production of PhDs, MPhils/MScs, publications and patents. Producing trained researchers strengthens the skilled research workforce trained at a National University on a scientific problem relevant to Sri Lanka. The NRC's encouragement to submit to SCI journals has invariably resulted in our scientists sharing their research findings with the international community. The NRC has always encouraged research, and even during funding limitations, has continued to provide support as research is crucial for the development of a country.




Events & Staff Highlights

Commencement of year 2025

NRC welcomed the New Year 2025 by organizing a Pirith Chanting Ceremony on January 1, 2025. With refreshed minds, all the NRC employees administered the Oath of the Government Servants for the duties and work responsibilities of the Council.




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