

Study and Designing of Sand Screening and Washing Machine

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Abstract:

In recent years the foundry industry has been showing an increased interest in Screening and washing of sands. Deposits of sand and gravel, the unconsolidated granular materials resulting from the natural disintegration of rock or stone, are generally found in near-surface alluvial deposits and in subterranean and subaqueous beds. Sand and gravel are siliceous and calcareous products of the weathering of rocks and unconsolidated or poorly consolidated materials. Grain shape, screen analysis, chemical characteristics, as well as thermal characteristics, must be uniform to get uniform properties in today's sand mixes. We are in a process of developing a concept which has the capability to bring revolution in the field of construction in most developing nations of the world. We present here our concept of "sand screening and washing". This project is a combination of basic principles called as screening and washing which is being used for many centuries in the field of construction all around the world.

Key words: Concrete requirement, Sand screening and Washing processes, screw conveyor.

1. Introduction

1.1. Concrete Requirement

Concrete is the most widely used versatile building material all over the world. Concrete technology has made significant advances in recent years which results in economical improvement of the strength of concrete. This economical development depends up on the intelligent use of the locally available materials. One of the important constituent of conventional concrete is natural sand, which is expensive and scarce[1].

Concrete Mix Proportions (kg)			
Material	M20	M30	M40
Cement	310	385	450
Artificial sand	612	590	556
Coarse aggregate A1	520	504	480
Coarse aggregate A2	780	755	720
Water	155	174	180
Super plasticizer (Lit)	3.1	3.85	4.5
Slump value (mm)	90	75	55
Compaction factor	0.90	0.87	0.87
Water / Cement ratio	0.50	0.45	0.40
Cement/Aggregate ratio	1:6.16	1:4.80	1:3.90

1.2. Sand

Conventionally concrete is a mix of cement, sand and aggregate. There is a large variation in the strength of concrete due to variation in the strength of aggregates used.

There is scarcity of natural sand due to heavy demand in growing construction activities which forces to find the suitable substitute. The cheapest and the easiest way of getting substitute for natural sand is by crushing natural stone to get artificial sand of desired size and grade which would be free from all impurities.

1.2.1. Elements Of Sand

- Fine aggregate
- Coarse aggregate

1.3. Screening

“Screening is the process of removing comparatively larger sand particles and other unnecessary impurities present in the sand which is excavated from the river banks”. Screening is the most important process in the screening process. Gravels and pebbles are separated from the required of sand. Due to screening of sand, we can give good strength to the concrete and improve quality of sand. Screening is used for getting good result and obtaining following sand specifications.

2. Industrial Requirement Of Sand

Sand required for construction is of size 7.5 micron to 4.5 mm impurities should be removed like table mud sand organic and inorganic materials pure sand gives high strength during concreting.

2.1. Sand Specifications

According to the ASTM C33 specification, and must meet all of the following conditions: Sand must meet gradation requirements for ASTM C-33 Fine Aggregate Concrete Sand. ASHTO M-6 gradation is also acceptable. Sand must be clean. Natural, unwashed sand deposits may not be used[3].

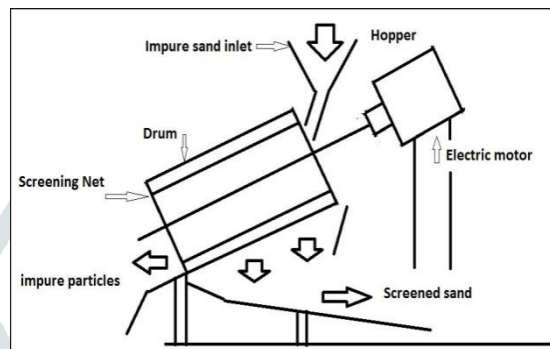


Figure 1: Block Diagram Of Screening Part

2.2. Main Parts

Sand screening and washing machine are following main parts.

- Drum: Drum acts as a container for inlet sand. Screening net is fitted inside the drum.
- Screening net: Screening net is provided for screening the sand, having size according to the requirement.
- Shaft: Shaft rotates with the help of the motor and it helps to transmit this motion to the screening net.
- Motor: An electric motor gives rotation to the net.
- Hopper: Hopper is used as an inlet for impure sand in the drum for screening.

2.3. Construction And Working

Firstly the sand which is to be screen is filled in the drum by using hopper manually. The drum is a screening part of the machine which is mounted on the shaft, driven by a general electric motor having certain RPM[4]. In the screening part net is provided for screening the sand. When the drum rotates then sand particles move randomly and passed through the net. The main requirement of sand is having size 7.5 micron to 4.5 mm. The screening part mainly allows the sand which having grain size, lies between this. The drum is inclined by some angle for good movement of the sand by gravity process and the slop by the screening process fine sand is poured down from drum and gravels and pebbles remains inside drum[5].

3. Washing

Washing is a process in which sand is washed out for construction purpose. The main parts of the system are

- Container
- Screw Conveyor
- Water jet
- Ejection blades

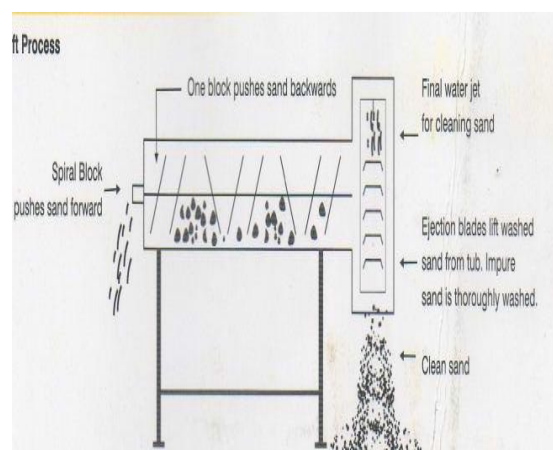


Figure 2: Block Diagram Of Washing Part

In washing part, dust particles and other impurities are removed with the help of water jet. Screw conveyor is fitted inside the container. The conveyor screw is connected to the motor where the sand and water flows in forward direction with the movement of the conveyor. Thus, the washed sand gets collected in the collector from the sand outlet. The unused sand and water is drained out from the water drain sand less than 7.5 micron is drained out and is rendered as useless. Strainer of 7.5 micron thickness is attached to the water drain. The motor used for the movement of the conveyor.

3.2.Applications

- Sand washer is used to remove the dust in sand.
- It aims at improving the quality of sand.
- The materials include the required gravel in building-site, gravel factories, hydropower station and concrete dam site, post and electric pole factory.

4.An Approach For Combining Screening And Washing Processes

By the study of above mentioned processes and the view of experts from construction field we can apply combination of these processes reducing man power, time, cost and we can increase efficiency of work.

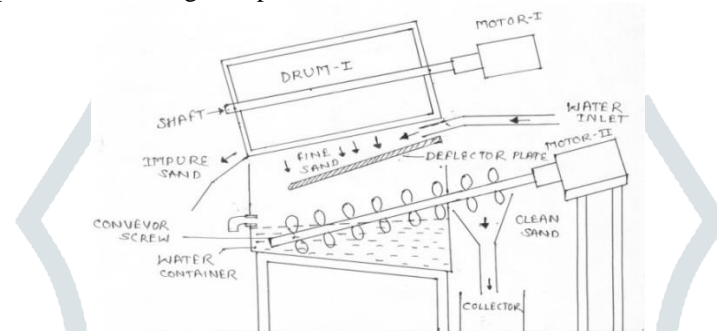


Figure 3: Block Diagram Of Screening & Washing Machine

Main parts

- Drum
- Screening net
- Shaft
- Motor
- Hopper
- Water Container
- conveyor Screw
- Water drain
- Water inlet
- Deflector plate
- Motor (1Hp)
- Collector
- Sand Strainer (7.5 micron)

4.1.Construction

Firstly the sand which is to be screen is fill in the drum by using hopper manually. Drum is a screening part of machine which is mounted on the shaft, driven by a general electric motor having certain RPM [6]. In the screening part net is provided for screening the sand. Deflector plate is used for transporting sand from drum to collector. Deflector plate has certain thickness and length. The sand from drum falls on the deflector plate and then it falls on conveyor. Deflector plate has certain inclination and is fixed[2]. Water from the reservoir is poured to the Collector from the water inlet. It serves as the passage to the flow of water. Water Container is placed below screening equipment. Water is collected in container .Water is limited up to drain outlet. Excess of water is rained out through drain outlet. There is certain capacity of collector beyond which it cannot collect water. Motor is connected for washing purpose. This motor is used for running the conveyor. Sand Strainer is used for staining the sand. Straining of sand includes partitioning of water and sand. Water is strained out through outlet and sand is retained in the system. Sand of minimum size 7.5 micron is drained out. Washed sand is collected in the collector and thus it can be used for further purposes such as construction site, sand making factories, hydroelectric concrete dam, oil pump filling and other industries.

4.2.Working

When the drum rotates then sand particles moves randomly and passed through the net The main requirement of sand is having size 7.5 micron to 4.5 mm .the screening part mainly allow the sand which having grain size, lies between this . Drum is inclined by some angle for good movement of the sand by gravity process and the slope by the screening process fine sand is poured down from drum and gravels and pebbles remains inside drum. This screened sand is allowed to pass through a deflector plate which is at a fixed inclination. We do not allow the sand from the drum to pass directly to the conveyor because we have to concentrate it. The sand thus gets collected on the deflector plate and as it is provided at some angle it falls down to the water container and gets mixed with the

water. A conveyor screw is connected to the motor where the sand and water flows in forward direction with the movement of the conveyor. Thus, the washed sand gets collected in the collector from the sand outlet. The unused sand and water is drained out from the water drain sand less than 7.5 micron is drained out and is rendered as useless. Strainer of 7.5 micron thickness is attached to the water drain. The motor used for the movement of conveyor.

5. Mechanism Used For Removal Of Washed Sand

5.1. Screw Conveyor



Screw Conveyors are an essential part of many conveying and storage systems dealing with powdered or granular materials[7]. Being simple and robust in design and easily maintained, they provide low cost versatile handling equipment with many applications in manufacturing and processing factories. In general most free flowing materials and many materials with poor flow characteristics can be successfully handled with a screw conveyor.

5.1.1. Advantages

- Labour cost requirement is less.
- Efficiency is higher than manual process.
- Sand with fewer impurities is obtained
- Strength of the concrete improves.

5.1.2. Applications

- We can use this machine where labour resources are not sufficient.
- It is used where space area is less.

6. Conclusion

Through this present investigation following some important conclusions are made which are discussed below.

- Considering the present case study, the screened and washed sand is obtained by combining two different processes.
- The labour cost of operation can be reduced with less time taken.
- It requires less area and it is portable.

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