



Nano Concrete Aggregate (NACA)

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

Name and Address of Certificate Holder: **NTPC LTD**,
NTPC Bhawan
Scope Complex Institutional Area,
Lodhi Road,
New Delhi – 110003
Website: www.ntpc.co.in

Performance Appraisal Certificate
PAC No. **1064-M/2023**
Issue No. **01**
Date of Issue: **22.06.2023**




Building Materials & Technology Promotion Council
Ministry of Housing & Urban Affairs
Govt. of India

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Performance Appraisal Certificate**For****Nano Concrete Aggregate (NACA)****Issued to****M/s NTPC LTD****STATUS OF PAC**

S. No.	Issue No.	Date of Issue	Date of Renewal	Amendment		Valid upto (Date)	Remarks	Signature of Authorized Signatory
				No.	Date			
1	01	22.06.2023				21.06.2024		

PAC No. 1064-M/2023**Issue No. 01****Date of issue: 22.06.2023**

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PART 1: CERTIFICATION

1.1 Certificate Holder: NTPC LTD, NTPC Bhawan
Scope Complex Institutional Area
Lodhi Road, New Delhi – 110003
Web Site : www.ntpc.co.in

Manufacturing Facility:
NTPC Sipat, Bilaspur, Chattisgarh

1.2 Description of product

1.2.1 Name of the Product: Nano Concrete Aggregate (NACA)

1.2.2 Proprietary Name/Brand Name/Trade Name/Trademark: Nano Concrete Aggregate (NACA)

1.2.3 Brief Description

NTPC has started the production of Nano Concrete Aggregate (NACA) using the technology patented by Technologists Dr. N Bhanumathidas and Sh. N Kalidas, wherein the NAC Aggregates are manufactured by crushing NAC stone (Boulders). The technology was chosen through a Nation-wide open competition named "NTPC Ash contest" in February 2019.

The basic process for manufacturing NACA based coarse aggregate involves production of homogenous self-compacting paste by mixing fine fly ash, cement, water and admixture which is used to cast Nano Concrete (NAC) boulders. After curing and gaining designed strength, the boulders are crushed in crusher to get aggregates of desired size.

NACA has a specific gravity of 1.85 and a bulk density of 1.0 t/cum compared to Natural Stone Aggregate (NSA) of 2.6 specific gravity and Bulk density of 1.4 t/ cum. As a result NACA based concrete is about 20% lighter than NSA concrete. NACA can be used in various concrete based applications as an alternate to NSA. The use of this aggregate can help in sustainable development of construction industry through use of Industrial by-product with proportionate conservation of natural stone aggregate resources.

1.3 Assessment

1.3.1 Scope of Assessment

The scope of assessment included suitability of Nano Concrete Aggregate (NACA) in the preparation of Cement Concrete / Concrete components upto Concrete Grade M30, as replacement of Natural stone coarse aggregate. The use of NACA shall be as per Concrete Mix Design.

1.3.2 Basis of Assessment

The assessment of the product is based on the followings;

- i. The In-situ test & evaluation of cores cut out of RCC Components carried out of one double storey building at NTPC Simhadri, by National Council for Cement & Building Materials (NCCBM) in December, 2020, wherein only NAC aggregates were used in all Concrete applications (beam, columns, slab & PCC).
- ii. Testing of NAC Aggregates at Shriram Institute of Industrial Research (August, 2019)
- iii. Quality Assurance Plan adopted by PAC Holder
- iv. The visit of the Manufacturing Facility at NTPC, Sipat & Interaction with concerned NTPC Officials & Technologist, through Video conferencing on March 02, 2023.

1.4 Uses of Nano Concrete Aggregate (NACA)

1.4.1 Uses of the Product

The product can be used as replacement of natural stone aggregate (NSA) in following ways;

- i. In Plain & Reinforced concrete components of the Building
- ii. Pre-cast concrete components such as Interlocking Paver Blocks, Wall panels, etc.
- iii. It results in reduction of dead load of concrete structure. Handling of material is easy due to its lower bulk density.

1.4.2 Special Aspects of Use/Limitations

- i. The Concrete Mix Designer & user Agencies shall gain full familiarity with various properties of the product.
- ii. NACA has relatively higher water absorption than natural stone aggregate. Hence, wetting the aggregate (to achieve saturated surface dry condition) is necessary before developing concrete/product out of it at construction site. The residual water in the aggregate helps to cure the concrete inherently enriching the transition zone.
- iii. As the water absorption of the aggregate is high, it needs to be ensured that water used during its manufacturing, curing process and use at construction site is potable, and the amount of chloride content is within permissible limits (as per IS 456: 2000).

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 all required technical details for application of this product to user agencies.
- iii. 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 redressal & 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 & Part-2 of this Certificate, Nano Concrete Aggregate (NACA) is 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 the NACA in accordance with the requirements specified in relevant IS Standards and other Codal provisions. In addition, it shall follow its own standards specifying requirements of various materials used in the manufacturing of the product.

2.2 Technical specification for Raw Materials

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.

Table 1 List of Raw Materials & Technical Specifications

S. No.	Raw material/ component	Source	Specification	If quality certified in any form, State
1.	Fine fly ash	Any	IS 3812 (Part I) -2013	In-house test certificate
2.	Cement	Any	43 or 53 grade of any standard brand governed by IS: 269-2015 (Ordinary Portland Cement- Specifications)	MTC
3.	Admixture	Any	With solid content at not less than 45%	MTC
4.	Water	Any	IS 456-2000	In-house test certificate

2.2.2 Performance requirements of the product

Table 2

S. No.	Performance Characteristics	Requirement with Tolerance, if any	Test Method
1.	Aggregate impact Value %	45 Max	IS: 2386 Part -4 (1963) (Reaffirmed : 2021)
2.	Aggregate Crushing Value %	50 Max	
3.	Aggregate Abrasion Value %	50 Max with Aggregate of Grade B vide Table II of I IS: 2386 (Part-4)	
4.	Specific Gravity	1.7 to 1.9	IS: 2386 Part -6 (1963) (Reaffirmed : 2021)
5.	Water Absorption %	12 Max	

2.3 Special features of the product

1. As the product (NACA) attains strength through hydration chemistry, no thermal energy is involved in the production.
2. Product is obtained from the crushing of the flyash cement based boulder. Hence, it is green product due to use of flyash, which is a by-product/ waste from coal based TPPs.
3. Product is cast as stone and then broken in crushers. The broken multiple phases of aggregates are useful for better bonding.
4. The product gains strength with passage of time.
5. Specific gravity of the product is in the range of 1.8 to 1.9 gm/cc. Being light in weight in comparison to NSA, it can be easily stored anywhere, and comfortably handled at site.
6. It is replacement of natural stone aggregate and thus by using NACA, burden on natural resources can be reduced.

2.4 Manufacturing Process

2.4.1 The process of making coarse aggregate based on NACA technology includes the following;

Raw materials

- Fine Fly ash
- Cement
- Chemical Admixture
- Water

The basic process for manufacturing NACA based coarse aggregate involves production of homogenous self-compacting paste by mixing fine fly ash, cement, water and admixture, which is used to cast Nano Concrete (NAC) boulders. After curing and gaining design strength, the boulders are crushed to get aggregate of desired size.

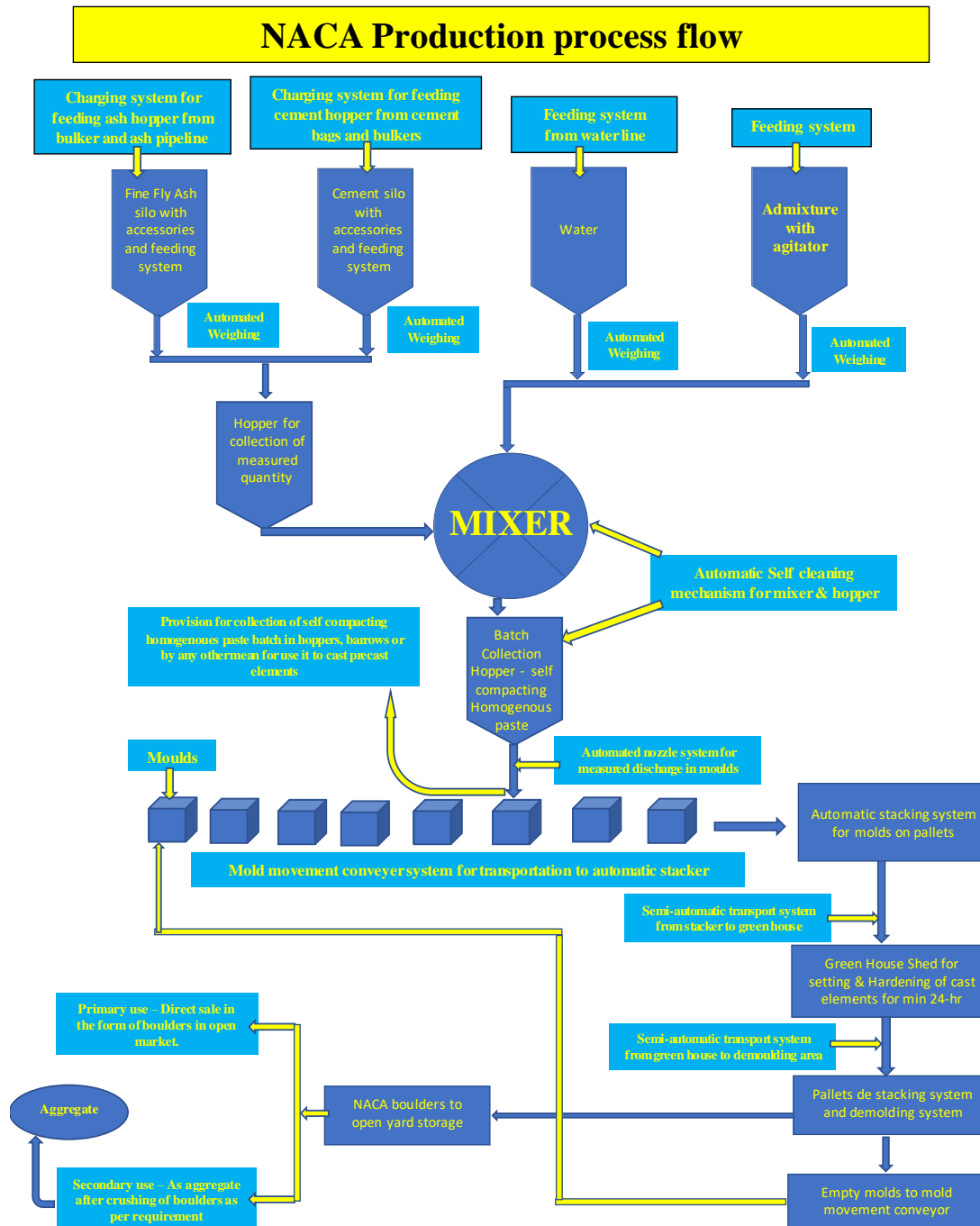
The homogeneous NAC paste, may also be used to cast precast elements of desired shape and size.

2.4.2 Manufacturing System does consist of three-step process:

- Step1: Production of self-compacting homogenous paste from raw materials stored in silos & tanks, which are the integral part of the manufacturing plant, and discharging the same into moulds.
- Step 2: Collection of the paste into moulds, draw it on pallets, transfer the pallets to green house shed and hold for due residential time. After gaining due design strength, demould the NAC boulders (from moulds) and transfer to open yard storage.

Step 3: From open yard storage, NAC boulders are transferred to crushing plant for crushing and segregation into specified sizes, followed by storage of the manufactured aggregate as per requirement.

2.4.3 Flow Chart for manufacturing of NACA



2.4.4 Manufacturing Machinery

Currently NACA is being produced at NTPC Sipat by modifying an automatic brick plant with capacity of approx. 1,00,000 bricks per day. Commercial grade manufacturing plants with production capacity of 40 cu.m. per hour each at six locations are under process of procurement and installation by NTPC. These manufacturing plants are expected to be commissioned by December 2024.

2.4.5 List of Testing Equipment

Table 3

S. No.	Date of installation	Name of equipment	Make (id no)	Range and least count	No.	Calibration frequency	Remarks
1.		Compression testing machine	M/s Rajco:17	IKN to 2000KN	1	1year	
2.		Compression testing machine	M/s PSI Sales	IKN to 2000KN	1	1year	
3.		Digital Vernier caliper	M/s MITUTOYO	0.01	1	1year	
4.		Digital Micrometer	M/s MITUTOYO	0.001	1	1year	
5.		Digital Thermometer	METRAVI	0.1Oc	1	1year	
6.		Vibration Machine	M/s AMIL: 011362		1	1year	
7.		Autoclave	M/s HELCO: 01030	0-4.2kg/cm ² (0.1 kg/cm ²)	1	1year	
8.		Mortar Mixer	M/s HELCO		1	1year	
9.		Universal Automatic Compactor	M/s HELCO: 01068		1	1year	
10.		Hot Air Oven			1	1year	
11.		Universal Testing Machine	M/s HELCO: H-27182		1	1year	
12.		Los Angeles Abrasion Testing Machine	M/s HELCO: 01061		1	1year	
13.		Vicat Needle Apparatus	M/s HELCO: 425		1	1year	
14.		Sive Shaker	M/s AMIL: 0111141		1	1year	
15.		Aggregate Impact Tester	M/s AMIL: 01624		1	1year	
16.		Impact Testing Machine	M/s AMIL: 01624		1	1year	
17.		150 KG Electronic Weighting	OPIRAT:9192	0.010Kg	1	1year	

S. No.	Date of installation	Name of equipment	Make (id no)	Range and least count	No.	Calibration frequency	Remarks
		Balance					
18.		20 KG Electronic Weighting Balance	OPIRAT:9193	0.001kg	1	1year	
19.		0.5 KG Electronic Weighting Balance	Instruments Eng. (Anamed) F0500	0.01Kg	1	1year	
20.		Cube Mould - 150mm	M/s HELCO		1	1year	
21.		Cube Mould - 70.6mm	M/s HELCO		1	1year	
22.		Slump test apparatus	M/s HELCO		1	1year	
23.		I.S Sieve (Brass Frame) with Lid and Pandiya 200mm	M/s AMIL		1	1year	
24.		I.S Sieve (Brass Frame) with Lid and Pandiya 200mm	Instrumentation		1	1year	
25.		I.S Sieve (Brass Frame) with Lid and Pandiya 450mm	M/s AMIL		1	1year	
26.		I.S Sieve (Brass Frame) with Lid and Pandiya 450mm	Instrumentation		1	1year	
27.		I.S Sieve (Brass Frame) with Lid and Pandiya 300mm	M/s HELCO		1	1year	
28.		Gauging Trowel	M/s R.H. Agency		1	1year	
29.		Pycnometer	M/s R.H. Agency		1	1year	

2.5 Method of curing and curing period

Normal ambient curing may be adopted if early strength attainment is not required by the end user. However, accelerated curing may be adopted to get uniform product quality in all seasons, that would also ensure higher strength gain at early ages.

For accelerated curing, the green product is stored in Green House shed for setting & hardening of cast elements for min 12 hrs, then the same is subjected to accelerated curing tunnel at 60+/- 5 °C for 30 Hours (Including pre-heating & cooling). The 'Green House' shed is a storage shed, where the green product (along with metal mould) is subjected to progressive curing

under elevated temperature (40-45°C) transferred through roof and captured by enclosed walls on all sides.

2.6 Method of handling of the product at site

No special care is required, to be handled similar to Natural Stone Aggregate.

2.7 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.

2.8 Guarantees/ Warranties provided by the PAC holder to the customer

The PAC Holder shall provide necessary guarantees/ warranties. A brochure giving relevant details of the Aggregate shall be made available to the user.

2.9 Responsibility

Specific performance of the product is the responsibility of the user Agency/ Concrete Mix Designer, as per the requirement of the Agency with guidance of the PAC holder

Part 3: BASIS OF ASSESSMENT & BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Assessment

3.1.1 The assessment has been done as per the provisions of the standards listed in Part-5 of this Certificate.

3.1.2 Tests report by National Council for Cement & Building Materials (NCCBM) for various In-situ test & evaluation of concrete cores from RCC Components of one Demo Structure at Deepanjali Nagar, NTPC-Simhadri. In the structure, only NAC aggregates were used in all Concrete applications (beam, columns, slab & PCC).

Based on the various in-situ and laboratory testing carried out, the Report highlights the followings;

- i. Based on Rebound Hammer Testing and Core Testing carried out, the equivalent cube compressive strength of the concrete satisfies the requirement for M30 Grade of concrete.
- ii. Based on UPV testing carried out, the quality of the concrete may be classified as 'GOOD'.
- iii. Based on the cover testing, the cover provided to the reinforcement is found satisfactory.
- iv. Based on Air permeability and RCPT test results, the concrete can be classified as NORMAL and having NEGLIGIBLE permeability against the ingress on chlorides.
- v. Based on the chemical testing carried out, it can be seen that the chloride content in the concrete is within the permissible value as per IS: 456 – 2000. However, the sulphate content is found to be higher than the limit prescribed in IS: 456 – 2000 in 1 sample and the pH of the concrete is found to lower when compared to Normal concrete.

Based on the above results, the report concludes that the Nano-concrete aggregate-based concrete is comparable to the Normal Concrete. However, proper care should be taken when using this type of concrete in Arid areas where chances of reinforcement corrosion due to carbonation may increase due to the lower pH value of the concrete.

3.1.3 The NACA aggregates were tested at Shriram Institute for Industrial Research, Delhi. The Various test results are given in the Table below;

The various test results by Shriram Institute of Industrial Research;

Table 4

S. No.	Name of Parameter	Observed Value	Requirements (As per IS-383:2016) Table 7	Conformity	Protocol used
1	Gradation sieve Size (mm)	%passing by wt.	%passing by wt. (single size aggregate)		IS:2386 (pt-1) 1963 (Reaffirmed : 2021)
	40.0	100	100	Yes	
	20.0	90	85-100	Yes	
	10.0	6	0-70	Yes	
	4.75	1	0-5	yes	
2	Aggregate Impact Value %	24	30 max for wearing surfaces 45 Max for other than wearing surfaces	Yes	IS:2386 (pt-1) 1963 (Reaffirmed : 2021)
3	Aggregate Crushing Value %	29	30 Max for wearing surfaces	Yes	IS:2386 (pt-1) 1963 (Reaffirmed : 2021)
4	Aggregate Abrasion Value %	26	30 max for wearing surfaces 45 Max for other than wearing surfaces	Yes	IS:2386 (pt-1) 1963 (Reaffirmed : 2021)

3.1.4 Quality Assurance system followed by the Certificate holder at **Annexure 1.**

3.2 Site Inspection

The setup of the Agency was visited by the members of TAC & Officers of BMTPC via video conferencing on March 02, 2023 & interaction were held with technical personnel of the Agency & the Technologist also. The agency presented/ through videos demonstrated the entire production process, testing results, quality assurance mechanisms, etc. One stretch of the road was also shown where the Interlocking blocks made out of Nano Concrete (NAC) were installed about six months back. It was informed that the road is performing satisfactorily without any defects despite heavy traffic.

During the Online review of the Application, the TAC representatives from NCCBM & CBRI, Roorkee made remarks that as NACA is higher size aggregate, & therefore it should not be named as Nano concrete aggregate. Further, in the process of making this aggregate (NACA), first bigger concrete component is produced & then it is broken into required sizes of coarse aggregates, which is not a sustainable practice. The apprehensions about water cement ratio of NAC mix as 0.15, were also expressed.

On the observations above, the clarifications in brief as provided by the Technologist/ Agency, are as per the details below;

- i) Why the Product is called as Nano Concrete: In RCPT studies of Nano Concrete (NAC), the coulomb value is significantly lower, in comparison to conventional concrete. This is as a result of pore refinement to the level of Nano-pores & by virtue of the same, the concrete has been christened as 'Nano Concrete' by inventors. Further, in the production of NAC, the fine fly ash is used, which have relatively higher fraction of fine particles.
- ii) Sustainability criteria (Breaking of NAC Boulders to Aggregates): A comparison of crushing aspects of natural stone aggregates & nano concrete aggregate (NACA) have been provided by the Technologist, as per the details below;

Table 5

Natural Stone Aggregate (NSA)	Nano Concrete Aggregate (NACA)
Crushing of boulders is common for both products, but there is relative difference in power consumption.	
Power consumption is more due to higher hardness.	Power consumption is lesser due to relatively lower hardness against NSA.
Large size of boulders retrieved from hillocks, mountains and mines, consume more power for desired size reduction.	Boulders' size is smaller and controllable, since moulds for casting the boulder is within the choice. Hence power consumption is relatively less.
Eco-hostile mining activity, involving blasting or mechanical breaking summoning for relative utilities.	Eco-friendly production activity with nominal utilities.
100% of output is against to the conservation of natural mineral.	Only 24% of product (OPC) is out of mineral (lime stone) and balance 76% is out of waste utilisation.
No effect on carbon foot print by material per se.	The carbon foot print associated with use of cement can be partly off-set against avoidance of power for mining and against the reduction of power during crushing; majorly countered with the avoidance of multi-faceted pollution caused by storage of fly ash in ponds.
Higher specific gravity of NSA results in heavier concrete (2500 kg/cu.m) necessitating relatively heavier structural design involving more cement.	Low specific gravity of NACA results in lighter concrete (2000 kg/cu.m) facilitating to rationalise structural design so much so conserving cement.

- i) Water to cementitious material factor: As further clarified by the Technologist, the Nano concrete sample produced & demonstrated during the review meeting, contained a water cementitious material ratio of 0.15.

In view of the above, the Agency is advised to establish through the reputed lab, that the pores indeed are of nano size, & may take a call regarding renaming the Aggregate. The agency is also advised to get the structural & durability properties of the concrete made using NACA, evaluated through specialized Research Institution, towards building further confidence about the product.

3.3 Usage of the product

The details submitted of some of the applications of NACA, are as per the followings;

- a. One Demo building (G+1) with built-up area is approx. 1,000 square feet at Deepanjali Nagar, NTPC-Simhadri, constructed in the Year 2019.
- b. 10.5 ft dia dome structure has been constructed at Technologist's residence at Vishakhapatnam.
- c. 1200 sq. feet concrete slab has been cast for a temple at Madhupada Village, S. Kota Mandal, Visakhapatnam district.
- d. Sacred pillars have been installed at Hyderabad and Vishakhapatnam.
- e. Two road patches are constructed using paver blocks cast using NAC paste with an area of 7.5mx3m each are in use at NTPC, Sipat.
- f. Used in switchyard /transformer yard at NTPC Sipat.



Fig. 1 NACA Building - NTPC Simhadri



Fig. 2 RCC Dome Technologist House – Vishakhapatnam



Fig .3 NACA Aggregate at Switchyard – NTPC Sipat



Fig. 4 Paver Blocks (NACA based)



Fig. 5 Paver Blocks (NAC Based) – Stack



Fig. 6 Paver Blocks (NAC Based) – Application

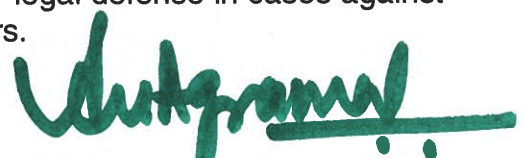
PART 4: STANDARD CONDITIONS

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-5. 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 5 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, PAC is unable to fulfill 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 defense in cases against him or for legal claims he may make from others.

Place: New Delhi
Date of issue: 22/06/2023


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

PART 5: LIST OF APPLICABLE STANDARDS AND CODE

- 5.1 **Standards:** These standards are referred for carrying out particular tests only & do not specify the requirement for the whole product as such.
 - 5.1.1 IS 383 – 2016, Coarse and Fine Aggregate for Concrete – Specification (Third Revision)
 - 5.1.2 IS 9142 (Part 2) - 2018, Artificial lightweight aggregate for concrete – Sintered fly ash coarse aggregate
 - 5.1.3 IS 3812 (Part I) -2013- Pulverized fuel ash flyash part I – for use as pozzolana in cement, mortar, concrete
 - 5.1.4 IS 456-2000 – Code of practice for plain and reinforced concrete
 - 5.1.5 IS 9103-1999 (Reaffirmed 2004)- Concrete Admixtures - Specification
- 5.2 Company Standards of PAC Holder - The PAC Holder has to make available the Company Standards to the consumers according to which testing has been done.

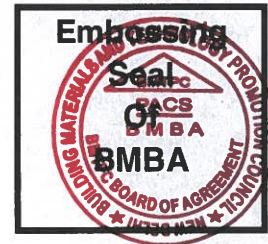
CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Nano Concrete Aggregate (NACA)** is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1064-M/2023** is awarded to **M/s NTPC Ltd., New Delhi.**

The period of validity of this Certificate is for a period of one year i.e. from **22/06/2023 to 21/06/2024** as shown on Page 1 of this PAC. This Certificate consists of pages 1 to 25.



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 6A, 1st Floor, India Habitat Centre
Lodhi Road, New Delhi-110003



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: 22/06/2023

PART 6: LIST OF ABBREVIATIONS

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 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

Annexure-1

Quality Assurance Plan

i. Quality Assurance Plan for Raw materials;

S. No.	Raw material/component	Testing Frequency	Specification	If quality certified in any form, State
1.	Fine fly ash	Each batch/lot	IS 3812 (Part I) -2013	In-house test certificate
2.	Cement (OPC)	Each batch/lot	43 or 53 grade of any standard brand governed by IS: 269-2015 (Ordinary Portland Cement-Specifications) rendering not less than 55 MPa strength at 28-day	MTC
3.	Admixture	Each batch/lot	With solid content at not less than 45%	MTC
4.	Water	For each change of source	IS 456-2000	In-house test certificate

ii. Quality Assurance Plan for Nano Concrete aggregate (NACA) has been submitted to be as per the details below;

S. No.	Performance Characteristics	Requirements, with tolerance, if any	Test Method	Frequency	
				In house	External NABL Accredited lab
1	Aggregates Impact Value %	45 Max	IS: 2386 Part-4 (1963) (Reaffirmed : 2021)	Each Batch	Every six months
2	Aggregates Crushing Value %	50 Max		Each Batch	Every six months
3	Aggregates abrasion value %	50 Max with Aggregate of Grade B vide Table II of IV)-1963		Each Batch	Every six months
4	Specific Gravity	1.7 to 1.9	IS: 2386 Part-3 (1963) (Reaffirmed : 2021)	Each Batch	Every six months
	Water Absorption %	12 Max		Each Batch	Every six months