Bureau of Energy Efficiency

सत्यमेव जयते
Government of India
Ministry of Power

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Augmenting Nature by Green Affordable New-habitat

A Courtyard for Revolutionary Change in Building Energy Efficiency

An International Conference on Building Energy Efficiency

9th-11th September, 2019 | Hotel The LaLiT, New Delhi

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THIS PRESENTATION WAS SHARED BY

C.K.Varma

Central Public Works Department

FOR THE SESSION:

"Emerging Construction Practices & Technologies"

DURING ANGAN 2019

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Creating Innovative Solutions for a Sustainable Future

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CPWD's Sustained efforts for Sustainability

(Augmenting Nature by Green Affordable Habitat-
International Conference on Building Energy Efficiency)

C. K. Varma, Chief Engineer, CPWD-10.09.2019

Central Public Works Department –A Construction Arm of Govt. of India

established in 1854 during sixth year of Lord Dalhousie's tenure as Governor General, CPWD since its inception is primarily performing two roles :-

- Principal Technical Advisor to Govt. of India- in framing policies related to construction sector, develops Specifications, Schedule of Rates, Manuals, Guidelines etc.

- Premier Construction Agency to Govt. of India- undertakes construction of offices, residences of Central Govt. Departments, Ministries and other works of National interest like Border fencing, Flyovers ,Samadhis, Important Monuments etc. funded by Govt. of India.

Few Built Environments by CPWD in recent Past

- Dr. Ambedkar National Memorial, Delhi
- Supreme Court Additional Office Complex, New Delhi
- National Institute of Securities Markets , Navi Mumbai
- Incubation and Data Centre, STPI, Mohali
- National Salt Satyagraha Memorial, Dandi
- PNB Head Quarter Building at Dwarka , New Delhi
- Parliament Annexe Building Extension , New Delhi
- Dynamic Facade Lighting - North Block / South Block, New Delhi
- Indira Paryavaran Bhavan, New Delhi

Glimpses of CPWD Constructions

CPWD uses various technologies to enhance energy efficiency, integrate renewable energy, water conservation etc. Few of these are:

1. LED Technology- For efficient Lighting
2. Human Centric Lighting-For enhancing well being & Performance of inhabitants
3. Sensor Technology –Wireless, occupancy & Daylight sensors
4. Solar Thermal-For water Heating
5. Solar Photo voltaic-For onsite Electricity Generation
6. IBMS- For monitoring & efficient control of Building Services
7. Dual Plumbing- For water Conservation
8. Water Aerator- For water saving
9. Drip Irrigation-For Water conservation
10. STP- For waste water Recycling
11. Water Harvesting- For conserving Rain water
12. Double Glazing with Argon Gas – For less thermal ingress

Now
Demonstration
of
these technologies
in
CPWD Constructions

Dr. Ambedkar National Memorial, Delhi

About

- Built in the memory of Dr B.R.Ambedkar- the architect of constitution of India who breathed his last at this place, this memorial got completed in 2 years at a cost of Rs 100 Crores, spread in an area of 2 acres & dedicated to the Nation by Hon'ble PM on 13.04.2018.
- In a plot area of 7274 sqm& built up area of 6758 sqm, the Memorial has Ground floor + 3 basements & is a RCC framed structure.
- Replica of Ashoka pillar at Sarnath made of Ashtadhatu stands at front . Replicas of the stone pillars at Sarnath, made of Jaisalmer stone stand on sides.
- The side wall of the entry to the basement is decorated with golden hands depicting various *mudras*.
- Building has exhibition gallery illustrating the days spent by Dr Ambedkar. One side of the basement is dedicated to the drafting of the constitution by him. It also has his huge bronze statue & nearby his statue showing him sitting under a banyan tree.

Dr. Ambedkar National Memorial, Delhi

Unique Features

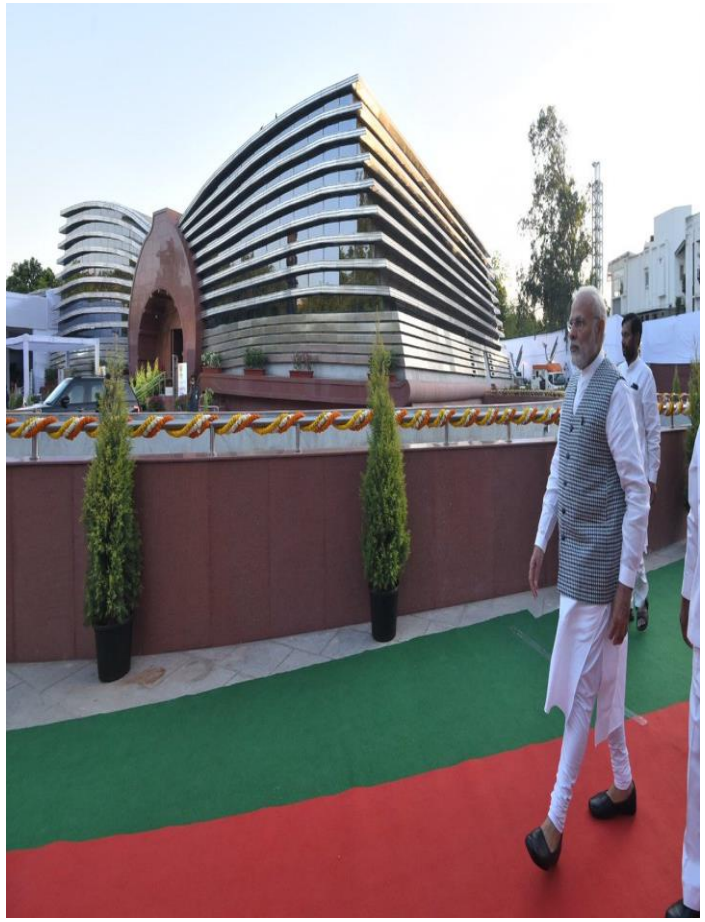
- Very unique Building Envelope.
- In the form of an open book depicting the constitution of India.
- S.S cladding in curvature and its precise positioning to get open book shape façade.
- Hollow space between the two successive fins is filled up with Double Glazing Unit(DGU) of 24mm thickness in facade for effective air-conditioning and saving in electricity.
- The pages of the book are working as in built shading devices thus preventing thermal ingress into the building.

Dr. Ambedkar National Memorial, Delhi

Technologies & Materials used:

- Static and dynamic effects by State of the art technology ,indoor LED walls , projection mapping and edge blending with projectors, holographic, artistic and museum light effects .
- Animatronics -A robotic device animating Dr Ambedkar operated through proximity sensors.
- Interactive Table : Work stations and interactive screens for browsing information relating to constitution and Dr. Ambedkar.
- Façade lighting:- Strip of LED nodes put in the tracks fixed to S.S. fins & programmed for various displays .
- Luminaries work on Ethernet based network using VSM (Video System Manager) controller.
- Musical Fountain:- Colorful musical fountain which is digitally controlled by DMX(Digital Multiplex-A lighting control protocol) control system.

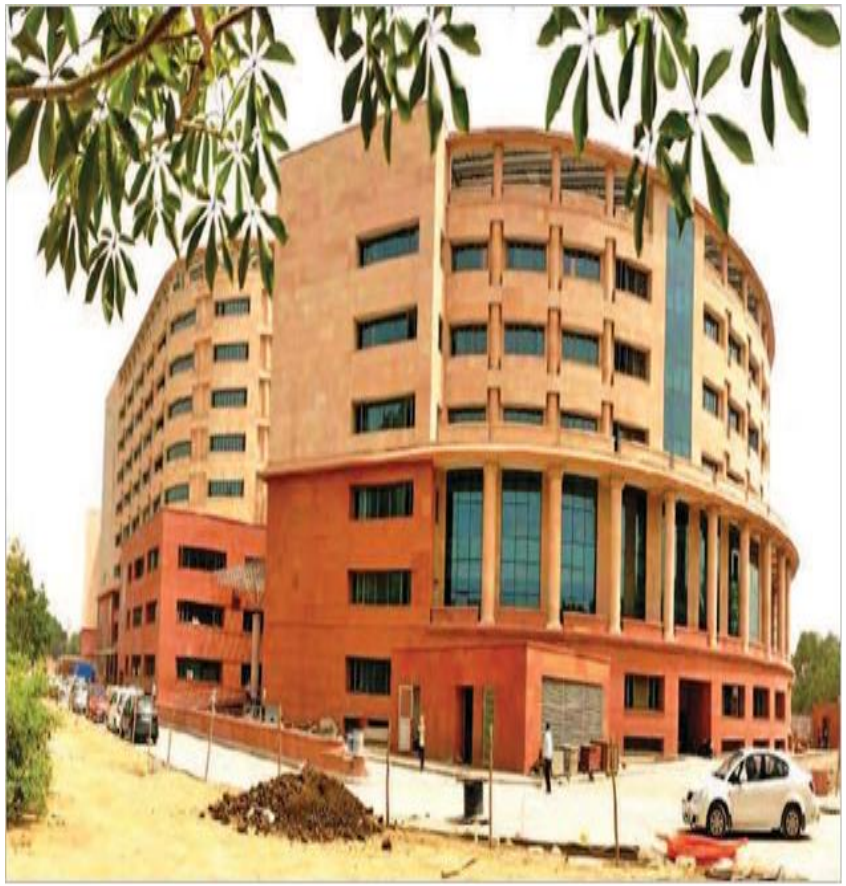
Dr. Ambedkar National Memorial, Delhi



Green Features

- Fly ash bricks(lighter , less costly& made of waste from coal based power plants) & fly ash admixed cement concrete(cost effective & increases durability)
- Waste water recycling through 25 KLD STP .
- Roof top grid connected solar of 50 KW installed on the curved roof.
- Energy efficient LED lights.
- Rain water harvesting.
- Low VOC paint/adhesive.
- Rockwool products in false ceiling(thermal insulation & acoustic control).
- VRV (Variable Refrigerant Volume) Air Conditioning-Energy Saving more than 20%.

Supreme Court Additional Office Complex, New Delhi



About

- The Supreme Court - the highest judicial & constitutional court of India has this Additional Office Complex on 12.19 acres land adjoining Pragati Maidan, New Delhi with total built-up area of 1,80,700 square meters at an estimated cost of Rs.884.30 crores.
- The complex houses the non judicial functions like library, offices, Registry, Storage of records, offices for Lawyers, waiting & interaction area for litigants, Parking etc.
- The complex was inaugurated by Hon'ble President of India on 17.07.2019
- The existing complex of the Supreme Court is linked through an underpass with the additional complex.
- Has 5 Functional , 1 Service Block & 3 Level Basement car parking .

Supreme Court Additional Office Complex, New Delhi

Unique Features

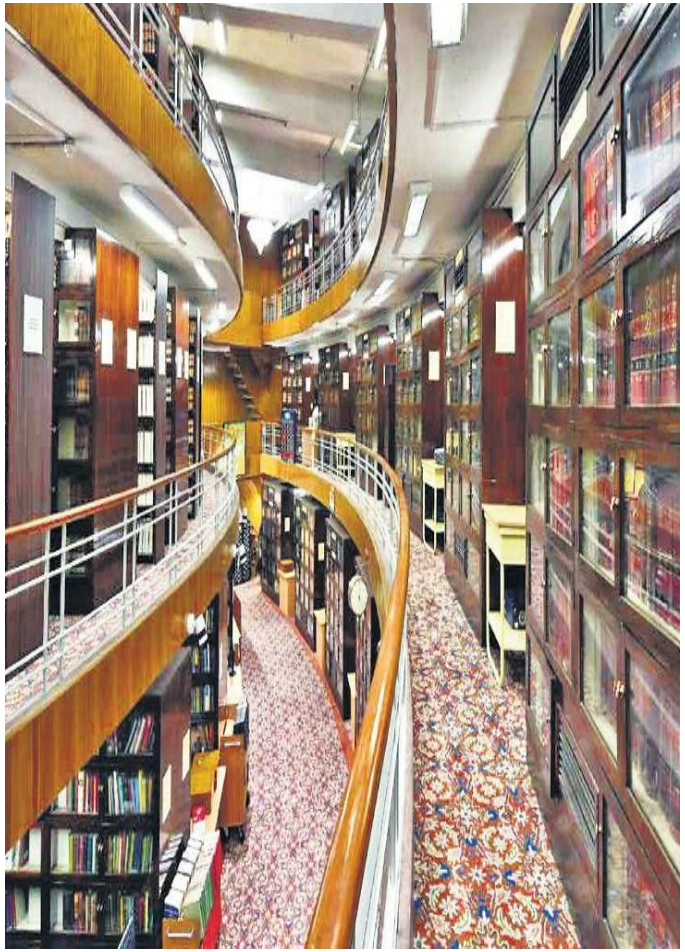
- Used Solar PV rooftop utilizing max. rooftop space
- Thermal insulation System for building envelope.
- The building complex has cavity wall insulation system
- Optimal thickness of insulation to conform the thermal transmittance value as per ECBC
- IT-enabled security framework spanning 825 CCTV cameras .

Supreme Court Additional Office Complex, New Delhi

Technologies & Materials used

- VFD control Ventilation System(Energy Efficient) for ventilation of basement.
- Centralized Parking Management System(Software based system to manage parking efficiently) in three basements with 1800 car capacity.
- fiberglass wool insulation(for reducing the thermal load) board of 30 mm fixed between the outer wall made of C&D block masonry and inner wall of AAC blocks.
- Zero discharge Complex through in house STP- will provide recycled water for horticulture & Airconditioning .
- Rain water Harvesting System.

Supreme Court Additional Office Complex, New Delhi



Green Features

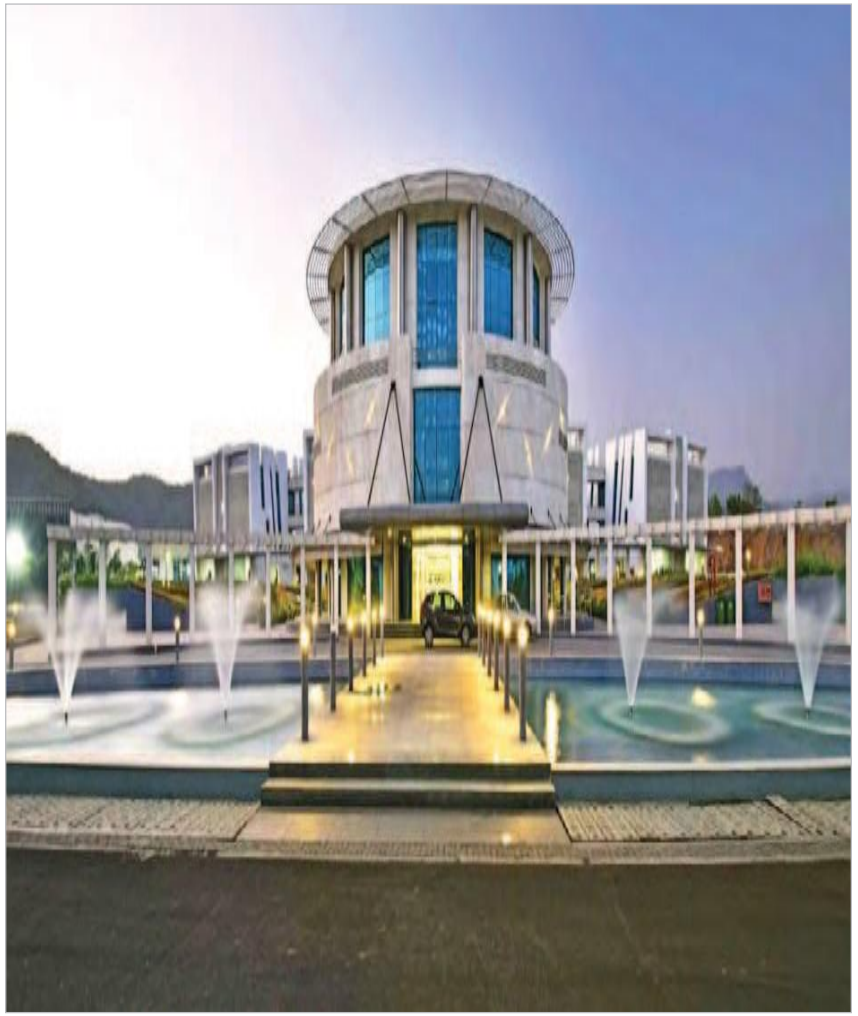
- No red brick has been used on this project saving about 35,000 MT of fertile soil.
- About 17.50 lacs of C&D waste blocks have been consumed on this project.
- Largest Roof Top Solar Power Grid of 1400 KWp capacity – maximum solar capacity in Delhi NCR till date.
- All LED based and energy efficient light fixtures with day light & occupancy sensors for optimizing power consumption.
- Integrated Building Management System for management of incoming power supply, HVAC system, Fire Alarm and Fire Fighting System.

National Institute of Securities Markets, Navi Mumbai

About

- An educational initiative of SEBI.
- Inaugurated by Hon'ble PM of India on 24 Dec.2016.
- The project cost Rs 315 Crores.
- The campus houses state of the art design Finance library, IT infrastructure, smart class rooms, seminar hall & conference hall.
- It has amphitheater, ultra-modern auditorium & multipurpose hall, recreation facilities for various activities.

National Institute of Securities Markets , Navi Mumbai



Unique & Green Features

- Fully air conditioned (energy efficient) campus
- Water bodies created to improve the micro climate
- Large numbers of patterns used in false ceiling & wall paneling to provide elegant looks like cloud false ceiling in dining hall.
- Wi-Fi enabled classrooms, interactive learning & Broadcasting facilities.
- LED fittings.
- Sewage treatment plant.
- Rain water harvesting system.
- Solar water heating & PV panel systems.

National Institute of Securities Markets , Navi Mumbai

Technologies & Materials Used

- Glass Fibre Reinforced Concrete Panels in façade of orientation block having curvilinear surface to avoid use of natural stone. These are also weather proof , durable , can be made in any shape & consist of glass fibers of @ 3.5 to 5% by weight, silica, white cement and admixtures. Water repellant coating was applied on the panels by dipping panels in required solution to withstand atmospheric conditions.
- Eco-friendly Autoclaved Aerated Concrete (AAC) Blocks(lightweight, pre-cast, foam concrete building material, low density (550 kg/m3)) in all masonry work. Also has good acoustic & insulation properties.
- Expanded Polystyrene (EPS) Geofoam Blocks used for construction of steps in academic blocks being very light & thus useful in weight reduction.

National Salt Satyagraha Memorial, Dandi

About & Technologies Used

- A project of Ministry of Culture, dedicated to the Nation by Hon'ble PM on 30 Jan 2019 on the occasion of Mahatma Gandhi's 71st death anniversary.
- The memorial has 24-narrative murals depicting various events and stories from the historic 1930 Dandi March.
- A Single storey building in RCC frame with sloping roof & roof covering with Manglore tiles for contemporary architecture & design of the Dandi March period.
- 7.5 acre land developed as green area .

National Salt Satyagraha Memorial ,Dandi

Unique & Green Features

- This is net zero energy memorial.
- 41 Solar trees installed within the complex .
- The generation is 144KW.
- Out of this 90 KW is grid interactive and 54KW is offline system in two parts of 26 KW & 28 KW with battery backup.
- E&M services -DG Sets, LT panels, street lights, illumination of Marchers, pathways, glass crystal with laser lights etc. have energy efficient features.

Dynamic Facade Lighting - North Block / South Block, New Delhi

- Dynamic façade lighting, a visual treat of the Capital provides volume as well as focus lighting having 16 million colour combinations to highlight architectural features of the building.
- It was switched on by Senior most MTS of Home Ministry Mr. Mahipal Singh on 11.10.2017 in presence of Hon'ble PM.
- Done at a cost of Rs 15.4 Cr,cost will be recovered in 6-7 years with energy cost reducing to Rs86.4 Lacs per Year.
- The light fittings have external lenses to facilitate change of beam angles as per site requirement.
- About 800 light fittings have been used in this project which involves about 40 km long cable laying (Electrical & Data cables).
- All light fittings have dust, vermin, moisture and outdoor weather protection of the highest order (IP-66) with robust design.
- Since then it has been taken up in Rashtrapati Bhavan, India Gate, Parliament House ,Banaras etc.

Sustainable Development Initiatives by CPWD

1. Use of fly ash bricks/blocks made from C&D waste/AAC blocks in masonry works for non structural members made mandatory in place of clay bricks for the works in Delhi-NCR, Mumbai, Chennai, Kolkata, Bangalore, Hyderabad, Ahmadabad and Surat.
2. CPWD is using C&D waste materials in its works as sand, aggregates, bricks, PCC blocks, Paver Blocks etc. In Delhi alone, more than 30000 Metric Ton of C&D waste and about 20 lacs recycled blocks have been utilized resulted in saving of equal quantity of natural stone and sand, reduction in CO_2 emissions by over 600 Metric Tons and saving in water use by about 40,000 kilo litres.
3. During last 5 years, over 11 million metric tons of fly ash used in CPWD in shape of bricks, concrete and cement additives resulted in reduction in CO_2 emissions by about 1 million metric tons.
4. Sewage Treatment Plants are being installed in the existing GPOAs and GPRAs maintained by CPWD as a water conservation measure. More than 20 Sewage Treatment Plants (STP) have been installed in various locations across the country.
5. For Solid waste management, Waste convertor composting machines are being installed at GPOAs and GPRAs. About 20 machines have been installed by now.

Sus. Dev. Ini. Continue…..

6. To address the problem of depleting ground water resources CPWD has so far provided about 1100 rain water harvesting systems in different locations/ areas under its jurisdiction in the country.
7. CPWD has produced 209.23 lacs unit of Green Energy up to December 2018 by 5.3 MWp capacity solar rooftops in 40 nos. GPOA buildings. This has resulted in the reduction of 16739 Tons of CO2 emission by avoiding production of conventional electricity savings 20.92 crores @ Rs. 10 per KWH.
8. CPWD has carried out the work of Energy Efficiency Measures in 147 nos. GPOA buildings from April 2017 to December 2018. This has saved 468.11 lacs units of electrical energy resulting in the reduction of 37449 tons of CO2 emission by avoiding production of conventional energy Savings 46.81 crores @ Rs. 10 per KWH.
9. Towards greening of Delhi, as a special drive, CPWD planted over 60,000 trees at various residential colonies and office complexes maintained by it.

Conclusion

- CPWD has always worked being in the forefront while adopting new Materials, Practices & Technologies, which is quite evident from its constructed environments.
- It has used all kind of materials which are green(local & renewable) like Bamboo, locally available, having low embodied energy, U value etc.
- It has also carried out works in various modes of construction like Execution with detailed engineering, Project Management including consultancy & Supervision, Turnkey Contracts, Performance contracts i.e. ESCO &RESCO, EPC contracts etc.
- Similarly, it has used various established as well as emerging technologies in its constructions.
- Also it is on the verge of trying and adopting new digital as well as disruptive technologies like drones, Robots, GIS(Geographic Information System) mapping, BIM(Building Information Modelling), BIPV(Building Integrated Photo Voltaic), Hydro ceramics (Sweating Building Envelope), AI based Security system etc.

THANKS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