I.3: Accelerator Subsystem Development Facility

The Lake Side Workshop, constructed approximately 30 years ago to support the accelerator-based program in technical area of RRCAT, required extensive modifications to meet the institution's current needs. The project aimed to adapt the existing rectangular building—with low bay areas on both sides and a high bay in the centre to accommodate three modern lab facilities. Renovation plans include incorporating a mezzanine steel structure, installing essential utilities, and reconfiguring spaces to optimize functionality. Following the renovation, the facility was renamed as the Accelerator Subsystem Development Facility.

Design Vision: To transform the aging structure into a contemporary facility, the core intent focused on maximizing usability, ensuring functional segregation, enhancing accessibility, and upgrading services to meet current standards. The planning strategy emphasized multi-user accommodation, spatial optimization, and inclusive infrastructure upgrades to create a versatile, efficient, and accessible environment.

Sustainability approach:

Design Philosophy: The Non-Destructive Testing (NDT) investigation of the Lakeside Workshop was carried out to evaluate concrete uniformity, corrosion risk, and overall structural health. The assessment used Ultrasonic Pulse Velocity (UPV) Test (80 locations), Rebound Hammer Test (80 locations), Half-Cell Potentiometer Test (22 locations), Carbonation Depth Test (11 locations), and Concrete Core Test (3 samples) along with visual inspection. UPV values ranged from 3968 m/s to 4156 m/s, while Rebound Hammer values ranged from 38 to 42, indicating consistent surface hardness. Carbonation depth ranged from 51 mm to 71 mm, particularly in few columns, where visible cracks were also observed. The half-cell potentiometer test (22 locations) showed a higher probability of reinforcement corrosion in these columns and in bathroom beams. Most roof beams and slabs showed no major visible defects during inspection.

The core test results (3 samples) showed equivalent corrected cube compressive strength ranging from 21.73–23.65 N/mm² (average ≈ 22.8 N/mm²), indicating satisfactory concrete strength at the tested locations. All test results were found to be within the permissible limits of relevant IS codes. Overall, the structure was assessed to be mostly in sound condition, except for a few columns requiring rectification and suitable repair measures to address localized deterioration. The report recommended structural repair of the deteriorated columns and corrosion protection treatments, particularly in moisture-affected areas such as bathroom, and restoration works have been carried out accordingly.

Seismic Requalification: The Lakeside Workshop was taken up for detailed structural assessment as part of the redevelopment planning. Over the past decades, there have been significant revisions in Indian seismic design codes, making it necessary to undertake seismic requalification of existing structures to ensure their continued safety and compliance with current standards. Accordingly, a comprehensive structural evaluation was carried out using Finite Element (FE)–based analysis software. Both static and dynamic analyses were performed in accordance with the latest IS seismic codes to evaluate the structural response under updated loading conditions. In addition, static nonlinear analysis was conducted to better understand the structural behaviour under potential extreme loading scenarios and to assess the reserve strength and deformation capacity of the structure. Based on the results of these analyses, the structure was found to be structurally adequate and qualified for continued use under the revised seismic requirements.

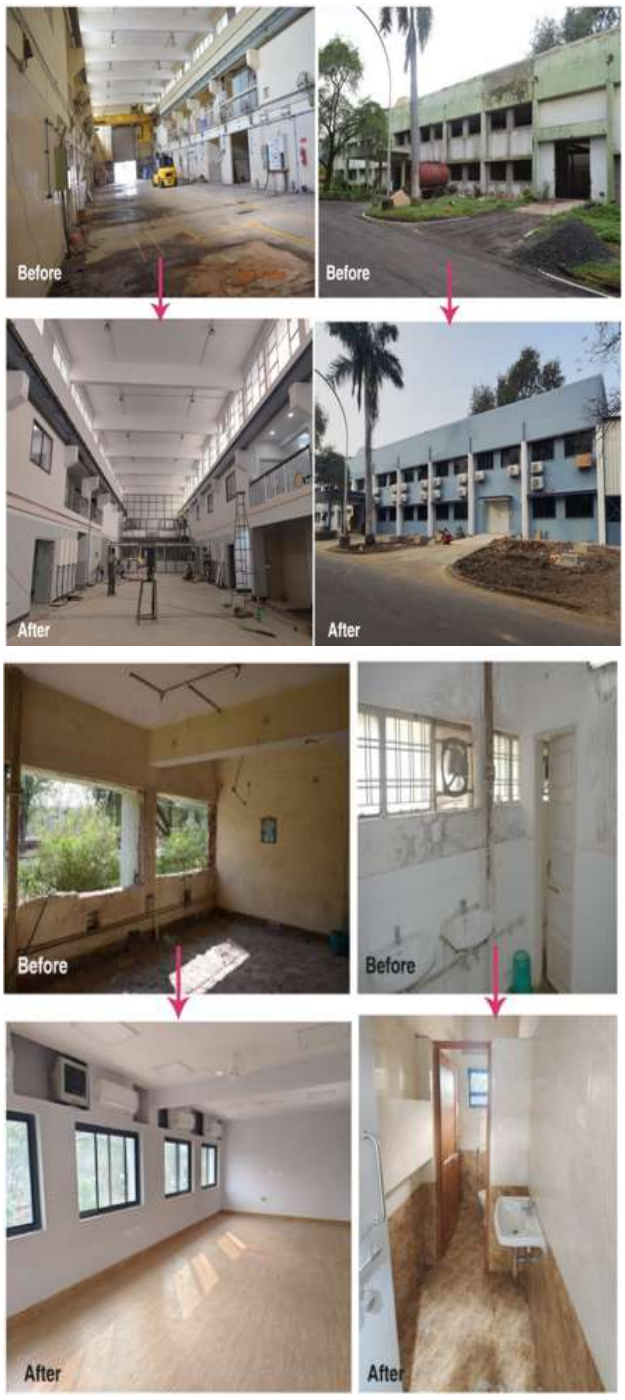
Renovation strategies: Renovation strategies included reconfiguring the building layout to accommodate three modern laboratory facilities with updated flooring, partitions, and ceilings. Provisions were made for lab sinks, ventilators, split AC units, grid false ceilings, cable duct wiring, and aluminium partitions at designated locations. A steel mezzanine structure was integrated within the building to increase usable laboratory space, along with a steel staircase for internal access to the mezzanine level. Additionally, the existing structure was modified to suit the proposed layout, including selective removal and addition of walls as required by different Science groups to optimize space utilization.

Construction Aspects: The scope of works broadly included dismantling and demolition of old finishes, earthwork, structural steel work for the mezzanine floor, Reinforced Cement Concrete (RCC), reinforcement, brickwork, plastering, painting, various floorings, waterproofing treatments, removal of old wooden doors, rolling shutters, and windows, and provision and fixing of new steel doors, PVC doors, aluminium fabrication including Aluminium Composite Panel (ACP) work, installation of galvalume roofing sheets, installation of a deck slab system for the mezzanine floor as well as structural repair and strengthening of concrete members.

Electrical system & HVAC upgradation: To improve electrical safety, operational reliability, and energy efficiency, the laboratory electrical infrastructure has recently undergone a comprehensive upgrade. The major improvements implemented are outlined below:

- *Advanced Distribution Protection System:* The earlier SFU-based Power Distribution Boards (PDBs) have been upgraded to microprocessor-based MCCB/MCB protection systems**.** This provides enhanced protection, better fault detection, improved reliability, and easier monitoring of electrical loads.
- *Improved Fire-Safe Electrical Wiring:* The existing PVC wiring has been replaced with FRLSH (Flame Retardant Low Smoke Halogen) copper wiring**.** This upgrade significantly enhances fire safety by minimizing smoke generation and toxic emissions in case of electrical faults.
- *Energy-Efficient Lighting System:* The previous Fluorescent Tube Light (FTL) based illumination has been replaced with LED lighting. The new system provides better illumination quality, reduces energy consumption, and requires lower maintenance.
- *Installation of Energy-Efficient Air Conditioning:* Five-star rated split air conditioning systems have now been installed to maintain a stable working environment for both personnel and sensitive laboratory equipment while ensuring high energy efficiency.
- *Electrical Panel Capacity Enhancement:* The electrical panels have been upgraded to accommodate the increased power demand resulting from new equipment installations and the addition of air-conditioning systems, ensuring reliable and safe power distribution.
- *Benefits of the Upgrade:*
  - Improved electrical safety and protection
  - Enhanced reliability of power distribution
  - Increased energy efficiency
  - Better environmental control within the laboratory.
  - Provision for future load expansion.

Cost & time saving: This adaptive reuse project was completed at a cost of Rs. 310 lakhs compared to an estimated Rs. 1320 lakh for equivalent new construction, resulting in nearly 75% cost savings. In addition, the project was delivered within 1.5 years whereas new construction would have taken approximately 2.5 years resulting in 40 % of Time saving.



Before and after renovation of the facility

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