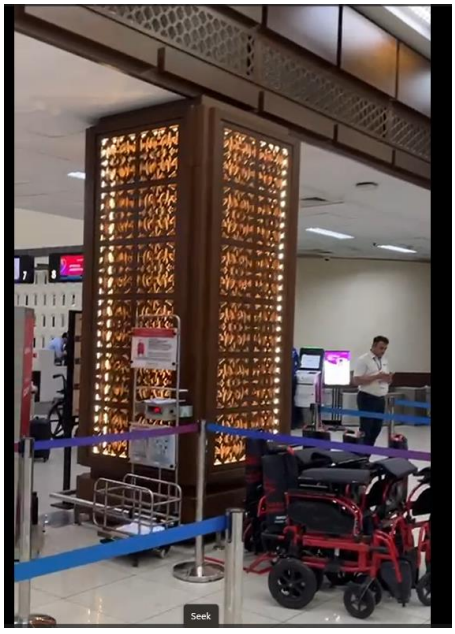
Name and Address of Certificate Holder:
M/s INDOWUD NFC PRIVATE LIMITED
First Floor, New No. 30,
First Main Road East,
Shenoy Nagar,
Chennai - 600030
Website: www.indowud.com

Performance Appraisal Certificate
PAC No.: **1072-P/2025**
Issue No.: **01**
Date of issue: **03/06/2025**

INDOWUD NATURAL FIBRE COMPOSITE (NFC) PRODUCTS



User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Affairs
Government of India
Core 5A, First Floor, India Habitat Centre, Lodhi Road, New Delhi – 110 003

Tel: +91-11-2463 6705, 2463 8097; Fax: +91-11-2464 2849
E-mail: info@bmtpc.org Web Site: http://www.bmtpc.org

PERFORMANCE APPRAISAL CERTIFICATE

FOR

NATURAL FIBRE COMPOSITE (NFC) PRODUCTS

ISSUED TO

M/s INDOWUD NFC PRIVATE LIMITED, CHENNAI

STATUS OF PAC NO: 1072-P/2025

S. No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1	2	3	4	5	6	7	8	9
1	1	03/06/2025				02/06/2026		

CONTENTS

PART 1: CERTIFICATION

1.1 Certificate Holder: **M/s Indowud NFC Private Limited**

First Floor, New No. 30,
First Main Road East
Shenoy Nagar, Chennai – 600030
Tel: 044-42158586
Email: info@indowud.com, jain@indowud.com
Website: www.indowud.com

1.2 Description of the Product

1.2.1 Name of the Product- Indowud Natural Fibre Composite (NFC) Products

1.2.2 Brand Name- Indowud NFC

1.2.3 Brief Description

Indowud Natural Fibre composite is an engineered wood alternative made primarily from agricultural fibers & polymers. It is designed to resemble wood in texture & appearance, and exhibits suitable performance for wide ranging applications.

It is manufactured primarily in the form of boards using a blend of natural fibers, PVC resin along with various fillers and additives such as lime stone, UV stabilizer, fire retardents, etc. to ensure required strength and durability. The product is useful for various applications such as exterior & interior cladding, panelling, furnishing, joinery and outdoor applications. The material can also be thermoformed and printed on.

The boards are available in the standard size of 8 feet x 4 feet (2440mm x 1220mm), with thickness options of 6mm, 8mm, 12mm, 15/16mm, 18mm, & 25mm.The boards have a rough surface on both sides, which enhances its usability. Further, the customized dimensions are also available of any size & thickness.

Salient features of the product include;

- NFC boards are eco-friendly with no wood used. It uses agricultural residue-rice husk to the extent of 30% of total weight of the product that are often discarded or burned, thus transforming this waste into sustainable panels using advanced process. The agricultural residue used is more than 110PHR (Parts per hundred Resin).
- The boards are recyclable, termite proof, resistant to pests / microorganisms, water & flame resistant and smoke suppressant.
- The product is resistant to weather conditions, moisture & temperature changes.
- It can be thermoformed, making it versatile in shaping and forming and useful for large number of applications including complex patterns.

- Compatibility with numerous surface treatments as staining, printing, varnishing, painting, and overlaying with veneer or laminate.
- Suitable for CNC routing and can be easily handled with commonly available woodworking tools.
- Exhibits good screw-holding capacity, which can be further improved as per the requirement.
- The product is non-hazardous RoHS certified & EPD verified. It is free from formaldehyde, VOC emissions, lead and asbestos components.
- Possesses high thermal insulation (similar to wood) and decent acoustics properties.

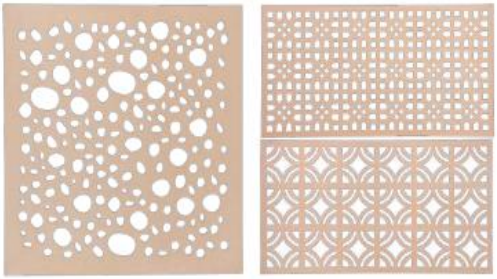
1.2.4 Types of Products

Indowud NFC board

NFC ceiling tile

NFC door

NFC Door/Window frame

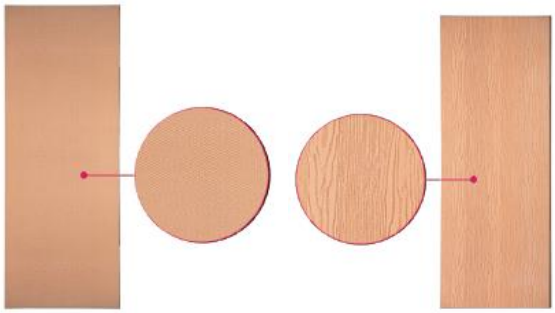


NFC Jaali

NFC decking

NFC flute

NFC trims



NFC Textured Panel

NFC glue

Fig.1 Various Products

1.3 Assessment

1.3.1 Scope of Assessment

The scope of the assessment included the suitability of Indowud NFC (Natural Fibre Composite) board & its various applications, as sustainable alternative to traditional wood.

1.3.2 Basis of Assessment

i. Test report of Indowud NFC board conducted by the National Test House (NTH), Chennai for various physical/ mechanical performances including density, water absorption, swelling in water, swelling due to surface absorption, Modulus of Elasticity, Modulus of rupture, Resistance to steam and Screw withdrawal strength.

ii. Test report of Indowud NFC board conducted by the Institute of Plastics Technology (CIPET), Chennai for testing of Tensile strength, Compressive Strength, Density, Flammability, Charpy Impact Strength (Unnotched), Heat Deflection Temperature, Vicat Softening temperature, Flexural strength, Elongation, Water Absorption.

iii. Test report Indowud NFC board conducted by the CIPET, Chennai for various performances as shore 'D' Hardness, Surface resistivity and Volume Resistivity.
iv. Test Report for Thermal insulation & Coefficient of Thermal Expansion of NFC Board by Institute of Petrochemicals Technology (IPT), Chennai
v. Test reports for Indowud NFC board for Sound absorption Coefficient, Transmission loss, Termite Resistant test, Fungal Resistant test & Borer resistant test, conducted at Indian Plywood Industries Research & Training Institute(IPIRTI), Bangalore
vi. Test reports for Indowud NFC board for smoke Developed Index, Flame Spread Index & Asbestor Fiber Content, conducted at Spectro Analytical Labs Limited, Greater Noida.
vii. The product has been awarded Green pro eco lebelling.
viii. The test report for Indowud NFC board regarding Volatile Organic Compounds (VOC) conducted at SGS Pvt. Ltd., Mumbai
ix. International Certifications for Environmental and safety (RoHS & CE) & Environmental Impact (EPD) for the product
x. Quality Assurance Scheme followed by Certificate Holder
xi. Inspection of Manufacturing Unit of the agency at Chennai by Technical Assessment Committee (TAC) representatives including BMTPC Official on November 28, 2024

1.4 Uses of Natural Fibre Composite (NFC)

1.4.1 Uses of the Product

Indowud NFC can be used for residential, commercial, institutional, hospitality buildings/ facilities, home theatre, etc. & the various applications include;

- Exterior Cladding**:** For building facades, walls and other exterior surfaces
- Interior Panelling: Wall panels, partitions and decorative features in buildings interiors
- Flooring & Ceilings**:** Uses in building spaces for flooring & ceiling solutions with variety of looks
- Architectural features**:** Includes use in custom designs such as decorative screens, partitions and accent walls
- Furniture**:** Suitable for creating furnitures including tables, cabinets shelving, etc.
- Outdoor applications: Used in pergolas, garden structures, benches, pool side furnitures and other outdoor elements due to its resilience to moisture and temperature changes.

1.4.2 Special Aspects of Use/ Limitations

i. Not recommended for structural use. To be used for cladding, panelling & other non-load bearing applications, with appropriate support & framework.
ii. Can withstand temperature upto 64^{o}C (Heat deflection temperature).

iii. It is resistant to UV rays, however, extended exposure over time, may cause surface colour fading. The regular cleaning & maintenance help in preserving the product appearance & performance.

1.5 Conditions of Certification

1.5.1 Technical Conditions

i. Technical Specifications- Raw materials and the finished product shall conform to the requirements of prescribed specifications.
ii. The Certificate Holder shall provide comprehensive product documentation, including technical specifications, installation guidelines, and maintenance instructions, to support customers in proper handling and care.
iii. The agency shall ensure that the NFC boards meet all relevant environmental regulations and standards. Regularly review and update manufacturing processes to minimize environmental impact.
iv. Quality Assurance- the Certificate holder shall maintain a quality assurance system in accordance with Quality Assurance Plan.

1.5.2 Handling of User Complaints

The Certificate holder shall provide quick redressal to Consumer/user complaints which proved reasonable & genuine and within the conditions of warranty provided by it to customer/purchaser.

As part of PACS Certification, it shall maintain data on such complaints with a view to assess the complaint satisfaction and suitable preventive measures taken.

1.6 Certification

On the basis of assessment given in Part 3 of this Certificate & subject to the conditions of Certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part 1 & 2 of this Certificate, the Indowud NFC products covered by this Certificate are fit for use set out in the Scope of Assessment.

PART 2: CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

2.1 General

The PAC holder shall manufacture boards/ its applications in accordance with the requirements specified in the relevant Standards (See Part 5). In addition it shall follow the Company standards specifying requirements of these sections for various materials used in the manufacturing of the product.

2.2 Specifications for the Product

The manufacturer shall only use the raw materials supplied with the relevant documents/ prescribed Quality Assurance Plan. The raw materials shall be subject to agreed controls and tests by the manufacturer before acceptance.

2.2.1 Technical specification for Raw materials

Table 1 List of Raw Materials/Components used

S. No.	Raw material/ component	Source	Specification	Standard
1.	Rice Husk Powder	Farmers & rice mills	40 mesh	Industry standard for fineness
2.	Calcium Carbonate	Local traders	1000 mesh	Manufacturer's Test Certificate
3.	Recycling waste	Scrap generated during production	Scrap during production	Same quality control norms are applicable
4.	PVC resin	Imported and local traders	K57	IS 17658: 2021
5.	Additives	Local traders		ROHS Certificate

2.2.2 Performance requirements of the product

Table 2 Performance requirement of the product (Typically in the Range of ±5%)

S. No.	Performance Characteristics	Test Method	Limit/ Unit	Value
1.	Density	IS: 2380 (Part-1-21) :1977, Reaffm.2018	Kg/m^3	800
2.	Moisture Content		%	1.03
3.	Water absorption after 2 hrs		%	0.1
4.	Water absorption after 24 hrs			0.9
5.	Swelling in Water after 2 hrs			Thickness swelling = 0.3 Length swelling = 0.1

S. No.	Performance Characteristics	Test Method	Limit/ Unit	Value
6.	Modulus of Elasticity		N/mm^2	Average-2866 Minimum-2804 (Individual)
7.	Modulus of Rupture			Average-15.3 Minimum-14.7 (Individual)
8.	Screw withdrawal strength		N	Face -1770 Edge -1085
9.	Nail withdrawal strength		N	Face: 519 Edge: 428
10.	Tensile strength	ASTM D638	MPa	7.6
11.	Compression strength	ASTM D695		40.2
12.	Elongation @ Break	ASTM D638	%	2
13.	Flexural Strength	ASTM D-790	MPa	13.6
14.	Charpy impact strength	ASTM D6110	KJ/m^2	6.25
15.	Heat deflection Temperature @ 0.45 MPA	ASTM D648	^0C	64.45
16.	Softening temperature @ 1 kg load	ASTM D1525		72.5
17.	Fire resistance	Appendix 11 of UIC 564.2		Class A
18.	Flammability	UL94		Vo Rating
19.	Flame Spread Index	ASTM E84:2020	0-25 Class 1 or A	6 (Class 1 or A)
20.	Smoke Developed Index		450	100
21.	Thermal conductivity at 55°C mean temperature	ASTM E 1530	W/mk	0.112
22.	Coefficient of Linear Thermal Expansion (30°C to 60°C)	ASTM E 228	/°C	1.95×10^{-5}
23.	VOC emissions	EPA: 5035A (by GCMS)		BDL (Below detectable limit)
24.	Test for termite resistance*	IS 4833:1993 (Reaff. 2003)		No sign of termite attack
25.	Test for fungal resistance	IS 4873 (Part 1): 2008		No sign of fungal attack
26.	Test for borer resistance			No sign of borer attack

**Guarantee of 33 years protection for the product against Termite attack is provided by the Agency.*

2.3 Manufacturing Process (Production Line) & Machinery

The raw materials in prescribed ratios are mixed in a heater cooler mixer machine to prepare a compound. The compound is then extruded under controlled temperature through the modern conical twin screw machine and passed through a coat hanger type T mould to prepare the board of desired thickness. After getting the sheet out of the mould it is passed through cooling calibrators and trimmed horizontally and vertically in an automatic system attached with the machine.

Finally the sheets are taken for surface processing to get wood / plywood like surface appearance and inspected physically. Once the quality is checked it will be labelled and covered with surface protection film before being dispatched. During the process, the generation of wasted and rejections are crushed and pulverized for recycling. The manufacturing flow chart is mentioned below:

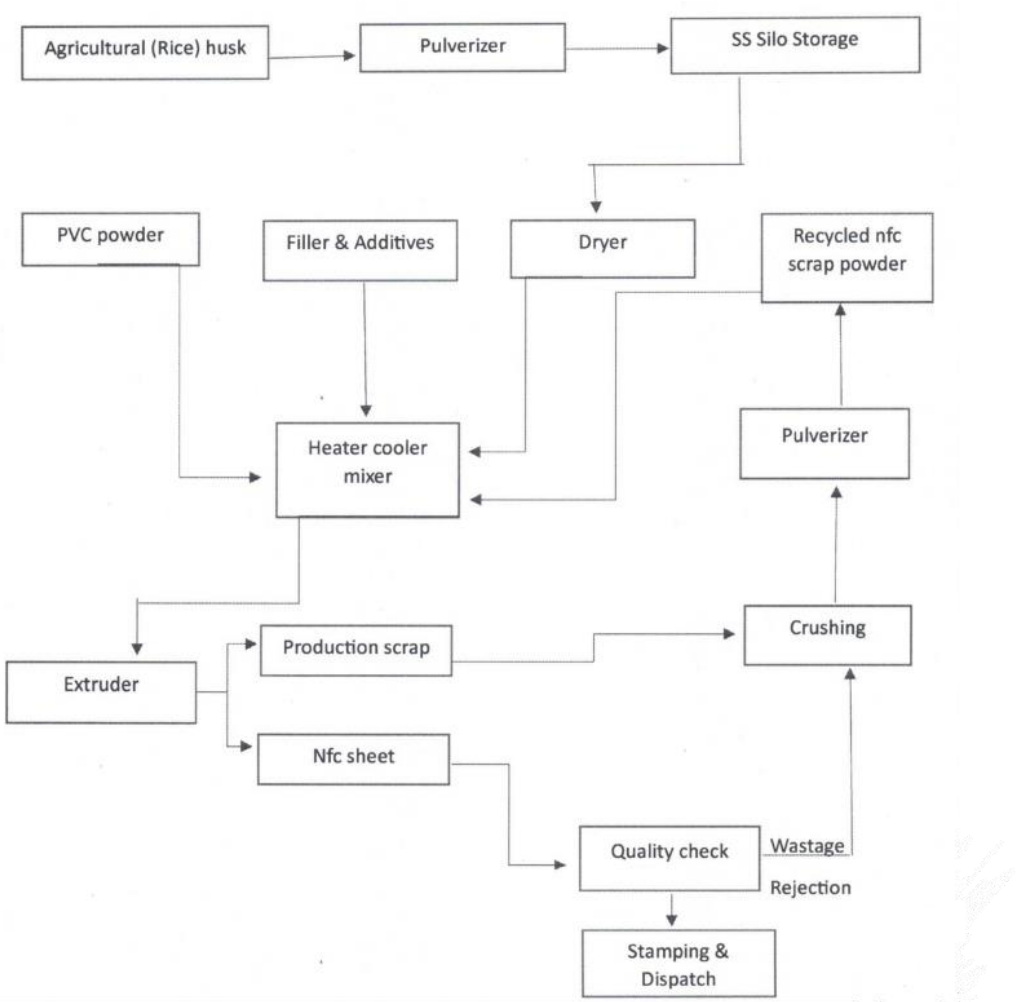


Fig. 2: Manufacturing Process

i. Material composition

Agricultural fiber rice husk**,** a by-product of rice production, are fibrous and provide texture and strength to the material. PVC Resin is used as a binder and provides water resistance and durability. Additional compounds such as lime, UV stabilizers, flame retardants are added to enhance the material's properties.

ii. Fiber Processing and Mixing

The manufacturing process begins with the selection of raw materials. The agricultural fibers which are typically derived from farmers are cleaned, dried and processed to ensure uniformity in particle size. The fibers must be free from moisture to avoid defects during the extrusion process.

Polymer resins are prepared by melting them into a workable state. These resins are mixed with chemical additives to improve the composite overall quality and durability.

iii. Extrusion Process

This step takes place in a compounding machine, which heats and blends the materials at precise temperatures and pressures. This creates a homogeneous composite material, ensuring that the fibers are evenly distribution throughout the polymer matrix.

The blended material is fed into an extruder, where it is melted and shaped through a die. The extrusion process allows for the creation of different profiles, from flat panels to complex shapes used in decorative elements. In this stage, the material is subjected to high temperatures and pressure, which ensures even distribution of the agri fibers within the polymer matrix. The extrusion process must be closely monitored to ensure consistent product quality. Factors such as temperature, pressure and extrusion speed play a critical role in determining the final dimensions and surface texture of the product.

iv. Cooling and Cutting

After extrusion, the material is immediately cooled to solidify its shape. The cooling process typically involves passing the extruded product through air cooling system. This step is crucial for maintaining the dimensional stability and mechanical strength of the product.

After cooling, it is cut into desired lengths and dimensions.

v. Quality Inspection and Packaging

The products go through a strict quality control process to ensure the consistency of dimensions, surface texture and appearance. The products are then packed and prepared for shipping. Quality checks include testing

for strength, water absorption, UV resistance and thermal expansion. The final products are then cut to the required sizes, packaged and prepared for distribution.

vi. Environmental Impact and Sustainability

The use of recycled agri fibers in the product significantly reduces the environmental footprint of the product compared to traditional wood.

vii. Manufacturing Machinery

Table 3
List of Manufacturing /
Installing machinery available with the Agency

S. No.	Date of installation	Name of machine and ID No.	Make	Capacity	Capability	No. of machine	Does the unit have maintenance schedule	Remarks
1.	Dec-18	80/173 Conical Twin Screw Extruder (Including calibration table, cooling table and haul off)	Imported	350 Kg/hr		1	Yes	
2.	May-19	80/156 Conical Twin Screw Extruder (Including calibration table, cooling table and haul off)	Imported	325 Kg/hr		1	Yes	
3.	Aug-23	Conical Twin Screw Extruder (Including calibration table, cooling table and haul off)	Imported	110 Kg/hr		1	Yes	
4.	Dec-18	Heater Cooler Mixer Machine	Prime Tech	500 Kg/hr		1	Yes	
5.	Dec-18	Heater Cooler Mixer Machine	Prime Tech	200 Kg/hr		1	Yes	
6.	Dec-18	Husk pulverizer	Imported	70 Kg/hr		2	Yes	
7.	Feb-21	Husk pulverizer	Punjab	180 Kg/hr		1	Yes	
8.	Dec-18	Water chiller	Prasad	24 Tr.		1	Yes	
9.	Dec-18	Water chiller	Imported	16 Tr.		1	Yes	
10.	Oct-22	Water chiller	Prasad	29 Tr.		1	Yes	
11.	Dec-18	Air compressor	Elgi	9.5 Bar		1	Yes	
12.	Dec-18	Air compressor	Gajendra	12 kg		2	Yes	
13.	Dec-18	Scrap Pulverizer	Imported	200 Kg/hr		1	Yes	
14.	Dec-18	Scrap crusher	Imported	300 Kg/hr		1	Yes	
15.	Nov-18	RO System	Eureka	500 ltrs/gr.		1	Yes	

S. No.	Date of installation	Name of machine and ID No.	Make	Capacity	Capability	No. of machine	Does the unit have maintenance schedule	Remarks
			Forbes					
16.	Dec-18	Husk dryer	Prasad	2500 Ltrs.		1	Yes	
17.	Dec-18	Brush sanding machine	SOSN (Imported)			1	Yes	
18.	Mar-19	Drum sanding machine				1	Yes	
19.	May-19	Auto weighing and dosing system	Sunrise			2	Yes	
20.	Aug-19	Surface film applicator	AMP			1	Yes	
21.	Oct-18	DG set	Kirloskar	500 KVa		1	Yes	
22.	Nov-18	Fork lift	Voltas	3 MT		1	Yes	
23.	Nov-18	EOT	Kiran	5 MT		1	Yes	
24.	Sep-22	CNC machine	K Tech			1	Yes	
25.	May-24	CNC machine	Imported			1	Yes	
26.	Nov-22	Thermoforming machine	Indian			1	Yes	
27.	Apr-22	Material conveying system	Madras Con.			1 set	Yes	

2.4 Inspections & Testing

Inspections & testing shall be done at appropriate stages of manufacturing process. The inspected products shall be stored & packed to ensure that no damage occurs during transportation, as per the industrial norms. As part of quality assurance, regular in-process inspections shall be carried out by the trained personnel of the PAC holder.

2.5 Storage & Handling at the user end before installation

Storage - Final manufactured product lot sample shall be tested for smooth working, and then packed for despatch, as per the industrial norms.
Handling - Product shall be packed as per industry standards or contract terms.

2.6 Maintenance

The mmaintenance procedures and frequency has been suggested as below;

Cleaning: Use a mild detergent and water solution. Avoid harsh chemicals or abrasive cleaners which may damage the surface.

Repair: Fix minor scratches with touch-up paint or fillers.

Sealing: Reapply protective coatings or sealants as needed, especially for exterior applications or in high-moisture environments. Ensure surfaces are clean and dry before application of sealants.

However, a proper maintenance guide shall be given by PAC Holder to the Client. The product shall be installed strictly as per the instructions contained in the technical literature.

2.7 Skills /Training needed for Installation

The workers shall be trained/ oriented on handling of the product and its installation, support system, etc. with all required safety measures. The installation at site of the product will be carried out by the trained professionals of the company.

2.8 Guarantees/Warranties provided by the PAC Holder

The agency has mentioned 33 years warranty on the product. However, the PAC holder shall provide necessary guarantees/ warranties in each case. A brochure giving relevant details of the product shall be made available to the client.

2.9 Services provided by the PAC holder to the customer

The PAC holder shall provide pre-sale advisory regarding the product. Customer/user may obtain from the PAC holder details of the advice that may be provided to him.

The PAC holder shall also provide after sales service. These include items like pre-finishing, trouble shooting in fixing and usage of the products/shutters. Users / Customers shall ascertain from the PAC holder the type of services and the conditions, the PAC holder is prepared to provide.

2.10 Responsibility

- Specific design of the product is the responsibility of the PAC Holder/ Authorized agency as per the requirement of the customer according to the contract with the instructions, supervision and guidance of the PAC holder.
- Quality of installation of the product on site is the responsibility of the trade persons engaged by the Client.
- Maintenance of the installation/ product is the responsibility of the client.

PART 3: BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Assessment

3.1.1 Technical Assessment

The technical assessment was done as per provisions of the Standards listed in Part 5 of this Certificate.

3.1.2 Tests Performed

Assessment of the suitability of the product is based on the various tests carried out by National Test House (NTH), Central Institute of Petrochemicals Engineering & Technology (CIPET), Indian Plywood Industries Research & Training Institute (IPIRTI), Spectro Analytical Labs Ltd., SGS India Pvt. Ltd, SGS India Pvt. Ltd., Chennai & International & National Agencies for environment & safety.

3.1.3 Assessment carried out by the Agency

i) Physical & Mechanical Properties

Sample details: Natural Fibre Composite Board
Test performed: NTH, Chennai
Test duration: June, 2024

Table 4

S. No.	Parameter	Standard	Unit	Result
1.	Density	IS 2380 (Part 3): 1977	Kg/m^3	836
2.	Accuracy of dimension	IS 2380 (Part 2):1977	mm	Length = 2440 Width = 1222 Thickness = 18.3 Straightness = 0.4 Squareness = 0.1 Dubbing = 0.04
3.	Moisture content	IS 2380 (Part 3): 1977	%	1.03
4.	Test for water absorption	IS 2380 (Part 16): 1977	%	2 hrs : 0.1 24 hrs: 0.9
5.	Swelling in water in 2 hrs	IS 2380 (Part 17): 1977	%	Thickness swelling = 0.3 Length swelling = 0.1
6.	Swelling due to surface absorption	IS 2380 (Part 17): 1977	%	0.2
7.	Tensile strength perpendicular to surface	IS 2380 (Part 5): 1977	N/mm^2	1.1
8.	Tensile strength perpendicular to surface after ageing	IS 2380 (Part 5): 1977	N/mm^2	0.8
9.	Tensile strength perpendicular to surface after accelerated water resistance test	IS 123823: 2015	N/mm^2	0.65
10.	Compression strength parallel to	IS 2380 (Part 7):	N/mm^2	9.2

	surface	1977		
11.	Compression strength perpendicular to board	IS 2380 (Part 7): 1977	%	Compressibility : 1.1% Retention compression: 0.2%
12.	Compression strength upto 2.5mm depth	IS 13360 (Part 5/sec8): 1996	MPa	8.0
13.	Charpy Impact Strength	IS 13360 (Part 5/sec 5): 1996	KJ/Sq. m	One direction = 9.4 Other direction = 10.8
14.	IZOD impact strength	IS 13360 (Part 5 / sec 4: 1996)	KJ/Sq m	One direction = 4.7 Other direction = 7.2
15.	Surface hardness indentation test & shore hardness	IS 2380 (11): 1977	Shore D	75
16.	Screw withdrawal strength	IS 2380 (Part 14): 1977	N	Face: 1770 Edge: 1085
17.	Nail withdrawal strength	IS 2380 (Part 14): 1977	N	Face: 519 Edge: 428
18.	Falling hammer impact	IS 2380 (Part 10): 1977	Mass: Grams Height: mm	Mass of the hammer: 1441 Height of the drop: 1775
19.	Crack resistance	IS 12823: 2015		Observed no sign of cracks or delamination
20.	Modulus of elasticity	IS 2380 (Part 4):1977	N/mm^2	Average: 2866 Minimum: 2804
21.	Modulus of rupture	IS 2380 (Part 4): 1977	N/mm^2	Average: 15.3 Minimum: 14.7
22.	VICAT softening temperature @ 50N	IS 13360 (Part 6/Sec 1): 1999	^0C	73°
23.	Resistance to steam (After exposure of sample to steam for 2 hours)	IS 12823:2015		Observed slight change in colour on the surface but no sign of blister, delamination or change in surface finish.
24.	Resistance to stain			Observed no stain on the specimen after cleaning with detergent.
25.	Resistance to Cigarette Burn			Observed no stain on the specimen after cleaning with water.

ii) Physical & Mechanical Properties

Sample details : Natural Fibre Composite Board
Size : 300 mm x 300 mm x 6 mm to 18 mm
Test Performed : CIPET, Chennai
Test duration : May, 2019/ July, 2022

Table 5

S. No.	Property	Standard	Unit	Results Obtained
1.	Tensile strength	ASTM D-638	MPa	7.6
2.	Elongation @ break	ASTM D-638	%	2.0
3.	Flexural Strength	ASTM D-790	MPa	13.6
4.	Charpy Impact Strength	ASTM D-6110	kJ/m^2	6.25

	(Unnotched)			
5.	Compressive Strength	ASTM D-695	MPa	40.2
6.	Flammability	UL 94	--	V_0
7.	Heat Deflection Temperature @ 0.45 MPa	ASTM D-648	°C	64.45
8.	Vicat Softening Temperature @ 1 kg load	ASTM D-1525	°C	72.5
9.	Density	ASTM D-792	Kg/m^3	800.35
10.	Water absorption for 24 hours	ASTM D-570	%	0.78
11.	Fire resistance	Appendix 11 of UIC 564.0	--	Class A

iii) Physical & Mechanical Properties

Sample details : Natural Fibre Composite Board
Size : 300 mm x 300 mm x 12 mm
Test performed : CIPET, Chennai
Test duration : May, 2019

Table 6

S. No.	Property	Standard	Unit	Results Obtained
1.	Shore 'D' Hardness	ASTM D-2240	--	49.2
2.	Surface resistivity	ASTM D-257	ohms	5.44×10^{14}
3.	Volume resistivity	ASTM D-257	ohm-cm	2.55×10^{15}

iv) Thermal Expansion

Sample details : Natural Fibre Composite Board Sample
Size : 1 sqft of Sheet
Test performed : CIPET, Chennai
Test duration : September, 2024

Table 7

S. No.	Test Name	Test Method / Standard	Unit	Test Value / Results Obtained
1.	Coefficient of Linear Thermal Expansion (30°C to 60°C)	ASTM E 228	/°C	1.95×10^{-5}

v) Thermal Insulation Property

Sample details : Indowud nfc Sheet
Size : 1x1 ft-5 Nos
Test performed : IPET, Chennai
Test duration : October, 2024

Table 8

S. No.	Test Name	Test Method/ Standard	Unit	Test Value Obtained
1.	Thermal conductivity at 55°C mean temperature	ASTM E 1530	W/mk	0.112

vi) Sound insulation Properties

Sample details : Natural Fibre Composite Board
Test performed : IPIRTI, Bangalore
Test duration : January, 2020

Table 9

S. No.	Frequency Hz	Sound absorption co-efficient (IS: 10420-1982)	Transmission Loss (dB/1.0) (ISO 10534-2:1998)
1.	125	0.02	26.19
2.	250	0.03	22.53
3.	500	0.04	32.85
4.	1000	0.05	40.2
5.	1500	0.06	44.5
6.	2000	0.06	47.33
7.	2500	0.05	45.61
8.	3000	0.06	47.83
9.	3500	0.08	46.6
10.	4000	0.10	47.56

vii) Termite, Borer & Fungal resistance Properties

Sample details : Natural Fibre Composite Board
Size : 25.4 mm x 25.4 mm x 18 mm
Test performed : IPIRTI, Banglore
Test duration : June, 2020

Table 10

S. No.	Test Name	Test Method / Standard	Test Value / Results Obtained
1.	Termite resistance test	Samples subjected to termite resistance test for 6 months duration as Per IS 4833	No sign of termite attack was observed on the samples
2.	Fungal resistance test	Samples subjected to Fungal resistance test for 3 months duration as Per IS 4873	No sign of fungal attack was observed on the samples

3.	Borer resistance test	Samples subjected to Borer resistance test for 6 months duration as Per IS 4873	No sign of borer attack was observed on the samples

viii) Fire Properties & Asbestos Content

Sample details : Indowud NFC Natural Fibre Composite
Size : 1210 mm x 607 mm x 25 mm
Test performed : Spectro Analytical Labs Ltd., Greater Noida
Test duration : September/October, 2020

Table 11

S. No.	Nature of tests	Test Method / Standard	Test Value / Results Obtained	Required
1.	Flame Spread Index	ASTM E84-2020	6 (Class 1or A)	0-25
2.	Smoke Developed Index		100 (Class 1or A)	450 max
3.	Asbestos Fibre Content	JIS A 1481: 2016 Part-1, 2, 3 & ISO-22262-2012, NIOSH 7400, 9000:1994	Absence	Negative <0.1%

ix) VOC Content

Sample details : Indowud NFC Natural Fibre Composite
Sample quantity : 100G
Test performed : SGS India Pvt. Ltd., Chennai
Test duration : September, 2020

Table 12

S. No.	Nature of tests	Test Method / Standard	Test Value / Results Obtained
1.	Vinyl Chloride	EPA : 5035A (by GCMS)	Below Detectable Limit
2.	Volatile Organic Compound (VOC)		

3.2 Quality Assurance

The Certificate Holder shall implement & maintain a quality assurance system in accordance with Quality Assurance Plan (QAP) as per **Annex-1.**

3.3 Quality, Environmental & Safety related Certifications by the Agency

i. **ISO 9001, 14001, 45001 Certificates:** Certification of quality management, environmental management and occupational health and safety management systems.
ii. **RoHS and CE Certifications:** Environmental and safety certifications for product compliance by Quality Veritas Certification Ltd., UK
iii. **GreenPro Certification:** Qualifying the product as Green product by CII- Green Products & Services Council.
iv. **EPD (Environmental Product Declaration):** Documentation providing about the product's environmental impact over it lifecycle, in accordance with ISO 14025: 2006 and EN 15804: 2012+A2:2019/AC:2021

3.4 Inspection of Manufacturing Unit of the Agency

The inspection of Manufacturing Unit of the agency at Chennai was conducted by Technical Assessment Committee (TAC) representatives including BMTPC Official on November 28, 2024. The entire production parameters/process including storage of raw material, pulverization of rice husk, mixing of other raw materials as PVC, $CaCo_3$ & other additives in mixer, and extrusion of NFC Sheets through Twin Screw Extruder machines were assessed. The technical representatives were interacted & quality assurance system was reviewed.

3.5 Project list for supply/usage of Natural Fibre Composite Products

The manufacturer has reported the supply of the Natural Fibre Composite Products as per the details given below;

Table 13

S. No.	Project Name & Application	Architect / Client	Location (Year of Completion)	Applications / Remarks
1.	Villa Project-85 (85 luxurious Sea facing Villas)	Sanjay Puri Architects, Mumbai	Duqm Marina, Sultanate of Oman (2021)	• Indowud CNC Jaali Screens in exterior facades, compound walls, porticos etc. • Hot & humid coastal Climate Exposure
2.	Indowud NFC Boards	Impulse Branding Solutions, Maharashtra & Chapman Taylor India Llp, New Delhi	• Lucknow Airport (2022) • Ahmedabad International Airport (2024)	• Airports: Interior panelling, Cabinetry and decorative screens in Lounge areas • Focus on Sustainability
3.	Indowud NFC Boards	Kriticons, Chennai	Accenture, Wipro and Capgemini Offices, Chennai (2020)	• Office Desks, Employees Work stations, modular Office furniture etc. • Focus on Sustainability, durability & design flexibility

4.	Indowud NFC Screens	Shree Cement HQ	• Jaipur (2018) • Udaipur (2022)	• Façade screens & Decorative panels on various building exteriors • Focus on weight reduction, weather resistance & aesthetic
5.	Indowud in Helical Staircase and Residential Interiors	Architecture RED & various Architects in Chennai	Chennai (2021)	• Helical Staircase in a Residential Project & other applications such as Wall paneling, flooring, ceiling, door frames etc. for various residential homes in Chennai • Focus on durability, termite & water resistance

The Photographs of the projects are attached at **Annex-2.**

PART 4: STANDARD CONDITIONS

This certificate holder shall satisfy the following conditions:

1 The certificate holder shall continue to have the product reviewed by BMBA.

2 The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.

3 The quality of the product shall be maintained by the certificate holder.

4 The product user should install, use and maintain the product in accordance with the provisions in this Certificate.

5 This certificate does not cover uses of the product outside the scope of this appraisal.

6 The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.

7 Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)

8 The certificate holder agrees to inform BMBA of their distributors / licensees whenever appointed by him and agrees to provide to BMBA a six monthly updated list thereof.

9 The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.

10 If at any time during the validity period, PACH is unable to fulfil the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

11 In granting this Certificate, BMBA takes no position as to:

(a) The presence or absence of patent or similar rights relating to the product;

(b) The legal right of the Certificate holder to market install or maintain the product;

(c) The nature of individual installations of the product, including methods of workmanship.

12 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

13 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

14 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

15 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

16 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

17 The PAC holder shall not use this certificate for legal defence in cases against him or for legal claims he may make from others.

Place: New Delhi
Date of issue: 03rd June, 2025

Chairman TAC & for and on behalf of Member Secretary, BMBA

PART 5: LIST OF APPLICABLE STANDARDS & CODES

IS 2380 (Part 1 to 11,14,16,17,20): 1977 Reaff.2018	Methods of Test for Wood Particle Boards and Boards from other Lignocelluloses Materials
IS 17658 : 2021	Poly Vinyl Chloride PVC Homopolymers Specification
IS 4833 :1993 (Reaff. 2003)	Methods for Field Testing of preservatives in Wood
IS 4873 (Part 1): 2008 (Rev.2024)	Methods of laboratory testing of wood preservatives against fungi and borers (powder post beetles) : Part 1 Determination of threshold values of wood preservatives against fungi
IS 13360 (Part 6/Sec 1): 201	Plastics - Methods of Testing- Part 6 Thermal Properties, Section 1 Determination of Vicat Softening Temperature of Thermoplastic Materials
IS 13360 (Part 5/Sec 8): 1999 (Reaff. 2003)	Methods of Testing- Part 5 Mechanical Properties, Section 8 Determination of Compressive Properties
IS 13360 (Part 5/Sec 5): 1999 (Reaff. 2003)	Plastics - Methods of Testing- Part 5 Mechanical Properties, Section 5 Determination of Charpy Impact Strength
IS 13360 (Part 5/Sec 4): 2013	Plastics - Methods of Testing- Part 5 Mechanical Properties, Section 4 Determination of Izod Impact Strength
IS 12823:2015 (Reaff. 2020)	Prelaminated Particle Boards from Wood and other Lignocellulosic Material — Specification
ASTM D792 − 20	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D638 − 14	Standard Test Method for Tensile Properties of Plastics
ASTM D695 - 23	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D6110 -10	Standard Test Method for Determining the Charpy Impact Resistance of Notched Specimens of Plastics
ASTM D648 - 01	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D1525 - 09	Standard Test Method for Vicat Softening Temperature of Plastics
ASTM E84:2020	Standard Test Method for Surface Burning Characteristics of Building Materials

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Indowud Natural Fibre Composite (NFC) Products** is satisfactory if used as set out above in the text of the Certificate. This **Certificate PAC No. 1072-P/2025** is awarded to **M/s Indowud NFC Private Limited, Chennai.**

The period of validity of this Certificate is for a period of one year i.e. from 03/06/2025 to 02/06/2026 as shown on Page 1 of this PAC.

This Certificate consists of a cover page and pages 1 to 34.

Dr. Shailesh Kr. Agrawal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing and Urban Affairs, Govt. of India
Core 5A, 1st Floor, India Habitat Centre
Lodhi Road, New Delhi-110003

Embossing Seal of BMTPC PACS BMBA

On behalf of BMTPC Board of Agreement, Chairman, Technical Assessment Committee (TAC) of BMBA & Member Secretary, BMTPC Board of Agreement (BMBA) under Ministry of Housing and Urban Affairs, Government of India

Place: New Delhi, India
Date: 03rd June, 2025

PART 6: LIST OF ABBREVATIONS

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BMBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

PERFORMANCE APPRAISAL CERTIFICATION SCHEME - A BRIEF

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing & Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing &Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (TAC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No.49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org.

Annex-1

Quality Assurance Procedures and Quality Assurance Documents

In line with the quality assurance (QA) documents used in manufacturing and construction industries, the List of quality assurance (QA) documents at Indowud is as under;

1. Raw Material Quality Assurance Documents

i. **Raw material inspection reports:** Documents detailing the testing and inspection of raw materials (fiber, polymers, etc.) for consistency, moisture content and compliance with specifications.
ii. **Supplier certificates of compliance:** Verification that suppliers meet the required standards (ISO certifications, RoHS, etc.)

2. Production Process Documents

i. **Standard Operating Procedures (SOPs):** Details instructions outlining every step of the manufacturing process.
ii. **Process Control Plans:** Documents outlining critical control points during production to ensure the final product meets quality standards.
iii. **Machine Calibration Records:** Logs and reports on the regular calibration of machinery, ensuring production accuracy and consistency.
iv. **Productions Logs:** Daily records of production runs, including batch numbers, material used and any issues encountered.

3. In-Process Quality Control Documents

i. **In-process Inspection Reports:** Documents detailing the quality checks carried out during the manufacturing process (e.g. dimensional checks, surface finish, etc.)
ii. **Non-Conformance Reports (NCRs):** Reports generated when a product or process does not meet the specific standards.
iii. **Corrective and Preventive Action Reports (CAPA):** Documents outlining steps taken to correct quality issues and prevent recurrence.

4. Final Product Quality Assurance Documents

i. **Final Product Inspection Reports:** Detailed inspection results verifying that the final product meets all required specifications.
ii. **Test Certificates (Mechanical and Physical Properties):** Documents showing test results for mechanical properties such as Modulus of Elasticity (MOE), Modulus of Rupture (MOR), impact resistance, moisture content, etc..
iii. **Environmental and Durability Testing Reports:** Results from tests on product performance under environmental stress like UV exposure, moisture, and temperatures variations.

5. Certifications

i. **ISO 9001, 14001, 45001 Certificates:** Certification of quality management, environmental management and occupational health and safety management systems.
ii. **RoHS and CE Certifications:** Environmental and safety certifications for product compliance.
iii. **GreenPro Certification:** Certification confirming the product's sustainability, applicable to LEED and green building standards.
iv. **EPF (Environmental Product Declaration):** Documentation providing transparent, verified information about the product's environmental impact over it lifecycle.

6. Field and Third Party Testing Documents

i. **Third Party Testing Reports:** Certification and reports from independent agencies validating product quality and performance.
ii. **Field Test Reports:** On-site testing reports / acknowledgement documenting product performance after installation.

7. Internal Quality Assurance Reports

i. **Internal Audit Reports:** Documentation from regular internal audits to ensure compliance with quality standards.
ii. **Internal Training Records:** Documents showing records of employee training in quality control processes.

8. Record Keeping and Reporting Documents

Inspection and Testing Records: Logs of all tests, inspections and checks performed throughout the production cycle. The documentation of the periodic reviews of the quality management system.

These documents are critical for ensuing consistent quality, tracking compliance with standards and improving processes within the manufacturing environment.

Method of Disposal of Non-Conforming Product – Indowud

At Indowud, a sustainable and environmentally friendly approval is taken towards the disposal of non-conforming products. Instead of traditional waste disposal methods, Indowud implements a closed-loop recycling process, ensuring that any defective of non-conforming products are not wasted but repurposed. The process is as follows:

1. **Identification of Non-Conforming Products:** During quality control checks, any Indowud boards or products that fail to meet specified standards for mechanical properties, dimensions, or surface quality are identified as non-conforming.
2. **Segregation:** The non-conforming products are separated from the approved products and documented as part of quality assurance protocols.

3. **Reprocessing:** The recycled material is mixed with fresh raw materials during the extrusion process to produce new boards or products, maintaining the company's commitment to sustainability.
4. **Quality Assurance:** Even after recycling, the material undergoes the same stringent quality control measures to ensure that the new products meet all required specifications.

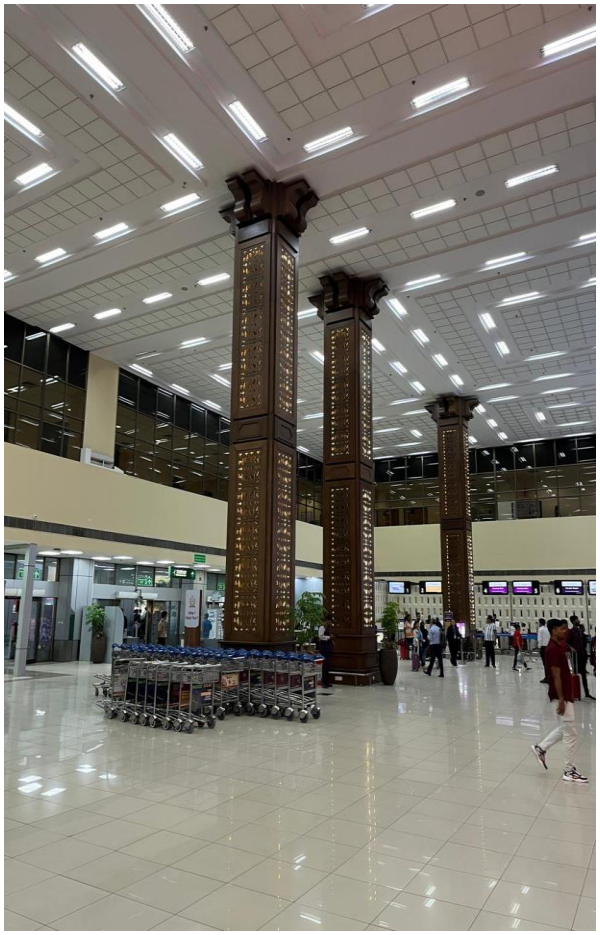
This recycling method ensures that Indowud operates with zero wastes, where non-conforming products are transformed back into usable materials, aligning with Indowud's environmentally conscious and sustainable production model.

Annex-2

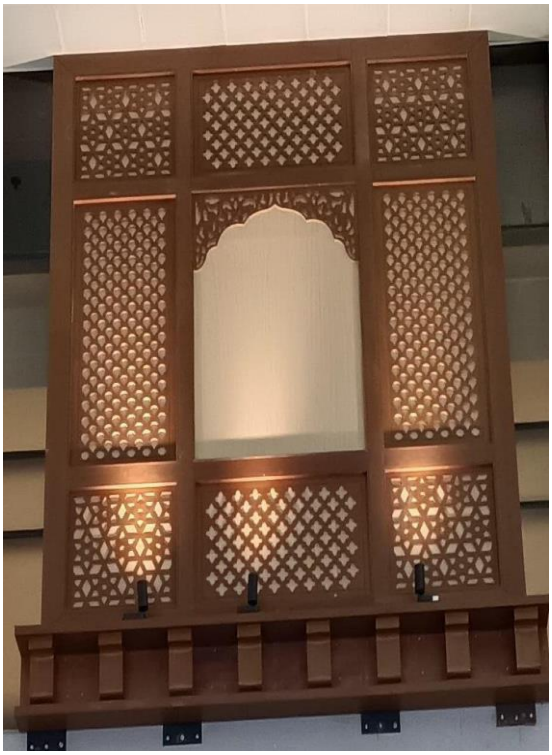
Photographs of the Projects

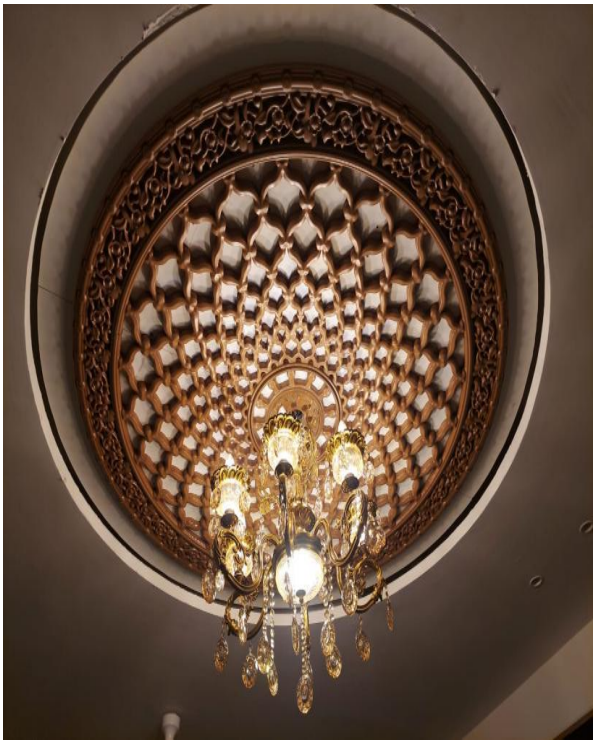
Sea facing residential Villas, Oman

Adani Airport, Ahmedabad



CNC Applications, Chennai



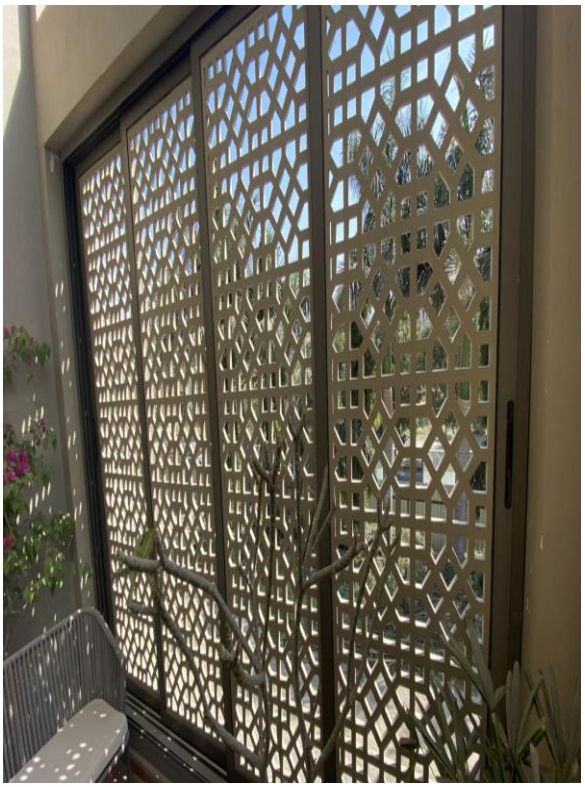


Thermoforming & CNC Applications

Outdoor Applications, Chennai

Headquarter of
M/s Shree Cement, Jaipur, Rajasthan

CNC Application, Udaipur



CNC Application in fencing