FOUNDRY SAND

By Er.T.Rangarajan,B.E,MSc(Struc.Engg),F.I.E,P.E

INTRODUCTION

Metal foundries use large amounts of sand as part of the metal casting process. Foundries successfully recycle and reuse the sand many times in a foundry. When the sand can no longer be reused in the foundry, it is removed from the foundry and is termed “foundry sand.”

Foundry sand that are technically sound, commercially competitive, and environmentally safe is beneficial applications to civil engineering industries. In USA many research works were conducted to make use of the same in various purposes in civil engineering field.

What is foundry sand? Foundry sand is high quality silica sand that is a byproduct from the production of both ferrous and nonferrous metal castings. The physical and chemical characteristics of foundry sand will depend in great part on the type of casting process and the industry sector from which it originates.

Foundries purchase high quality size-specific silica sands for use in their molding and casting operations. The raw sand is normally of a higher quality than the typical bank run or natural sands used in fill construction sites.

Foundry sand is produced by five different foundry classes. The ferrous foundries (gray iron, ductile iron and steel) produce the most sand. Aluminum, copper, brass and bronze produce the rest.

Foundry sand is basically fine aggregate. It can be used in many of the same ways as natural or manufactured sands. This includes many civil engineering applications such as

1. Embankments,

2. Flowable fill,

3. Hot mix asphalt (HMA) and

4. Portland cement concrete (PCC).

5. Foundry sands have also been used extensively agriculturally as topsoil.

The largest volume of foundry sand is used in geotechnical applications, such

as embankments, site development fills and road bases.

This is true of any recycled material. The success of using foundry sand depends upon economics. The bottom line issues are cost, availability of the foundry sand and availability of similar natural aggregates in the region.

What are the key engineering properties of foundry sand? Since foundry sand has nearly

all the properties of natural or manufactured sands, it can normally be used as a sand

replacement. It can be used directly as a fill material in embankments. It can be used as a sand replacement in hot mix asphalt, flowable fills, and Portland cement concrete. It can also be blended with either coarse or fine aggregates and used as a road base or subbase material. Table shows the relative ranking of foundry sand uses by volume.

Ranking	Application
1	Embankments/Structural Fills
2	Road base/Subbase
3	Hot Mix Asphalt (HMA)
4	Flowable Fills
5	Soil/Horticultural
6	Cement and Concrete Products
7	Traction Control
8	Other Applications

Table . Foundry sand applications by volume

Embankment with foundry sand subbase (Ohio Turnpike, sand from Ford Motor Company

supplied by Kurtz Bros. Inc.)

Foundry sands have also been used in conjunction with geogrid systems and with reinforced earth retaining walls that use straps or grids as horizontal tiebacks.

Standard construction procedures can be adjust to account for using foundry sand.


Stepped embankment.

In US foundry sand has been used successfully to replace a portion of the fine aggregate used in HMA (Hot Mix Asphalt). Foundry sand can be used to replace between 8 and 25% of the fine aggregate content.

Foundry Sand in Portland Cement Concrete:

Portland cement concrete (PCC) is a mixture of approximately 25% fine aggregate, 45% coarse aggregate, 20% cement and 10% water. Foundry sand can be used beneficially in concrete production as a fine aggregate replacement.

Various characteristics of foundry sand can significantly affect the quality of concrete produced. The material characteristics of greatest importance and their effects on the product are discussed below. Foundry sand properties vary in samples taken from one foundry, and there is increased variation from foundry to foundry. **This necessitates testing the sand every time prior to use to ascertain its quality.**

Tests should be carried out for its suitability for the use in concrete. The following properties are to be tested:

1. **Particle size distribution;**
2. **Dust content;**
3. ***Density;***
4. **Organics content/deleterious materials content;**
5. **Grain shape; and**
6. **Specific gravity.**

A basic set of parameters to test for other engineering use are:

1. Fineness number (grain size/AFS Number) of the base sand
2. Moisture content in the mixture (ranges from 2-7% depending on the casting method)

3. Permeability (ability of compacted mould to pass air through it)
4. Total clay content (dust content)
5. Active clay content (presence of active bentonite/clay which can readily bond)
6. Compressive strength
7. Hardness ('B' or 'C' Scale)

For parameters 1, 2, 4 and 5 standard bulk material sampling methods can be applicable or sampling can be done with help of sand muller, sand sampler and sand splitter to do it in a standardized manner.

Limitations

Foundry sand is black. In some concretes, this may cause the finished concrete to have grayish/black tint, which may not be desirable. A 15% fine aggregate replacement with foundry sand produces a minimal color change.

Foundry Sand in Grouts and Mortars:

Mortars primarily consist of sand, cement and other additives, and are used in masonry construction. Its primary uses are to joint and seal concrete masonry units, to strengthen masonry structures by bonding with steel reinforcing and to provide architectural quality.

In India various engineering colleges conducted test on use of foundry sand and it is evident from those tests that foundry sand can be replaced with normal sand upto 20% to get more strength and beyond 20% the result is not advantageous. It can be tried with the following options for further test:

1. Use normal sand with the replacement of foundry sand up to 20% and fly ash up to the maximum limit as per IS code.
2. Use of chemical admixtures like superplasticizers from construction chemical companies- Fosroc, Sika etc. can be added with the above.

In Bangalore Karnataka students fo Jahawarlal Nehru National college of engineering produced bricks using foundry sand. (Ref: The Hindu Feb17th 2008)

Efforts should be made to make use of the foundry sand which is available in plenty in Coimbatore which an industrial city where many foundries are manufacturing different mechanical parts.

Many of the above contents are extracted from the first reference and it is brought to the knowledge of engineers who are unaware of the fact that foundry sand can be used as a sand replacement like other materials-flyash,rice husk, red soil etc.

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