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

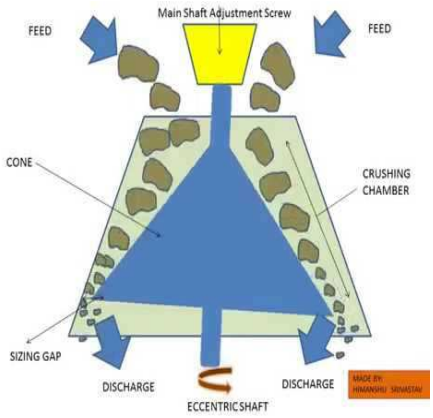
16.0. By-products during crushing of rocks are not Crushed Stone Sand. A Crusher Dust (or Quarry Dust) produced from fine screening of quarry crushing cannot be called Crushed Stone Sand.

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

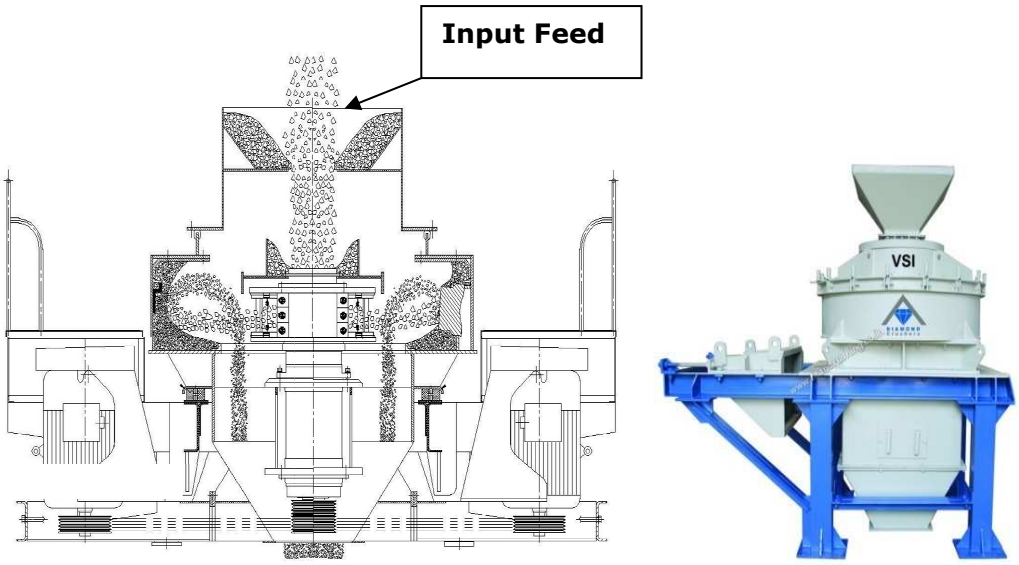
Jack Crusher



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