

# ARCHITECTURE DBR

## **VOL – II PART - B**

*CONSTRUCTION OF “PROPOSED CENTRE OF  
EXCELLENCE OF FIRE TESTING TRAINING AND  
RESEARCH LABORATORY AT IIT, PATNA”.*

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## 1. PROJECT BRIEF:

The proposed Construction of center of excellence of fire testing training and research laboratory at IIT Patna will be equipped to evaluate the fire safety performance of materials, structural assemblies, and building systems in accordance with national (BIS/IS codes) and international standards (ASTM, ISO, EN). The facility will include fire resistance test furnaces, reaction-to-fire testing equipment, smoke density measurement systems, and flame spread apparatus, enabling comprehensive analysis of fire behavior. The proposed G+2 building has been segregated into 3 parts.

S.N	Description for Centre of excellence of fire testing training and research laboratory at IIT Patna	Building Height	Building Area (Excluding the area of cavity)
1	Live Fire Testing Building	G+2	452.94 Sqm
2	Fire Testing Laboratory	Ground	792 Sqm
3	Institute	Ground	588.0 Sqm (including mummy rooms)
	Total Built up Area		1832.94 Sqm

## 2. SITE LEVELS

The EPC Contractor shall get detailed site survey done with existing contour levels, immediate surrounding features, site access road, existing site features and tree positions (mentioning the variety & girth), prior to any construction activity at site.

























The Finished Ground Level of the site shall be maintained 150mm (to be decided as per the site conditions by engineer in charge) above the level of the existing approach road at the entrance gate of the campus. The gradient of the site shall be designed such that there are no pockets of waterlogging and the storm water is properly drained off.

























The EPC contractor shall provide the site plan with proposed FGL, road levels & plinth levels of all buildings, for approval from BCD and the primary consultant, prior to execution.

The top of road level shall be maintained at 75mm (to be decided as per the site conditions by engineer in charge) above the FGL. The building plinth levels shall be measured from the FGL at the building entrance.

### 3. CIVIL SPECIFICATIONS – ALL BUILDINGS

S.N.	Description	Specification
1.	<b>Foundation</b>	Pile/ Isolated/ Raft foundation as per soil investigation report and structural Design.
2.	<b>Super Structure</b>	RCC Framed Structure
3.	<b>External brickwork</b>	
	Live Fire Testing Building	Cavity wall with an air gap as per the approved architectural GFC drawing and finished within refractory brick, mortar, cement in (1:6) 100mm RCC band at mid lvl.
	Fire Testing Laboratory	250mm thick fly ash brickwork in C.M. (1:6) 100mm RCC band at mid lvl.
	<b>Institute – Ground Floor</b>	250mm thick fly ash brickwork in C.M. (1:6) 100mm rcc band at mid lvl.
4.	<b>Internal brickwork</b>	
	Live Fire Testing Building	i. 250mm thick refractory brickwork in refractory C.M. (1:6) 100mm RCC band at mid lvl.
	Fire Testing Laboratory	ii. 250mm or 125mm fly ash brick work in C.M. (1:4) with 100mm RCC band at
	<b>Institute – Ground Floor</b>	iii. 250mm or 125mm fly ash brick work in C.M. (1:4) with 100mm RCC band at
5.	<b>Flooring Sub-Base</b>	i. 100mm PCC (1:2:4) (along with nominal reinforcement)) over brick flat soling and 100mm sand as per the approved GFC drawing.
6.	<b>Damp proof course</b>	ii. 50 mm thk. Cement concrete 1:2:4 (cement to be mixed with required waterproofing chemical as per manufacturer spec. along with nominal reinforcement) wherever required.
7.	<b>Anti-termite treatment</b>	i. Preconstruction application along the retaining walls, Foundation, plinth filling & external periphery of all proposed buildings. (At the rate of 7 ltr/sqm). Note :- As per BCD SOR / DSR
8.	<b>Plinth/ floor to floor/ parapet heights</b>	As per approved architectural drawings.
9.	<b>Door Specification</b>	

i	Automatic sliding glass door – For Main Entrance to office building	Automatic sliding glass door as per specifications approved from the engineer in charge. Providing and fixing auto sensor automatic sliding door with the mechanism all complete accessories and fittings inclusive of 12mm plain toughened glass etc. complete including taxes and royalty and as per company specification and direction of E/I.  Note: - Self-Adhesive Vinyl Sheet Glass Film on glass door has to be applied as per the approved design by E/I.																																				
10.	Live Fire Testing and Training Facility and High temperature material testing and simulation lab	Fire rated door for maximum hours available in market . The specification needs to get approved from the E/I. The window to be provided in 2 layers to withstand the heat upto minimum of 4 hours.																																				
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i	Doors for High temperature material testing and simulation lab	Factory made Fireproof door (with vision panel with fireproof glass (refer glass specifications from BIS- IS2553 PART-1). Fire sandwich door is proposed																																				

ii	Flush Door for Institute	Factory made 35 mm Wooden flush door of HDHMR board as per specification with waterproof laminate on inside face and High-Pressure Decorative Laminates. And for physically disabled toilet both way swing flush door of same specification.																																																				
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	Large Scale Fire Testing Lab and in Institute	Aluminum Window with insulated glass pane																																																				
12.	MS Work	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting,																																																				

		<p>fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. As per Drawing and specification approved from the BCD and should be duly vetted.</p> <p>All the MS work for institute and railing work for staircase for both the staircase should be pre painted and needs to be applied as mentioned below:</p> <ul style="list-style-type: none"> <li>• Pre Prepare the surface:</li> </ul> <p>Remove grease, dust, dirt, and other contaminants from the surface. If there is rust, use a rust remover. For heavy rusting, you can blast clean the surface or use de-rusting chemicals.</p> <p>Apply primer: Use an epoxy zinc phosphate primer to create a smooth base for the PU paint.</p> <p>Mix the paint: Stir the base and hardener together in the recommended ratio. Let the mixture stand for about 10 minutes to initiate the reaction.</p> <p>Apply the paint: Apply the PU: paint in multiple thin coats using a brush, roller, or spray gun. Avoid drips and streaks.</p> <p>Let it dry: Allow the PU paint to dry to the touch before applying additional coats. Follow the manufacturer's drying time.</p> <p>Let it cure: After the PU paint dries, it needs time to fully cure. Avoid touching or disturbing the surface during the curing period.</p> <p>For Live Fire Testing Building and Large-Scale Fire Testing: The <b>intumescent</b> paint shall be applied in the truss and grill work as per the design approved, as per the IS code. Prior to application it has to get approved from E/I</p>
<b>13.</b>	<b>Partitions</b>	
b	Office Full Height Partition – up to false ceiling as per approval from BCD.	75mm thick partition with FR&MR grade magnesium oxide HDFR Board / BWP Ply board with suitable finish of Paint/ /Laminate/6mm or 3mm Acrylic/Vinyl Graphics / Veneer on it, as got approved from client by EPC contractor, as approved by client.
c	Office Low Height Partition- height up to 1350mm (1050mm ht. solid partition + 300mm ht. toughened glass )	75mm thick partition with FR&MR grade magnesium oxide HDFR Board / BWP Ply board with suitable finish of Paint/ /Laminate/6mm or 3mm Acrylic / Veneer on it, as got approved from client by EPC contractor, as approved by client.

<b>14.</b>	<b>Waterproofing</b>	
	All underground structure.	Providing and carrying out waterproofing treatment to wall by using 4 mm thick Proofex Engage.
	Waterproofing of Terrace	Waterproofing: Polyurea WH100 system at 1.5mm thick.
	Toilet	High Performance & Ultra flexible polymer modified elastomeric waterproofing membrane system Brushbond Ultraflex as per description mentioned in DBR.
	UGR and OHT	Providing and carrying out waterproofing treatment by using 4 mm thick Proofex Engage
<b>15</b>	<b>Finishes</b>	
	Exterior Wall paint and Façade Ceiling	<b>Stony Coat: Stone Effect-</b> Using a combination of color sands, Suzuka Stony Coat crafts the authentic effects of natural stones. Its granular surface gives the wall a bold and prominent finish. Its colors can be customized to suit your design and decor. The sample to be approved from engineer in charge.
<b>16.</b>	<b>Furniture</b>	<p>Furniture is to be provided as per the floor layout plan and as per their requirement and the Furniture Layout Plan to be approved by the BCD before installation. 3D view must be submitted by the contractor for approval by BCD before construction. 3D Office layout with Laminated Partition walls should be submitted by the contractor for approval.</p> <p><b>Note:</b> All furniture is subjected to sample approval by the BCD before installation.</p>
<b>17.</b>	<b>Toilet Cubicles</b>	





STANDARD CUBICLE SPECIFICATIONS

DIVIDERS

12mm thick compact laminate options available for dividers panels, providing a robust structure fixed with premium quality Wall Fixing Profiles.

MID & END PANELS

Mid and End Panels provide stability to the whole structure made from 12mm thick compact laminate, hence providing a thick durable structure.

DOORS

600mm wide doors are made from 12mm thick compact laminate.

DIMENSIONS (IN MM)

Width of Cubicle	1000
Depth of Cubicle	1500
Height of Divider	1820
Height of entire cubicle	1995
Width of Door	600
Height of Door	1785
Ground Clearance	150

**20 days Prior to scheduled date of execution, EPC contractor shall conduct a meeting at site to discuss requirements, including application methods in presence of Client, Architect, Owner, Contractor, Installer, and manufacturer’s authorized field representative.**

**Contractor Should submit the methodology before execution. Also, sample approval for the same to be done.**

## 4. DETAILED SPECIFICATION

### A. EXPANSION JOINT SPECIFICATION

Providing and fixing and all height and depth between beam and column and foundation 50 mm thick filler board (BIS : 1838- part 3) (Supreme DURABoard HD 100 or equivalent), having minimum density  $100 \pm 10$  kg/cum, Non staining with maximum water absorption 0.080kg/sq.mt when tested as per ASTM-D 3575 including cost and conveyance of all materials, cutting and placing to the required size, labor charges, Sundries ,wastage etc. at all levels complete as per drawings and as direction and satisfaction of engineer in-charge. The filler board will become one side of the shuttering while the expansion joint is being is created or has to be pressed inside the expansion joint cavity if the slab construction is already over.

Providing and laying EPDM-150 grade (175 Width) having elongation at break 120%Tensile strength at break 5.5 kg/cm<sup>2</sup>, 3 mm thick to cover the expansion joint gap appropriate epoxy adhesive should be used to bond EPDM with the concrete surface as directed by Engineer- in- charge as per manufacture's specification at all heights and fastener.

Cladding - Providing and fixing 2 mm thick Aluminium sheet to cover EPDM. The MS sheet should have round shape slots for fastener at one end and oval shape slots at another end for free movement of MS sheet covering

### B. WATER PROOFING

#### 1. WATER PROOFING & ALL UNDERGROUND STRUCTURE.

Retaining wall outer side – Preformed EPDM/ SBS membrane on retaining walls (FOSROC/MyK Armet/Sika)

Retaining wall of UGT–

Swellable type water stop tape, 19mm x 25mm thick in linear meter (expansive nature) for construction joints treatment of RCC structure such as raft slab, retaining walls, water storage tank and at the junctions of raft slab with the retaining walls etc. After cleaning the surface, one coat of required primer for swellable water stop tape shall be applied throughout the length of the joint

@3.78 litre per 240 running meter. Over the primed surface swellable type water stop tape shall be placed. The work shall be carried out all complete as per specification and the direction of the engineer-in-charge. The product performance shall carry guarantee for 10 years against any leakage. (FOSROC/MyK Armet/Sika)

Integral crystalline admixture for waterproofing treatment to RCC structures like basement raft retaining walls, Reservoir, sewage & water treatment plant, subway and bridge deck etc. at the time of transporting of concrete into the drum of the ready-mix truck, using integral crystalline & admixture @80%(minimum) to the wt of cement content per cubic meter of concrete or higher as recommended by the manufacture specification in reinforced cement concrete at site of work. The material shall meet the requirements as specified in ACI-212 -3R -2010 i.e by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydro static pressure. The crystalline admixture shall be capable of self-healing of crack up to a width of 0.50 mm. The works shall be carried out all complete as per specification & the direction of the E/I. The product performance shall carry guarantee for 10 years against any leakage. (FOSROC/MyK Armet/Sika)

Grouting- At each construction joint nozzle must be pre-installed and grouting should be done. Cement grouting followed by Epoxy grouting to make it water tight from the water ingress from the water table around the retaining wall. (FOSROC/MyK Armet/Sika)

Sub soil drainage system - Perforated minimum 160 mm dia pipe of min. 6kg/cm<sup>2</sup> wrapped with geofabric membrane and the pipe should be surrounded with graded gravels for controlled percolation of water. The pipe should drain into the sump and 2 (two) automatic (one on standby and other functional) sump motor should be installed with NRV.

Note : Fine Sand Filling to be done in excavated land till raft.

## 2. TOILET AREA WATER PROOFING

- Nozzle Grouting:(if required) - Nozzle grouting to be done with cement slurry admixed with expanding grout admixture Cebex 100. Cebex 100 to be mixed @225 gm per bag of cement after ponding test for 72 hours
- Bore packing: Providing necessary formwork for packing the bore using suitable arrangement (depending upon site conditions). Applying a coat of styrene- butadiene based polymer

coating using Nitobond Packing the gap using non-shrink cement polymer based grout using Conbextra GP2 up to the surface of the bore whilst the Nitobond SBR Latex is in tacky state and then sealing with epoxy putty NITOCOTE VF.

### **Application of waterproofing layer**

Providing and Applying High Performance & Ultra flexible polymer modified elastomeric waterproofing membrane system Brush bond Ultra flex

For best results damp the surface before coating with Brush bond Ultra Flex. After application of first coat, the second coat must be applied in perpendicular direction to the first coat when it has dried (approximately 5 to 6 hours at 30°C).

Provide Nito bond tape /Glass fibre cloth of 45 to 60 GSM over construction joints and coving area between second and third coats of Brush bond Ultra flex.

Brush bond Ultra Flex conforms to the requirements of:

- DIN 1048, Part 5, 1991
- ISO 7783:2018
- ASTM D412: 2013
- Brushbond UltraFlex is deemed to be suitable for use with potable water sources as tested as per USFDA CFR 175-300

### **Properties:**

- Pot life at 27°C: Approx. 1.0 hr
- Adhesion to substrate (ASTM D4541:2002): > 1.0 N/mm<sup>2</sup>
- Shore A hardness (ASTM D2240:2010): 79
- Tensile strength N/mm<sup>2</sup> (ASTM D412-2013): >1.50 N/mm
- Elongation at break (ASTM D412-2013): > 150%
- Water Permeability EN12390 (part8) 2008) Negative Pressure: Nil
- Water vapour transmission (ISO 7783:2018): ~20.81 g/m<sup>2</sup>.hr
- Crack bridging: (ASTM C1305): 1.0 mm
- Foot traffic\*: 6 hr +/- 1 hr
- Coverage: One 25kg pack covers approximately 16m<sup>2</sup> at about 1.0mm
- Thickness depending on surface conditions and water usage.

### 3. TERRACE WATERPROOFING

Recommended System For Waterproofing: Polyurea system at 1.5mm thick.

#### **Product description:**

Polyurea is a hand-applied, flexible, two components, and rapid curing hybrid Polyurea system, designed as a waterproofing and protective coating. It combines the advantages of seamless coating with long life cycles and high durability.

#### **Application Methodology:**

- i. Surface preparation by mechanical means to remove laitance, loose particles which may hinder bond strength of the waterproofing system to the mother slab.
- ii. Ponding test to be done for 48 hours for 100 mm water depth to observe if any seepage or dampness in the slab.
- iii. Injection Grouting: All damp areas to be treated with pressure grouting with cement slurry admixed with non-shrink additives Cebex 100 at low pressure of max upto 2 to 2.5 kg/sq cm.
- iv. All construction joints to be treated with pressure grouting with cement slurry admixed with non-shrink additives **Cebex 100** at low pressure max upto 2 to 2.5 kg/sqcm at 300mm c/c. Dampen areas has to be treated locally on the damp spot with same process.
- v. All hairline cracks shall be chased to a 6mm x 6mm groove and filled using Epoxy Primer putty **Nitocote VF**.
- vi. Bore packing of sleeves & rain water pipes to be done using free flow non-shrink grout **Conbextra GP2** for a minimum width of 20mm all around the sleeves by placing a leak-proof shuttering all around and then sealed with epoxy putty Nitocote VF.
- vii. Coving at all the junctions to be done for a size of 50mm X 50mm with polymer modified mortar prepared by mixing with in required ratio Nitobond SBR Latex + Water required for mortar consistency.
- viii. Application of primer: Apply epoxy primer Nitoprime 31 over the surface after proper mixing at a proper coverage as per technical datasheet.

- ix. Application of waterproofing layer: Polyurea WH100 is Fast setting, hand-applied hybrid polyurea elastomeric waterproof coating. Apply to substrate using roller, brush, trowel or squeegee. Use a spiked roller afterwards to remove entrapped air and prevent surface bubbling. Normal recommended dft of Polyurea WH 100 is 1.5mm. Applied product can be walked on carefully after 2 hours minimum depending on temperature; is light duty trafficable (e.g. light foot traffic) after approximately 24 hours, and fully serviceable after 2-3 days.
- x. Ponding test again for 48 hours to make sure there is no leakage
- xi. Geo textile (minimum 120 GSM) to be laid over the waterproofing membrane as a separation layer. (For areas with landscaping, a layer of drain cells with 150 GSM geo fabric is to be laid again before landscaping).
- xii. **Protective Layer (Horizontal):** Providing and applying screed concrete mixed with water proofing admixture rystalline at the dosage of 200ml/bag of cement over geotextile fabric to a required thickness as per site requirement.
- xiii. **Protective Layer (Vertical):** Sprinkle quartz sand adequately to provide mechanical bonding. Providing and applying plastering mixed with water proofing admixture crystalline at the dosage of 200ml/bag of cement over waterproofing system as per site requirement.

## C. ROOFING SHEET SPECIFICATIONS

### 1. Polycarbonate sheet – Large Scale Fire Testing Laboratory

Supply and Installation of 16mm thick Multi-cell standing seam polycarbonate panels having U value of 2.1 W/m<sup>2</sup>K as per EN 16153 & EN ISO 10077-2. Panel shall be 900mm wide with standing seam on both sides for better wind uplift. Panels shall have minimum six layers with truss bridge design for higher flexibility and strength. The panels should work on angular daylighting concept with translucent and opaque combination, for better thermal insulations and diffusion of light especially with white and clear combination designed for tropical regions & shading throughout the day for better ambient temperature below the roof. The system shall be secured using suitable connectors with double tooth grip lock locking mechanism and fixed on purlin with trapezoid SS fasteners & 3 numbers self-drilling screws holding the base of the standing seam offering best stability with pull out load of min 7000N tested as per ISO 6892-1998 and IS 1608-2005. Panels must satisfy dart drop

impact test as per IS 14443-97 shall show no sign of breakage which have been exposed to UV for 500 hours (min) as per ASTM G155. Panels shall have yellowness index of not more than 15 units as per ASTM D 1925 when tested on sample exposed to UV for 500 hours as per ASTM G155. Panel shall be closed at the end with additional Aluminium U profile as required. All Aluminium profiles should be factory finished or mill finished. Panel shall be fixed over MS structural steel / MS purlin conforming to the detail technical specifications as per approved architectural drawings.

## **2. Tata Lysaght for Large Scale Fire Testing Laboratory**

Providing and fixing colour coated trapezoidal „LYSAGHT TRIMDEK 1072” Profile sheet manufactured by Tata BlueScope steel having nominal 1072 mm supply width nominal 28 mm deep ribs with subtle square fluting in the five pan at nominal 203 mm centre- to- centre. The end rib shall be designed for anti-capillary action, to avoid any seepage of water through the lateral overlap. The feed material shall be made out of COLORBOND Steel. The base metal shall be of High Tensile Steel of 550 MPa minimum yield strength with hot dip metallic coating of Zinc-Aluminum alloy (55% Aluminum, 43.5% Zinc and 1.5% Silicon) AZ150, of minimum 150 Gms./ Sq.mtr total of both side as per ASTM A792 or AS 1397. The Base Metal Thickness shall be 0.45 mm (BMT) and the Total Coating Thickness (TCT) shall be 0.50 mm. The Paint shall be Super Durable Polyester paint system, factory painted and oven backed with a total coated thickness of 35microns (nominal) as per AS/NZS 2728 Type 4. The exterior side shall comprise of 20 microns (Nominal) paint over 5 Microns (Nominal) corrosion inhibitive solvent based primer. The interior side shall comprise of 5 Microns (nominal) reverse / back coat over 5 microns (nominal) corrosion inhibitive solvent based primer. The pigments shall be in- organic ceramics based pigments. There shall be no lead content in the paint system. The sheet shall be fixed over a layer of Glass wool 50 mm thick using self-drilling /self-tapping screws of size (5.5 x 55 mm) with EPDM seal, complete up to any pitch in horizontal/ vertical or curved surfaces, excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.

Using -Fasteners: Self Drilling Screw with nominal 40-micron zinc coated, Hex head, as per AS 3566-2002 Class 3 fasteners of approved make (Boustead or equivalent) with EPDM washer. (12-14x55)

## 5. PROPOSED FAÇADE OF BUILDINGS

The proposed building façade is finished with texture paint and the sample needs to get approval from the Engineer in Charge and before finalization sampling needs to get approved from the department.



## 6. FINISHING SCHEDULE – ALL BUILDINGS

Common Area	Floor Finish	Skirting/ Dado Finish	Wall Finish	Ceiling
Live Fire Testing Lab	Refectory Brick lining with refractory adhesive and sealant and finished with intumescent paint	Refectory Brick lining with refractory adhesive and sealant upto roof level and finished with intumescent paint		Refectory Brick lining with refractory adhesive and sealant and finished with intumescent paint
Cooman Lobby area and Staircase– All finishes as per SOR	Granite Flooring. Size as per the approval from the E/I	150mm height skirting		Acrylic Paint – Color to be approved from E/I
High Performance material testing and	Refectory Brick lining with	Refectory Brick lining with refractory adhesive and		Refectory Brick lining with



<b>simulation lab – All finishes as per SOR</b>	<b>refractory adhesive and sealant and finished with intumescent paint upto 240 mins (4 hrs) fire withstand</b>	<b>sealant upto roof level and finished with intumescent paint upto 240 mins fire withstand</b>		<b>refractory adhesive and sealant and finished with intumescent paint upto 240 mins fire withstand</b>
<b>Material Storage – All finishes as per SOR</b>	<b>Kota Stone of size – 800 x 800 m</b>	<b>150 mm height Kota stone</b>	<b>Finished with intumescent paint upto 120 mins fire withstand</b>	<b>Finished with intumescent paint upto 120 mins fire withstand</b>
<b>Large Scale Fire Testing – All finishes as per SOR</b>	<b>Kota Stone of size – 800 x 800 m</b>	<b>150 mm height Kota stone</b>	<b>Finished with intumescent paint upto 120 mins fire withstand</b>	<b>Truss to be finished with with intumescent paint upto 120 mins fire withstand and primer and other material as per IS standard code.</b>
<b>Office Area</b>				
<b>Cooman Lobby area , Waiting Area and Staircase – All finishes as per SOR</b>	<b>Granite Flooring. Size as per the approval from the E/I</b>	<b>Granite 150mm height skirting</b>	<b>Acrylic Paint – Color to be approved from E/I</b>	<b>Acrylic Paint – Color to be approved from E/I</b>
<b>Toilet Area– All finishes as per SOR</b>	<b>Granite – 600 x 600 mm Flooring. Size as per the approval from the E/I</b>	<b>Granite on wall upto ceiling height</b>		<b>Metallic Ceiling</b>
<b>Electrical room /Store – All finishes as per SOR</b>	<b>Kota Stone – 800 x 800 mm</b>	<b>Kota - 150mm height skirting</b>	<b>Acrylic Paint – Color to be approved from E/I</b>	<b>Acrylic Paint – Color to be approved from E/I</b>
<b>Conference cum Meeting Hall</b>	<b>Bamboo Flooring</b>	<b>Bamboo Wall Paneling</b>		<b>Fire rated gypsum perforated ceiling and grid ceiling</b>

## **7. SIGNAGES**

All building names to be mentioned in steel letters of a suitable size and position. To be illuminated at night, using façade lighting. Directional signages to be placed at road turnings. (Reflective Signages for night visibility).

Signages should be mentioned in Hindi and English. Content of all signages to be approved by BCD.

## **8. PHYSICAL MODEL/3D SIMULATED MODEL**

A 3D printed model & 3D Walkthrough in a suitable scale of the site (minimum A1 sized) showing buildings, roads, pathways, trees and other relevant features to be placed at the Administrative Building Entrance Lobby

encased in glass box & 1080p in case of 3D walkthrough.

## **9. STANDARDS AND GUIDELINES TO BE FOLLOWED BY THE EPC CONTRACTOR**

- a. All relevant statutory approvals (Environmental Clearance, Municipal Approval, Fire Approval & any other as required) to be taken prior to execution
- b. BCD EPC SOP to be followed for approval of all drawings.
- c. NBC 2016 & Bihar Building Byelaws 2014 (amended in 2022) to be followed.
- d. Scale of amenities (Civil, Plumbing & electrical) for residential buildings to be as per relevant CPWD GPRA standards (as per unit areas).
- e. CPWD Civil Specifications 2019 (Volume 1 and 2) to be followed for all civil works.
- f. CPWD handbook on barrier free and accessibility to be followed for universal accessibility
- g. Generic requirement even though not mentioned in DBR for proper functionality of building has to be adhered.
- h. All testing of materials /products and approval of drawings, vetting etc. lies in the scope of contractor itself. No Extra Payment against it shall be made.
- i. For Safety of nearby buildings necessary arrangement/precautions/methodology should be taken and no extra payment in this regard will be made.
- j. Barricading of site as per the requirement should be made and all safety and environmental laws should be followed.

## 10. GREEN BUILDING RATINGS

As the building is to be constructed as per GRIHA norms and intended for minimum 3 Star rating, The EPC Contractor has to comply all the specific requirement at their own cost such as barricading the site at required height, covering the construction material, sedimentation tank, conserve the top soil, arrangement of wheel wash for all inward and outward vehicle, segregation of all scrap material, disposal of hazardous extract generated during construction at appropriate place etc. The EPC contractor shall appoint a suitable green building consultant for preparation and submitting required energy simulations, documentations and other requirements to GRIHA for getting minimum 3 -star rating. The EPC Contractor should extend their all-out support to the GRIHA Team as and where required for achieving the desired GRIHA rating. Following guidelines shall be followed as per rating targeted during construction and design of various components:

### 10.1. Low-impact design

- a) The incorporated design strategies should enable the project to protect the natural site features (topographical/microclimatic) and incorporate them into the project design.
- b) Annual Heat Gain should be controlled through favorable orientation and design of facades and unfavourable areas like the ‘West’ should have service areas/ buffer zones.
- c) Site plan should be designed to preserve existing vegetation/ existing water bodies /other topographical features like boulders etc. and trees should be used to control heat gain.

### 10.2. Design to mitigate UHIE

More than 50% of the site surfaces visible to sky (including building roofs but not the landscape area\*) should be either soft paved/covered with high SRI coating ( $SRI > 0.5$ )/shaded by trees/shaded by vegetated pergolas/shaded by solar panels or any combination of these strategies

### 10.3. Site Imperviousness Factor

High imperviousness on site leads to rapid runoff of rainwater reduces urban rainwater recharge and contributes to conditions of urban flooding. Net Imperviousness factor of site should meet the NBC 2005 norms & the site is designed such that post-construction storm water discharge from the site is zero.

### 10.4. Air and Water Pollution Control

The intent of this criterion is to minimize air and water pollution during construction on site.

- a. Provide 3-meter-high barricading around the construction area - Mandatory
- b. Wheel washing facility at the vehicular entrance of the site
- c. Cover of fine aggregate and excavated earth on site with plastic/geotextile sheets
- d. Water sprinkling on fine aggregate (sand) and excavated earth
- e. All diesel gensets on site to have proper chimneys with their outlet facing away from the site.
- f. Develop and implement a spill prevention plan (to control effects of spill from hazardous materials like bitumen, diesel etc.) on site

#### 10.5. Preserve and protect landscape during construction

- a. Ensure that no existing mature tree is cut on site OR transplant mature trees within the site and ensure they survive OR Plant 3 trees for every 1 tree cut of the same native/naturalized species OR any combination of these for all mature trees on site – Mandatory
- b. Increase total number of trees on site by 25% above the pre-construction phase OR Plant 4 trees for every 1 tree cut of the same native/naturalized species
- c. Preserve top soil during construction, maintain its fertility (during construction phase) and use for landscape post-construction

#### 10.6. Construction Management Practices

- a. Adopt staging during construction on site
- b. Adopt strategies to prevent/reduce movement of soil (not top soil) outside the site through adoption of various strategies (like soil erosion channels, sedimentation control etc.)
- c. Adopt strategies (at least 3 from the list below) to manage water during construction -
  - Using gunny bags for curing and using ponding for curing
  - Monitoring to avoid leaks and water wastage
  - Use of additives to reduce water requirements during curing
  - Use of treated waste water/captured storm water
- d. A construction waste management plan for segregation of construction waste, its safe storage and on-site/off-site recycling is developed and implemented in the project.

#### 10.7. Energy Efficiency

- a. Ensure that the project meets the mandatory requirements of ECBC\* & all fans must be BEE star rated.
- b. Peak heat gain through building envelope (for each AC building individually) should meet the GRIHA Building Envelope Peak Heat Gain Factor thresholds.
- c. 100% of outdoor lighting fixtures (lamps + lamp housing) should meet the luminous efficacy requirements of GRIHA.
- d. All lamps + lamp housing must demonstrate luminous efficacy of at least 75 lumens/watt.
- e. Demonstrate (through simulations) that project EPI is below GRIHA benchmark.

#### 10.8. Renewable Energy Utilization

On-site/Off-site renewable energy system installation to offset a part of the annual energy consumption of internal artificial lighting and HVAC systems as per GRIHA.

#### 10.9. Low ODP Materials

- a. All the insulation used in building should be CFCs and HCFCs free.
- b. All the refrigerant in the HVAC and refrigeration equipment should be CFCs.
- c. The fire suppression systems and fire extinguishers installed in the building are free of halon.

#### 10.10. Achieving indoor comfort requirements (visual/thermal/acoustic)

- a. The WWR and SRR to not exceed 60% & 5% respectively & all the fenestrations should meet the SHGC requirement of ECBC-2007/Weighted Façade average SHGC (for each orientation) meets SHGC requirements of ECBC-2007. OR conduct solar path analysis for windows of AC as well as non-AC spaces, to ensure that the window is completely shaded for the duration between 10:00 am on 1st April to 15:00 on 30th September.
- b. Minimum of 25% of the living area should meet adequate level of daylight (daylight factors) as prescribed in SP 41.
- c. Artificial lighting design to fall within limits (lower and higher range limits) as recommended space/task specific lighting levels as per NBC\*\* and to meet a minimum uniformity ratio of 0.4.
- d. Demonstrate that project can achieve the thermal comfort requirements of NBC 2005 OR ASHRAE 55 OR requirement of Indian Adaptive Comfort Model

- e. The indoor noise levels should be within the acceptable limits as specified in NBC 2005 and key noise source on site (like DG sets, chiller plants etc.) should have sufficient acoustic insulation as per NBC 2005 norms.

#### 10.11. Maintaining good IAQ

- a. The building must meet the minimum requirements of CPCB National Ambient Air Quality Standard (NAAQS) for quality of fresh air; and ASHRAE Standard 62.1–2010, Sections 4–7, Ventilation for Acceptable Indoor Air Quality (with errata), or a NBC-2005 for quantity of fresh air. The clause shall cover treatment of outdoor air for predominantly PM 10 and PM 2.5.
- b. Monitoring the CO<sub>2</sub> , temperature and RH at the occupied spaces or at AHUs for the air conditioned spaces.

#### 10.12. Use of low-VOC compounds

- a. Ensure that all interior paints are low-VOC \*(as mentioned in the GRIHA manual) and lead-free.
- b. Ensure that all adhesives and sealants used shall be low-VOC \*& that interior composite wood products do not use urea-formaldehyde as a bonding resin.

#### 10.13. Use of Low-Flow Fixtures and Systems

The intent is to ensure reduction in the building water consumption through the use of low flow fixtures. Reduce water demand through selection of low-flow fixtures by 30% below the GRIHA base case.

#### 10.14. Reducing Landscape Water Demand

The intent is to promote the planting of native/naturalized flora and use of water efficient irrigation system to reduce the demand for landscape water. Reduce landscape water demand by at least 30% from the GRIHA base case.

#### 10.15. Water Quality

- a. Water used for various purposes like drinking, irrigation etc. shall conform to the BIS standards.
- b. The STP installed on site meets the CPCB norms.

- c. On site Water Reuse Demonstrate that the project meets the on-site water reuse requirements (through on-site recycle and reuse of waste water and use of on-site harvested rainwater) in at least 20% of its annual water requirements for domestic use, buildings, landscape and utilities.

#### 10.16. Rainwater Recharge

The intent is to promote the recharge of groundwater aquifers. Recharge of surplus rainwater into aquifer (through appropriate filtration measures).

#### 10.17. Utilization of BIS recommended waste materials in building structure

- a. The intent is to promote use BIS recommended wastes (such as fly ash, blast furnace slag etc.), having properties similar to conventional construction materials for building construction. These being low embodied energy materials as well as waste products, reduce the need for virgin materials in the building structure and help divert waste from landfills. Minimum 15% replacement of Ordinary Portland cement with fly ash\* by weight of cement used in structural concrete and plaster/ mortar.
- b. Minimum 40% composition of building blocks/bricks by fly ash\* by volume, for 100% load bearing and non-load bearing masonry walls.

#### 10.18. Use of low-environmental impact materials in Building Interiors

Project should demonstrate that at least 25% of all materials(false ceilings/internal partitions/paneling /flooring/internal door & window panels & frames) calculated by surface area used for building interiors are low-impact materials like :

- a. Stones from India.
- b. Composite wood-based products.
- c. FSC Chain of Custody certified products.
- d. Manufactured products with at least 5% recycled content.
- e. Products with EPD (cradle to gate) analyzed and published as per ISO 14025 / ISO 21930.
- f. Products with water footprint (cradle to gate) analyzed and published as per ISO 14046.

#### 10.19. Avoid post-construction landfill

- a. Provide infrastructure (multi-colored dustbins/different garbage chutes) to building occupants to ensure segregation of waste at source.
- b. Provide dedicated, segregated and hygienic storage spaces in the project site to store different wastes before treatment /recycling.
- c. Provide contractual tie-ups with waste recyclers for safe recycling for recyclable wastes like metal, paper, plastic, glass etc.

#### 10.20. Treat organic waste on-site

Implement strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas etc.).

#### 10.21. Labor Safety and Sanitation

- a. Ensure compliance with the NBC (2005) safety norms for providing the necessary safety equipment and measures for construction workers.
- b. Ensure provisions for drinking water, hygienic working & living conditions and sanitation facilities shall be provided for the workers.
- c. Provide a crèche facility for children of construction workers.

#### 10.22. Design for Universal Accessibility

Compliance with National Building Code norms on Requirements for Planning of Public Buildings Meant for Use of Physically Challenged.

#### 10.23. Dedicated facilities for Service Staff

- a. Provide dedicated resting rooms for the service staff on site.
- b. Provide toilets for the service staff on site.

#### 10.24. Increase in Environmental Awareness

Adopt measures to create environmental awareness.

#### 10.25. Smart Metering and Monitoring

- a. Comply with the Basic and extended metering requirements of GRIHA.
- b. Installation of one-way or two-way communicable smart metering and monitoring system capable tracking energy and water consumption.



### 10.26. Operation & Maintenance Protocols

Provision for a core facility/service group responsible for the O&M of the building’s systems after installation as per GRIHA requirements. Inclusion of a specific clause in the contract document of the systems supplier for providing training to the core facility/ service group responsible for the O&M of the building systems after installation, on the operating instructions/dos and don’ts/ maintenance requirements for the specific system. Development of a fully documented O&M manual/ CD/ Multimedia /information brochure enlisting the best practices for O&M of the building’s systems.