PUBLIC WORKS DEPARTMENT

OFFICE OF THE CHIEF ENGINEER (BUILDINGS), CHEPAUK, CHENNAI-600 005

CIRCULAR MEMORANDUM NO. AEE /T10 / 57017 / 2007, dated 09.05.2008

Sub: Buildings - Recommendation of High Level Committee constituted to Survey Rivers and River beds in the State - Finding alternate material to Sand - Use of Crushed stone sand - Instructions issued of - Regarding.

Ref: This office letter No. AEE / T10 (B) / 57010 / 2003-1, dated 25.05.2004.

* * *

The High Level Committee consisting of Scientists, Geologists and Environmentalists constituted in G.O(2D).No.46, Industries, dated 25.09.2002 to conduct a specific survey with reference to sand quarrying in rivers and river beds in the state and submitted their findings and the suggestions based on their field visit and also considering the views expressed by the District Collectors to the Government.

2.0. One of major recommendation of the High Level Committee is that initiative should be taken to encourage research programme to find alternate materials for sand. During the course of arguments in the batch of writ petitions filed against G.O.Ms.No.95, Industries, dated 01.10.2003, the Hon'ble Chief Justice High Court, Madras also stressed the need to find out an alternate material for sand and to help to prevent the depletion of river sand and save the rivers from exploitation and ecology.

3.0. In this regard instructions were already given to the Superintending Engineers and Executive Engineers of Building Organisation vide this office letter cited, to use the quarry dust as an alternate to sand after sieving the quarry dust as per the requirements specified in IS:383:1970, by replacing 30% of sand requirements in a construction work.

5.0. Because of the extensive use of sand as fine aggregate for construction works, the availability of river sand is getting scarce due to the multifarious construction activities in our state, it becomes very essential to adopt alternate materials for river sand as fine aggregate.

6.0. In this regard, the Superintending Engineer, PWD., Planning & Design Circle (Buildings), Chennai has been requested to send a report on the usage of crushed stone sand as fine aggregate in construction works. The Superintending Engineer, PWD., Planning and Designs Circle, Chennai after obtaining test reports from the Executive Engineer, PWD., Tamilaga Arasu Building Research Station, Chennai-113 reported that crushed stone sand is nothing but the crushed stone fines and which passes through the sieves as defined in IS:383-1970 in respect of concrete, IS:1542-1992 in respect of mortar and IS:2116-1980 in respect of masonry works provides the compressive strength as that of natural sand and therefore the same can be used as alternate material to the river sand.

7.0. Based on the Superintending Engineer's report and also recommendations by Bureau of Indian Standards, permission is hereby accorded to the field officers that the crushed stone sand shall also be used in construction work as an alternate material to natural sand, wherever the Crushed stone sand is available; provided that,

i. Proper mix design shall be made and adequate number of cubes tested for 28 days compressive strength and the required strength ensured as per IS 456 / 2000.

ii. The Crushed stone sand to be used on concrete shall conform to the gradation requirements as per IS 383 / 1970 specification for coarse and fine aggregates from natural sources for concrete.

iii. The Crushed stone sand to be used on mortar for plastering shall conform to the gradation requirements as per IS 1542 / 1992.

iv. The Crushed stone sand to be used on masonry work shall conform to the gradation requirements as per IS 2116 / 1980.

v. Suitable admixtures as recommended by the BIS conforming to IS:4032-1985 shall be adopted while using quarry rock fines(Crushed Stone Sand)

vi. Crushed stone sand manufactured only from the approved quarry can be used.

8.0. Stone dust and quarry rubbish for which rates are available in the schedule of rates can be used only in filling low lying areas, filling in basement etc. Necessary steps will be initiated to include the crushed stone sand in the schedule of rates, so as to adopt uniform rates through out the state.

9.0. The use of crushed stone sand for Reinforced Cement Concrete structure requires more detailed research studies before going in for wide practical application and hence, the instructions thereon will be issued separately.

10.0. A model specification adopting Crushed stone sand as fine aggregate for certain items involved in building works are prepared and enclosed herewith vide Annexure-I for ready reference and adoption.

11.0. The receipt of this circular memo may be acknowledged.

Encl.: Annexure-I

9/5/2008

for Chief Engineer (Buildings)

09/05/08

To

All the Superintending Engineers &
Executive Engineers of PWD.,
Buildings Organisation.

Copy to

The Engineer-in-Chief, WRO, & Chief Engineer (General), PWD, Chennai-5
The Chief Engineer (Buildings), PWD, Chennai-5
The Joint Chief Engineer (Buildings), PWD, Chennai-5
The Deputy Chief Engineer (Buildings), PWD, Chennai-5
The HDO-I, HDO-II, O/o. the Chief Engineer (Buildings), PWD, Chennai-5
The AEEs of all Technical Sections, O/o. Chief Engineer (Bldgs), PWD, Chennai-5
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ANNEXURE-I

PUBLIC WORKS DEPARTMENT
BUILDING ORGANISATION

SPECIFICATION FOR ITEM OF WORKS USING CRUSHED STONE SAND (QUARRY ROCK DUST)

Sl. No.	Description	Unit
1	Supplying and filling in basement with sand and quarry rubbish / stone dust [sand and quarry rubbish / stone dust mixed in the ratio of 1:1] in layers of not more than 10cm thick well rammed, watered and well consolidated complete complying with standard specification.	$1m^3$
2	Supplying and filling in basement with Gravel and quarry rubbish / stone dust mix [gravel and quarry rubbish / stone dust mixed in the ratio of 1:1] in layers of not more than 10cm thick well rammed, watered and consolidated upto the optimum limit complete complying with standard specification.	$1m^3$
3	Cement concrete 1:5:10 [One part of cement, five parts of Crushed stone sand and ten parts of hard broken stone jelly] using 40mm gauge hard broken granite stone jelly for foundation including dewatering wherever necessary and laid in layers of not more than 15cm thick, well rammed consolidated and curing etc., complete complying with standard specification. [The Crushed stone sand to be used on concrete work shall conform to gradation as per IS 383-1970]	$1m^3$
4	Brick work using ground moulded 2nd class country bricks of size 8¾" x 4¼" x 2¾" set in cement mortar 1:5 [One part of cement and five parts of Crushed stone sand] including finishing, curing etc., complete complying with standard specification. [The Crushed stone sand to be used on brick work shall conform to IS 2116-1980]	$1m^3$
5	Cement concrete 1:5:10 [One part of cement, five parts of Crushed stone sand and ten parts of hard broken granite stone jelly] using 40mm gauge hard broken granite stone jelly for flooring including laying in alternate bays, consolidating, rendering the top surface rough to take the floor finish and curing etc., complete complying with standard specification. [The Crushed stone sand to be used on concrete work shall conform to gradation as per IS 383 - 1970]	$1m^3$
6	Providing granolithic floor finish of following thick with plain cement concrete 1:2:4 [One part of cement, two parts of Crushed stone sand and four parts of stone jelly] using 10mm to 12mm hard broken stone jelly and the top surface shall be rubbed smooth with cement and finishing, threading and curing in all floors etc., complete complying with standard specification. [The Crushed stone sand to be used on concrete work shall conform to gradation as per IS 383 -1970 and the Crushed stone sand to be used for mortar shall conform to IS 1542 - 1977]	
a	20mm thick	$1m^2$
b	25mm thick	$1m^2$
c	40mm thick	$1m^2$

Sl. No.	Description	Unit
7	Paving the floor with approved quality fine polished kota stone slab of size 610 x 610 x 20mm laid over a cement mortar bed of 20mm thick using cement mortar 1:3 [One part of cement and three parts of Crushed stone sand] fixing the slabs in true right angles with minimum possible width of joints and pointing the joints with cement mortar 1:3 [One part of cement and three parts of Crushed stone sand]. White cement mixed with colouring pigments shall be used for slurry for pointing the slab portion at the rate of 1.80 kg / sqm. and polishing with floor polisher to a high degree of finish and curing etc., complete complying with standard specification. [The Crushed stone sand to be used in base mortar shall conform to gradation as per IS 1542 - 1977]	$1m^2$
8	Paving the floor with design colour ceramic tiles of size 305 x 305 x 6mm in all floors over a base layer of cement Mortar 1:3 [One part of cement and three parts of Crushed stone sand] 20mm thick pointed with white cement mixed with colouring pigments at the rate of 0.3 kg / sqm. including finishing neatly and curing etc., complete complying with standard specification and as directed by the departmental officers. [The Crushed stone sand to be used in base mortar shall conform to gradation as per IS 1542 - 1977]	$1m^2$
9	Dadooing the walls with best approved first quality printed design glazed tiles of size 305 x 200 x 6mm set in cement mortar 1:2 [One part of cement and two parts of Crushed stone sand] 10mm thick and pointed with colour cement at the rate of 0.40 kg per sqm. finishing neatly and curing in all floors etc., complete complying with standard specification. [The Crushed stone sand to be used in base mortar shall conform to gradation as per IS 1542 - 1977]	$1m^2$
10	Finishing the top of roof with one course of approved first quality machine pressed tiles of size 230mm x 230mm x 20mm thick laid in cement mortar 1:3 [One part of cement and three parts of Crushed stone sand], 12mm thick mixed with water proofing compound conforming to Indian Standard Specifications at 2% by weight of cement used and the joints pointed neatly to full depth of tiles with the same mortar mixed with red oxide etc., complete complying with standard specification. [The Crushed stone sand to be used in base mortar shall conform to gradation as per IS 1542 - 1977]	$1m^2$
11	Plain cement concrete 1:2:4 [One part of cement, two parts of Crushed stone sand and four parts of hard broken stone jelly] using 20mm / 10 to 12mm HBGS metal for wearing coat including laying consolidating, finishing and curing etc., complete complying with standard specification as directed by the departmental officers [The Crushed stone sand to be used on concrete work shall conform to gradation as per IS 383 - 1970 and also as per IS 456 - 2007]	
a	Foundation and basement	$1m^3$

Sl. No.	Description	Unit
12	Special ceiling plastering and finishing the exposed surface of RCC items of work with cement mortar 1:3 [One part of cement and three parts of Crushed stone sand], 10mm thick including hacking the surfaces and providing cement mortar nosing for staircase steps, beading for sunshade, finishing and curing etc., complete in all floors complying with standard specification. [The Crushed stone sand to be used in base mortar shall conform to gradation as per IS 1542 – 1977]	$1m^2$
13	Plastering with cement mortar 1:5 [One part of cement and five parts of Crushed stone sand] 12mm thick in all floors including finishing neatly curing etc., complete complying with standard specification. [The Crushed stone sand to be used shall conform to IS 1542 – 1977]	$1m^2$
14	Casting and fixing in position of 50mm thick RCC precast slab in cement concrete 1:2:4 [One part of cement, two parts of Crushed stone sand and four parts of stone jelly] using machine crushed hard granite broken stone jelly of 20mm / 10mm to 12mm size excluding cost of steel reinforcement but including cost of moulding charges, casting of slab, finishing, curing and fixing the precast slab in position in all floors etc., complete complying with standard specification. [The Crushed stone sand to be used for concrete work shall conform to IS 383 – 1970]	$1m^2$
15	Cement concrete 1:2:4 [One part of cement, two parts of Crushed stone sand and four parts of stone jelly] using 20mm machine crushed hard broken granite stone jelly for plain cement concrete precast pavement slab of following size including moulding charges, finishing, curing and fixing them in position including pointing with cement mortar 1:3 [One part of cement and three parts of Crushed stone sand] to full depth of the slab etc., complete complying with the standard specification. [The Crushed stone sand to be used for concrete work shall conform to IS 383 – 1970 and in respect of mortar shall conform to IS 1542 – 1977]	
a	Pavement slab of size 60 x 60 x 5cm	$1m^2$
b	Pavement slab of size 45 x 45 x 5cm	$1m^2$

9/5/2008

for Chief Engineer (Buildings)

09/05/08

GOVERNMENT OF TAMIL NADU
PUBLIC WORKS DEPARTMENT
BUILDINGS ORGANISATION

OFFICE OF THE ENGINEER IN CHIEF (BUILDINGS) &
CHIEF ENGINEER (BUILDINGS) CHENNAI REGION AND CHIEF ENGINEER (GENERAL)
PWD., CHEPAUK, CHENNAI 600 005

Circular Memorandum No. AEE / T10 / 57017 / 2012, dated 30.08.2012

Sub: Buildings- Finding alternate material to sand – Use of Crushed Stone Sand – Instructions issued –Regarding

Ref Recommendation of Superintending Engineer, PWD, Planning and Design Circle, Chepauk Chennai in Letter No. SE/P&D/AA-IV/M-Sand/ 2012 Dt. 27.08.2012

1.0. Sand resulting from the natural disintegration of rock which have been deposited by streams / rivers are known as Natural Sand or River Sand. Extensive use of this river sand as fine aggregate in construction works result in scarcity of river sand. Further Excess mining of sand affects the river system and lowers the ground water level. Therefore it is imperative to find alternate material to river sand. In this connection a circular has already been issued in the Chief Engineer (Buildings) PWD , Circular No AEE/T10/ 57017/2007 DT 09.05.2008 for the use of Crushed Stone Sand as an alternate to river Sand, based on the Recommendations of the High Level Committee consisting of Scientists, Geologists and Environmentalists constituted in G.O (2D) No 46, Industries dt 25.09.2002.

2.0. The Sand Manufactured by crushing hard stones are called Manufactured Sand (M-Sand) or Crushed Stone Sand. In stone crusher units stone boulders are crushed and converted in to 40mm, 20mm, 12mm, and 6mm stone jellies. The other crushed particles are left unutilized as quarry debris and dust. The particles of sizes ranging from 4.75mm to 150 microns are collected and commercially sold as Manufactured Sand or M-Sand in open market.

3.0. The Quarry dust is not M-Sand and it should not be used as an alternate to sand except for filling basement. Most of the M-Sand now sold in the open market produced by compression crushing is flaky and more angular in shape. The surface texture is very rough and concrete results in honey combing. The process of manufacturing M – Sand shall be such that it should give Cubical particles and the Manufactured Sand shall comply with Bureau of Indian Standards to ensure good quality. Vertical Shaft Impactor (VSI) is the best machine for making M-sand from stone and therefore the M-Sand manufactured using this type of machinery only should be permitted for use in construction.

4.0. In the circular under reference, the field officers of PWD have been permitted to use Crushed Stone Sand in the construction work as an alternate material to Natural Sand subject to certain conditions. Regarding this, it is reiterated specifically that the Crushed stone sand should comply with all the provisions furnished in the following IS Codes and detailed in the following paragraphs.

IS 383:1970	Gradation details for fine aggregate for concrete shall be as in **Table 4** ; The information to be furnished by the supplier and the Description & Physical characteristics of aggregates for concrete shall be as in **Appendix A & C**
IS 2116 :1980	Gradation of sand to be used on masonry works shall conform to the requirements in **Table I**
IS 1542: 1992	Gradation details of sand (Natural and crushed stone sand) for internal wall, External wall and Ceiling Plastering shall be as in **Table 1**

The tables mentioned above are enclosed in the Annexure for Ready Reference

4.1. Since the quality of the fine aggregate depends on the source and the nature of the rock to be crushed, the information of the fine aggregate **to be furnished by the supplier** should be as per the **APPENDIX A of IS 383:1970 (Clause 0.8)** enclosed in the Annexure.

4.2. In the circular under reference it is already instructed to make proper Mix Design and adequate number of cubes shall be tested for 28 days compressive strength as per **IS 456:2000**. It is now instructed that the description and physical characteristics of aggregates **for concrete** should be as **on Appendix C of IS 383: 1970** wherein the Trade groups of Rocks

used as concrete aggregate, Particle shape and Surface Texture are described. Further for Reinforced Cement Concrete produced using M Sand, the following test shall be conducted before field adoption.

(i) Consistency of Concrete IS 1199-1959 (2004)
(ii) Drying shrinkage IS 1199-1959 (2004)
(iii) Bond Strength (Pull out test) IS 2770 (Part I) – 1967 (2002)
(iv) Compressive strength and Flexure Strength IS 516- 1959 (2004)

4.3. The Gradation of sand to be used on **masonry works** shall conform to the requirements in **Table I of IS 2116 - 1980** enclosed in the Annexure.

4.4. Gradation details of crushed stone sand for internal wall, External wall and Ceiling Plastering shall be as in **Table 1 of** IS 1542: 1992 enclosed in the Annexure.

5.0. The field officers are requested to adopt "M Sand" conforming to the above IS codal provisions in the detailed estimate itself depending on their availability in the open market. Even for the on-going works , M Sand can be substituted without exceeding the expenditure over and above the estimate value.

Encl.: Page 4 to 11 (Extracts from I.S. Codes)

Sd/-
Engineer-in-Chief (Buildings) &
Chief Engineer (Buildings) Chennai Region
and Chief Engineer (General), PWD,

To

All Chief Engineer of W.R.O & B.O.

All Superintending Engineers of W.R.O & B.O.

All Executive Engineers of W.R.O & B.O.

Copy to

1. The Secretary to Government, Public Works Department, Secretariat, Chennai-9
2. The Engineer-in-Chief, Water Resources Department, Chepauk, Chennai-5
3. The Joint Chief Engineer (Buildings), PWD., Chepauk, Chennai.5
4. The Deputy Chief Engineer (Buildings) PWD., Chepauk, Chennai.5
5. The HDO, AEEs of all technical sections of office of the Engineer in Chief (buildings) & Chief Engineer (Buildings), Chennai region and Chief Engineer (General) PWD, Chepauk, Chennai 600 005
6. Stock file

// Forwarded by Order //

30/8/2012

for Engineer-in-Chief (Buildings) &
Chief Engineer (Buildings) Chennai Region
and Chief Engineer (General), PWD,

TABLE 4 - IS 383:1970-FINE AGGREGATES

IS SIEVE DESIGNATION	PERCENTAGE PASSING FOR			
	Grading Zone 1	Grading Zone II	Grading Zone III	Grading Zone IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600micron	15-34	35-59	60-79	80-100
300micron	5-20	8-30	12-40	15-50
150micron	0-10	0-10	0-10	0-15

Note 1-For crushed stone sands, the permissible limit on 150-micron IS Sieve is increased to 20 percent. This does not affect the 5 percent allowance permitted in 4.3 applying to other sieve sizes.

Note 2 - Fine aggregate complying with the requirements of any grading zone in this table is &table for concrete but the quality of concrete produced will depend upon number of factors including proportions.

Note 3 - Where concrete of high strength and good durability is required, fine aggregate conforming to any one of the four grading zones may be used, but the concrete mix should be properly designed. As the fine aggregate grading becomes progressively finer, that is, from Grading Zones I to IV the ratio of fine should be progressively reduced. The most suitable fine to coarse ratio to be used for any particular mix will, however, depend upon the actual grading, particle shape and surface texture of both fine and coarse aggregates.

Note 4- It is recommended that fine aggregate conforming to Grading Zone IV should not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

TABLE 1 of IS 2116-1980 GRADING OF SAND FOR USE IN MASONRY MORTARS

IS Sieve Designation	Percentage Passing by Mass
4.75 mm	100
2.36 mm	90 to 100
1.18 mm	70 to 100
600 micron	40 to 100
300 micron	5 to 70
150 micron	0 to 15

Table 1 of IS 1542:1992 - Grading of Sand for Internal Wall or External Wall or Ceiling Plaster

IS Sieve Designation (See IS 460:1985)	Percentage Passing
10mm	100
4.75mm	95-100
2.36 mm	95-100
1.18mm	90-100
600 micron	80-100
300 micron	20-65
150 micron	0-15

NOTE - For crushed stone sands and crushed gravel sands, the permissible limit on 150 micron IS Sieve is increased to 20 percent. This does not affect the 5 percent allowance permitted in 5.1.

APPENDIX A of IS 383:1970 (Clause 0.8):

A-I. DETAILS OF INFORMATION OF FINE AGGREGATE

A-I.1 When requested by the purchaser or his representative, the supplier shall provide the following particulars:

a) Source of supply, that is, precise location of source from where the materials were obtained;
b) Trade group of principal rock type present (as in Appendix C of the code);
c) Physical characteristics (see Appendix of the code C);
d) Presence of reactive minerals; and
e) Service history, if any.

A-I.2 Subject to prior agreement, the supplier shall furnish such of the following additional information, when required by the purchaser:

i. Specific gravity,
ii. Bulk density,
iii. Moisture content,
iv. Absorption value,
v. Aggregate crushing value or aggregate impact value,
vi. Abrasion value,
vii. Flakiness-index,
viii. Elongation-index,
ix. Presence of deleterious materials,
x. Potential reactivity of aggregate, and
xi. Soundness of aggregate

APPENDIX C

(*Clause* A-1.1)

DESCRIPTION AND PHYSICAL CHARACTERISTICS OF AGGREGATES FOR CONCRETE

C-1. GENERAL HEADINGS

C-1.1 To enable detailed reports on aggregates to be framed on a comparable basis, the following general headings under which the appropriate information may be given are suggested as a guide:

a) *Trade Group* — For example, granite, limestone and sandstone (*see* **C-2.1**);

b) *Petrological Name and Description* — The correct petrological name should be used and should be accompanied by a brief description of such properties as hardness, colour, grain, imperfections, etc;

c) *Description of the Bulk* — The degree of cleanliness, that is, freedom from dust, should be stated and reference made to the presence of any pieces not representative of the bulk, such as elongated or flaky pieces;

d) *Particle Shape* — *See* **C-3**; and

e) *Surface Texture* — *See* **C-3**.

C-2. NOMENCLATURE OF ROCK

C-2.0 The technical nomenclature of rocks is an extensive one and for practical purposes it is sufficient to group together with those rocks having certain petrological characteristics in common. Accordingly, the list of trade groups given in **C-2.1** is adopted for the convenience of producers and users of stone.

C-2.1 Trade Groups of Rocks Used as Concrete Aggregate

Names of trade groups: Granite, Gabbro, Aplite, Dolerite, Rhyolite, Basalt, Sandstone, Limestone, Granulite, Gneiss, Schist and Marble

C-2.1.1 *List of Rocks Placed Under the Appropriate Trade Groups* — The correct identification of a rock and its placing under the appropriate trade group shall be left to the decision of the Geological Survey of India or any competent geologist.

IGNEOUS ROCKS

Granite Group

Granite
Granophyre
Granodiorite
Diorite
Syenite

Gabbro Group

Gabbro
Norite
Anorthosite
Peridotite
Pyroxenite
Epidiorite

Aplite Group

Aplite
Porphyry
Quartz reef

Dolerite Group

Dolerite
Lamprophyre

Rhyolite Group

Rhyolite
Trachyte
Felsite
Pumicite

Basalt Group

Andesite
Basalt

SEDIMENTARY ROCKS

Sandstone Group

Sandstone
Quartzite
Arkose
Graywacke
Grit

Limestone Group

Limestone
Dolomite

METAMORPHIC ROCKS

Granulite and Gneiss Groups

Granite gneiss
Composite gneiss
Amphibolite
Granulite

Schist Group

Slate
Phyllite
Schist

Marble Group

Marble
Crystalline
Limestone

C-3. PARTICLE SHAPE AND SURFACE TEXTURE

C-3.1 The external characteristics of any mixture of mineral aggregate include a wide variety of physical shape, colour and surface condition. In order to avoid lengthy descriptions, it may be convenient to apply to distinctive group types of aggregates some general term which could be adopted.

C-3.2 The simple system shown in Tables 6 and 7 has, therefore, been devised and is put forward in the hope that it will facilitate defining the essential features of both particle shape and surface characteristics.

C-3.3 Surface characteristics have been classified under five headings or groups. The grouping is broad; it does not purport to be a precise petrographical classification but is based upon a visual examination of hand specimens. With certain materials, however, it may be necessary to use a combined description with more than one group number for an adequate description of the surface texture, for example, crushed gravel, 1 and 2; oolites 3 and 5.

TABLE 6 PARTICLE SHAPE

(*Clause* C-3.2)

Classification	Description	Illustrations of Characteristic Specimens	Example
(1)	(2)	(3)	(4)
Rounded	Fully water worn or completely shaped by attrition	Fig. 1	River or seashore gravels; desert, seashore and windblown sands
Irregular or partly rounded	Naturally irregular, or partly shaped by attrition, and having rounded edges	Fig. 2	Pit sands and gravels; land or dug flints; cuboid rock
Angular	Possessing well-defined edges formed at the inter-section of roughly planar faces	Fig. 3	Crushed rocks of all types; talus; screes
Flaky	Material, usually angular, of which the thickness is small relative to the width and/or length	Fig. 4	Laminated rocks

TABLE 7 SURFACE CHARACTERISTICS OF AGGREGATES

(*Clause* C-3.2)

GROUP	SURFACE TEXTURE	EXAMPLE
1	Glassy	Black flint
2	Smooth	Chert, slate, marble, some rhyolite
3	Granular	Sandstone, oolites
4	Crystalline	Fine: Basalt, trachyte, keratophyre
		Medium: Dolerite, granophyre, granulite, microgranite, some limestones, many dolomites
		Coarse: Gabbro, gneiss, granite, granodiorite, syenite
5	Honey combed and porous	Scoriae, pumice, trass

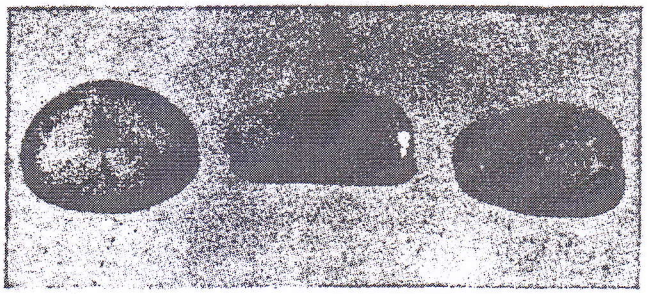

FIG. 1 PARTICLE SHAPE: ROUNDED

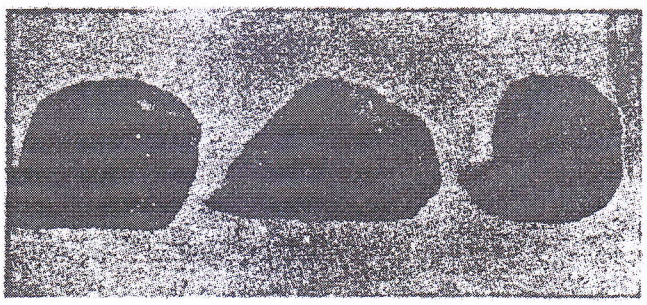

FIG. 2 PARTICLE SHAPE: IRREGULAR

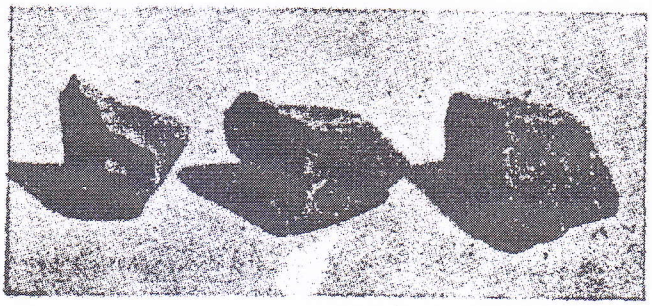

FIG. 3 PARTICLE SHAPE: ANGULAR

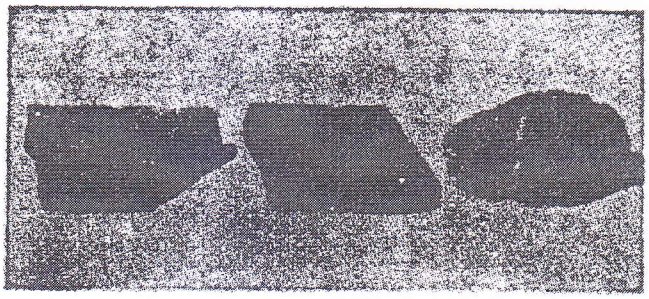

FIG. 4 PARTICLE SHAPE: FLAKY

PUBLIC WORKS DEPARTMENT
BUILDINGS

OFFICE OF THE ENGINEER-IN-CHIEF (BUILDINGS),
CHIEF ENGINEER (BUILDINGS) CHENNAI REGION AND
CHIEF ENGINEER (GENERAL), PWD.,
CHEPAUK, CHENNAI – 5

Technical Circular No. AEE / T10 / 57017 , dated 12.07.2017

Sub : Building – Crushed Stone Sand (CS-Sand) - Alternate material to River sand – Circular Instructions issued - Regarding

Ref : Engineer-in-Chief (Buildings) & Chief Engineer (Buildings) Chennai Region and Chief Engineer (General), PWD., Circular No. AEE / T10 / 57017 / 2012, dated 30.08.2012

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1.0. In recent years, considerable emphasis has been made by the experts in the construction industry to use Manufactured Sand (M-Sand) as River Sand resources are exhausting very rapidly. It has also been proved that Good quality M-sand can be used as an alternative construction material to River sand.

2.0. Though the definition of Manufacturing Sand (M-Sand) as per IS 383:2016 code refers to processed fine aggregates, the Crushed Stone Sand is commercially called as M-sand in the Market.

3.0. IS 383:2016 code under clause 3.1.2 defines the crushed sand as, (1) Crushed stone sand - Fine aggregate produced by crushing hard stone. (2) Manufacturing fine aggregate (Manufactured Sand) - Fine aggregate manufactured from other than natural sources, by processing materials, using thermal or other process such as separation, washing, crushing and scrubbing.

4.0. In the reference circular cited, PWD permitted to use Crushed Stone Sand hereafter called **"CS-Sand"** in the construction work as an alternate material to Natural Sand with the condition that it should comply with all the requirements as stipulated by relevant codes of Bureau of Indian Standards.

5.0. However, there has been general reluctance to use the CS-Sand in construction works mainly due to lack of supply of good quality CS-Sand. It has been noticed that Quarry Dust which contains Flaky particles and higher percentage of Micro fines (particles less than 75 micron) is being supplied in the name of CS-Sand and these properties affect the quality of concrete and other works.

6.0. Hence, in continuation of earlier circular instructions issued, to bring awareness about the use of good quality CS-Sand and to promote the use of the CS-Sand an alternate to River Sand, the following further circular instruction are issued in respect of quality checks to be carried out on CS-Sand and the manufacturing process of good quality CS-Sand.

Quality checks on Crushed Stone Sand

7.0. Following aspects help to assess the quality of CS-Sand.

- Carrying out Simple field tests for certain parameters.
- Testing at the Laboratories shall be in accordance with IS Bureau of Indian Standards.
- Inspection of CS-Sand production unit to ensure that the unit has the five stage processes established and practiced.

Field Tests on Crushed stone sand

8.0. Keeping in hand the Crushed Stone Sand taken from a heap and just by visual observation and rubbing it in between fingers, excess presence of quarry dust , flakiness , gradation , texture of crushed stone sand etc., is verified and quality can be ensured based on the experience.

Testing of CS-Sand by "visual observation" and "rubbing with hand" to assess the presence of Quarry dust

Shape test by visual observation

9.0. Particles retained on 4.75mm and 2.36 mm can be verified visually for the particle shape. Additionally, an image taken with the help of Mobile camera that has resolution of 8 MP and more can be zoomed to verify the shape.

Good quality CS-Sand (2.36mm) - Cubical

River Sand (2.36mm) - Cubical

Poor Quality CS-Sand with Flaky Particles

Good Quality CS-Sand

VSI Crushed Sand - Cubical - Good Quality

JAW Crushed Sand - Flaky - Poor Quality

Particle Size Distribution by Sieve Analysis

10.0. Sieve Analysis can be carried out at site with the set of sieves as stipulated by BIS to find out the particle size distribution of CS-Sand across various size fractions.

Particles less than 75 micron (Micro fines)

11.0. This test is done by "Wet Sieving" CS-Sand sample through 75 micron sieve through which the presence of Micro fines can be measured. Though IS 383:2016 accepts 15% as upper limit for presence of Micro fines, according to Industry experts it is advisable to limit this upper value to 7%.

Cube test for compressive strength

12.0. After the use of CS-Sand, to test the compressive strength of concrete, the specimen of required numbers of standard cube of (150 mm x 150 mm x 150 mm) have to be casted and cured in water and tested for 3, 7 and 28 days and test results should comply the stipulated requirements of Bureau Indian Standards.

Laboratory Tests on CS-Sand

13.0. CS-Sand should adhere to the highest standards and must undergo the following quality tests

1. Sieve analysis
2. Specific gravity
3. Water absorption
4. Bulk density (loose and compact)
5. Alkali aggregate reaction
6. Soundness
7. Deleterious materials
8. Organic impurities
9. Micro fines content
10. Chloride and Sulphate Content
11. Petro graphical Analysis if Manufacturer does not possess.
12. Tests for Silt and clay

14.0. List of few labs for conducting test on CS-Sand are furnished below :

1. National Test House, Government of India, Taramani, Chennai
2. ICOMAT- The IIT incubated lab, Perungudi, Chennai
3. Soil Mechanics and Research Lab, PWD, Taramani, Chennai
4. Tamilaga Arasu Building Research Station, Taramani, Chennai
5. Labs of various Engineering Colleges all over Tamilnadu

Plastering

15.0. The specialized CS-Sand of particular gradation (as called Puuchchu Manal) should alone be used for plastering with addition of super plasticiser at the rate of 100ml per bag of cement for better bonding and achieving the required strength of plaster.

Caution

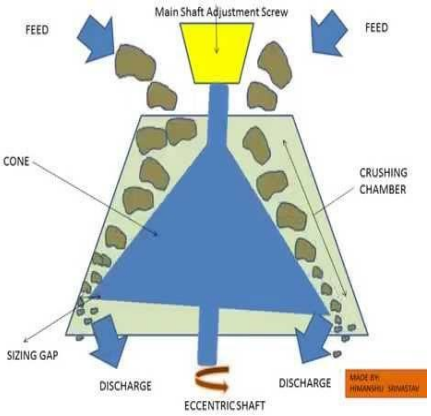
16.0. By-products during crushing of rocks are not Crushed Stone Sand. A Crusher Dust (or Quarry Dust) produced from fine screening of quarry crushing cannot be called Crushed Stone Sand.

The fine particles obtained, as by-products during crushing of rocks to produce coarse aggregates (by jaw crusher and/or cone crusher) are known as Quarry Rock Fines / Quarry Dust / Crusher Dust. These by-products are not suitable for concrete or mortar as they contain higher percentage of dusty, flaky particles of un-controlled sizes with high water absorbent property. If the crusher dust is flaky and angular in shape, the workability will be very difficult. There is no plasticity in the concrete and mortar which makes it even difficult for the mason to work, whereas if it is cubical in shape with grounded edge, superior gradation and good plasticity to concrete will be obtained.

17.0. Crushed Stone Sand (CS-Sand) manufacturing process

Quarrying good Stones
⇩
Jaw Crushers
⇩
Cone Crushers
⇩
Vertical shaft Impactor
⇩
screening
⇩
washing
⇩
Crushed Stone Sand

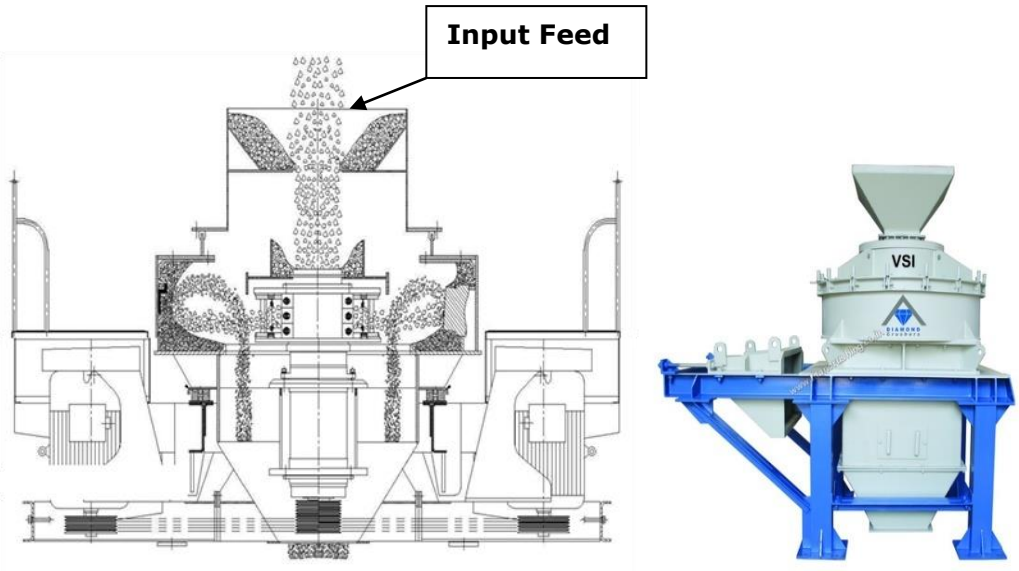
Jaw Crusher



Cone Crusher

18.0. Vertical Shaft Impact (VSI) Crusher

This involves an important stage of using Tertiary crusher called Vertical Shaft Impact (VSI) Crusher which carries out a combined process of reducing coarser particles into finer particles and shaping the fine particles by removing the flaky and weak edges.



Vertical Shaft Impact (VSI) Crusher

19.0. Conclusion

Adhering to the above mentioned technical aspects and based on various studies conducted by Industry experts and also examination made by TNPWD, Use of Good quality Crushed stone Sand with distinctive properties, manufactured following the above mentioned processes can be permitted in PWD for construction works as alternate material to River Sand.

Further it is informed that, Good Quality C.S-Sand provides greater durability and required strength to concrete by overcoming deficiencies like segregation, honey combing, voids and capillary action.

Hence, through this circular memorandum, it is instructed that all the officials of PWD are requested to use CS-Sand in construction activities as alternate to River Sand without any reluctance by adhering to all the above instructions.

The rates for Crushed Stone Sand and River Sand are provided vide page 19 of PWD Schedule of Rates for the year 2017-2018.

(Sd/- R. Jayasingh)
ENGINEER-IN-CHIEF (BUILDINGS),
CHIEF ENGINEER (BUILDINGS) CHENNAI REGION AND
CHIEF ENGINEER (GENERAL), PWD.,
CHEPAUK, CHENNAI – 5

To
All Chief Engineers of PWD,
All the Superintending Engineers of PWD,
All the Executive Engineers of PWD,
All the AEEs & HDO, O/o Engineer-in-Chief (Buildings), PWD., Chennai

Copy to the Principal Secretary to Government, Finance Department, Secretariat, Chennai-9
Copy to the Principal Secretary to Government, Public Works Department, Secretariat, Chennai-9

// Forwarded by Order //

12-7-2017

FOR ENGINEER-IN-CHIEF(BUILDINGS),
CHIEF ENGINEER (BUILDINGS) CHENNAI REGION AND
CHIEF ENGINEER (GENERAL), PWD.,

12/7/17

PUBLIC WORKS DEPARTMENT
BUILDINGS

OFFICE OF THE ENGINEER-IN-CHIEF (BUILDINGS),
CHIEF ENGINEER (BUILDINGS) CHENNAI REGION AND
CHIEF ENGINEER (GENERAL), PWD.,
CHEPAUK, CHENNAI – 5

Technical Circular No. AEE / T10 / 24475 , dated.14.09.2017

Sub : Building –Crushed Stone Sand (CS-Sand)- Commercially called as M Sand - Product approval by the PWD Assessment Committee - Circular Instructions issued - Regarding

Ref :
1. G.O. Ms. No. 106, Department of Housing, dated 06.03.1975
2. Engineer-in-Chief (Buildings) & Chief Engineer (Buildings) Chennai Region and Chief Engineer (General), PWD., Circular No. AEE / T10 / 57017 / dated 12.07.2017

****

1.0. In this office Circular 2nd cited orders were already issued to use the M Sand (technically called as Crushed Stone Sand) as alternate to River sand.

2.0. It is necessary to identify and use good quality M Sand in all building works executed by PWD. To ensure the quality of the M.Sand, firms manufacturing M Sand may place their product in the PWD Assessment Committee for approval of the product.

3.0. The Government in G.O. Ms. No. 106, Department of Housing, dated 06.03.1975 constituted Assessment Committee to evaluate the innovations in use of materials and construction techniques with representatives from various institutions.

4.0. At present the Assessment committee is constituted with Engineer-in-Chief (Buildings) & Chief Engineer (Buildings) Chennai Region and Chief Engineer (General), PWD.,, as Chairman and the Superintending Engineer , PWD Planning and Design circle Chennai as Member Secretary. The members of this committee are representatives from Indian Institute of Technology (IIT), Bureau of Indian Standards (BIS), Anna University, Structural Engineering Research Centre (SERC), Tamil Nadu Housing Board, Tamil Nadu Slum Clearance Board, Tamil Nadu Police Housing Corporation, Tamil Nadu Electricity Board, Directorate of Technical Education, Military Engineering Service, Institution of Engineers and Builders Association.

5.0. The Assessment committee examines the product details based on the Bureau of Indian standards and based on the **Test Reports from the Government laboratories** such as National test house or MSME laboratories and Laboratories of Government Academic Institution such as IIT, IIT incubated Labs, Anna University etc. The committee issues product approval certificates with a validity of three years. After three years firms should apply for renewal of approval with necessary details.

6.0. Now it is instructed that the M Sand products manufactured by the firms also have to apply for the approval of the PWD Assessment Committee like other building materials to qualify for use in PWD Government projects.

7.0. In this connection the form of application/ checklist for approval to be submitted to the assessment committee is enclosed.

8.0. The application should be submitted along with the details of Registrations/ licences, the facilities available including the machineries etc along with the Test Reports from the State / Central Government laboratories such as National test house or MSME laboratories, or PWD SM&R Laboratory or Government Academic Institution such as IIT, IIT incubated laboratories , Anna University, Government Engineering colleges. The test reports should show compliance of the specifications of M Sand as per BIS Standards as already issued in the circular 2nd cited.

9.0. After the application is received by the Chairman Assessment Committee, the product details shall be placed in the PWD Assessment Committee through the Member Secretary and approval Certificate shall be issued by PWD only upon approval by the committee

10.0. Executive Engineer, PWD should inspect the manufacturing unit and site to verify the details furnished in the application for approval.

11.0. After approval also the nominated PWD Engineer shall inspect then and there to see that the M Sand is manufactured as per approved Specification. Whenever any deviations in manufacturing process/ quality of the products are noticed the approval shall be cancelled by the Chairman of the Assessment Committee PWD at any time.

Hence, through this circular memorandum, the Superintending Engineers and Executive Engineers of PWD are requested to interact with the interested firms which are manufacturing M Sand as per BIS Specifications so as to apply for approval of their product in the PWD Assessment Committee to qualify for the use of their Product in the Government works.

Encl : Application and Check list for approval of M Sand.

14/9/2017

for Engineer-in-Chief (Buildings),
Chief Engineer (Buildings) Chennai Region &
Chief Engineer (General) PWD.

14/9/17

To:

1. All Chief Engineers of PWD, WRD & B.O.
2. All Superintending Engineers of PWD, WRD & B.O.
3. All the Executive Engineers of PWD, WRD & B. O.
4. All the Executive Engineers of PWD, WRD & B.O.
5. All the AEEs & HDO, O/o. Engineer-in-Chief (Buildings),PWD, Chennai.

Copy:

1. The Principle Secretary to Government, Public Works Department, Secretariat, Chennai – 600 009.
2. All the District Collectors.
3. Commissioner of Geology and Mining, Department of Geology and Mining, Thiru.Vi.Ka. Industrial Estate, Guindy, Chennai – 600032.
4. All Assessment Committee Members of
   (i) Indian Institute of Technology (IIT),
   (ii) Bureau of Indian Standards (BIS),
   (iii) Anna University,
   (iv) Structural Engineering Research Centre (SERC),
   (v) Tamil Nadu housing Board,
   (vi) Tamil Nadu Slum Clearance Board,
   (vii) Tamil Nadu Police Housing Corporation,
   (viii) Tamil Nadu Electricity Board,
   (ix) Directorate of Technical Education,
   (x) Military Engineering Service,
   (xi) Institution of Engineers and Builders Association.
5. Spare Copy to File.

CHECKLIST FOR

PRODUCT APPROVAL OF THE CRUSHED STONE SAND – CS SAND (M SAND)

BY THE ASSESSMENT COMMITTEE OF THE PUBLIC WORKS DEPARTMENT,

GOVERNMENT OF TAMILNADU

1	a.	Name of Applicant / Company	
	b.	Full Address	
	c.	Telephone Number	
	d.	Mobile Number	
	e.	Email ID	
	f.	Details of Registration of Company (enclosed copies) – Whether Individual, Private / Public Limited Company / Proprietorship firm etc.	
	g.	Tax / GST Registration	
	h.	Location of Manufacturing Unit	
	i.	Sources of Raw Materials	
	j.	Annual Turnover	
	k.	PAN No. IT Returns	
	l.	Experience in this field	
	m.	Employees in the firm (i) Technical (ii) Non-Technical	
2		Product, Product Range for which approval is required (Any brand name)	

3	a.	Machineries / Equipments available for manufacturing (i) Collection of Good Stones (ii) Jaw Crusher (iii) Cone Crusher (iv) Vertical Shaft Impactor (v) Sieve (vi) Washing	
	b.	Own in house Laboratories / testing facilities available in the Factory & Site	
4.		Whether enclosed Test Reports (Test Reports Test Reports from the State / Central Government laboratories such as National test house or MSME laboratories, or PWD SM & R Laboratory or Government Academic Institution such as IIT, IIT incubated laboratories, Anna University, Government Engineering Colleges)	
5		Technical Specification / codes Followed for manufacturing	
6		Whether supplied to Government departments?	
7		Whether the firm or connected person in firm involved in any legal case - If yes furnish details	

Note: Any other copy of document required by the committee is to be furnished.

for Engineer-in-Chief (Buildings) ,
Chief Engineer (Buildings) Chennai Region &
Chief Engineer (General) PWD.

14/9/17.

CONTENTS OF THE DOCUMENTS TO BE ENCLOSED WITH THE APPLICATION

(Attested photocopies should be furnished)

1	General Profile of the Company, Annual turnover Manufacturing and Distribution Facilities/ **Details of Machineries** etc	PART 1
2	Product/Product range for which approval is sought/ Pamphlets etc	PART 2
3	Licenses/ Firm Registrations/ GST registration/ ISO Certification etc/ IT Returns	PART 3
4	**Test Reports** Test Reports from the State / Central Government laboratories such as National test house or MSME laboratories, or PWD SM&R Laboratory or Government Academic Institution such as IIT, IIT incubated laboratories , Anna University, Government Engineering colleges	PART 4
5	Description/ Technical specifications of the products/Product range	PART 5
6	Product Approvals already available / Performance Certificate / Purchase Order / List of clients	PART 6

14/9/2017

for Engineer-in-Chief (Buildings),
Chief Engineer (Buildings) Chennai Region &
Chief Engineer (General) PWD.

14/9/17.

3	a.	Machineries / Equipments available for manufacturing (i) Collection of Good Stones (ii) Jaw Crusher (iii) Cone Crusher (iv) Vertical Shaft Impactor (v) Sieve (vi) Washing	
	b.	Own in house Laboratories / testing facilities available in the Factory & Site	
4.		Whether enclosed Test Reports (Test Reports Test Reports from the State / Central Government laboratories such as National test house or MSME laboratories, or PWD SM & R Laboratory or Government Academic Institution such as IIT, IIT incubated laboratories, Anna University, Government Engineering Colleges)	
5		Technical Specification / codes Followed for manufacturing	
6		Whether supplied to Government departments?	
7		Whether the firm or connected person in firm involved in any legal case - If yes furnish details	

Note: Any other copy of document required by the committee is to be furnished.

for Engineer-in-Chief (Buildings) ,
Chief Engineer (Buildings) Chennai Region &
Chief Engineer (General) PWD.

14/9/17.

FORM OF COVERING LETTER FOR APPROVAL OF THE PRODUCT

COMPANY LETTER PAD TITLE

Date:
Place:

To

Engineer-in-Chief (Buildings) ,
Chief Engineer (Buildings) Chennai Region &
Chief Engineer (General), PWD.,
Chepauk, Chennai-600 005.

Sir,

Sub : "M Sand" Product approval by Public Works Department Assessment committee – Application and 6 point document – Company Name_____ Reg.

We enclose filled in application for approval of our "M Sand" product in the Tamil Nadu Public Works Department Assessment Committee. We enclose the enquired details in the prescribed 6 point document.

We are also sending the soft copy of the filled checklist to pwdkmtabrs@gmail.com

Encl: Checklist for Product Approval of the M Sand.

Yours Sincerely,

(Authorized Signatory)