

Indian Standard
METHODS OF
SAMPLING FLY ASH

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

METHODS OF SAMPLING FLY ASH

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Scientist Emeritus
National Physical Laboratory
New Delhi

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METHODS OF SAMPLING FLY ASH

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 February 1972, after the draft finalized by the Building Materials and Components Sampling Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Fly ash is a finely divided residue resulting from the combustion of pulverized coal and transported by the flue gases of boilers fired by pulverized coal. It is available in large quantities in the country as a waste product from a number of thermal power stations and industrial plants using pulverized coal as fuel for the boilers. Its availability is likely to increase with the increased industrialization in the country. The use of fly ash as a pozzolana and a fine aggregate and also for other allied purposes is well established in a number of countries abroad, but it has come in vogue in India only recently. Some recent investigations on Indian fly ashes have proved their suitability for various uses. Indigenous fly ashes for replacement of cement and for use with lime, as an admixture for cement, concrete bituminous mixtures and as fine aggregate for mortar and concrete have already been successfully tried out and greater attention is now being paid to fully exploit the potentialities of fly ash as a construction material. It is, therefore, desirable that, due consideration is given to scientific methods of sampling which will help in the proper and objective assessment of the characteristics of the material.

0.3 The procedure of sampling of fly ash had been indicated in IS : 3812 (Part I)-1966, IS : 3812 (Part II)-1966 and IS : 3812 (Part III)-1966. However, in view of the experience gained in course of years and the importance of the material, it was felt necessary to revise sampling procedure and make it more rational for determining the various characteristics of fly ash. It is hoped that this standard would help in the development of proper sampling procedures for fly ashes in the country.

0.4 This standard forms a necessary adjunct to the following Indian Standards on fly ash:

IS : 3812 (Part I) - 1966 Specification for fly ash, Part I For use as pozzolana

IS : 3812 (Part II) - 1966 Specification for fly ash, Part II For use as admixture for concrete

IS : 3812 (Part III) - 1966 Specification for fly ash, Part III For use as fine aggregate for mortar and concrete.

0.5 In reporting the results of test or analysis, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard lays down the procedures to be followed in collecting and preparing samples from a lot for determining the physical and chemical characteristics of fly ash.

1.1.1 A method for reporting the quality of the bulk of fly ash sampled is also included.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Fly Ash — A finely divided residue that results from the combustion of pulverized coal and is transported from the combustion chambers of boilers by flue gases and collected by cyclone separation or electrostatic precipitation.

2.2 Lot — The quantity of fly ash indicated to be for the same use and of the same type offered for inspection at one time. A lot may consist of the whole or a part of the quantity ordered for.

2.3 Sub-lot — The quantity of fly ash in each of the portions into which a lot is divided for the purpose of sampling.

2.4 Increment — The quantity of fly ash taken by a single operation of filling up the sample scoop to its capacity.

2.5 Gross Sample — Sample as collected from a sub-lot, that is, the quantity of fly ash obtained by aggregating together all the increments from the same sub-lot.

2.6 Laboratory Sample — The quantity of fly ash obtained by reducing a gross sample following a specified procedure and intended for laboratory testing.

2.7 Composite Sample — The quantity of fly ash obtained by mixing together in equal proportions all the laboratory samples obtained from all the gross samples and reduced following the specified procedure for laboratory testing.

*Rules for rounding off numerical values (revised).

3. SAMPLING

3.1 The samples shall be selected and examined from each lot (*see* 2.2) separately.

3.1.1 For obtaining reliable conclusions, it is recommended that as far as possible, fly ash be sampled when in motion; that is from conveyors or during loading and unloading.

3.2 Sampling from Conveyors

3.2.1 *Sub-lots* — For the purpose of sampling a lot, while it is being discharged over a conveyor, shall be divided into a number of *sub-lots* of approximately equal size as specified in Table 1.

TABLE 1 NUMBER OF SUB-LOTS INTO WHICH A LOT IS TO BE DIVIDED

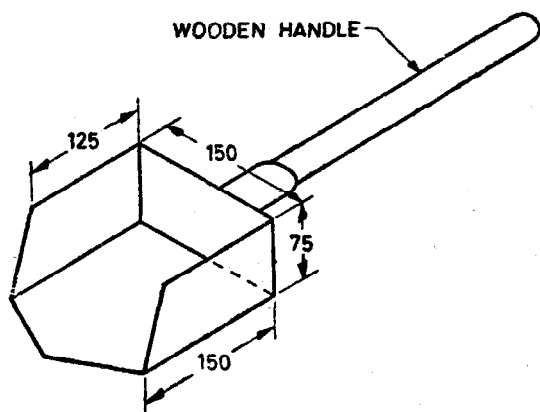
SIZE OF THE LOT (IN TONNES)	NO. OF SUB-LOTS
Up to 50	1
51 „ 150	2
151 „ 300	3
301 „ 500	4
501 „ 1 000	5

3.2.1.1 A representative gross sample shall be drawn from each of the sub-lots and shall be kept separately. Thus there will be as many gross samples as the number of sub-lots into which the lot has been divided.

3.2.2 The number of increments specified in Table 2 shall be collected at regular intervals, evenly distributed over the sub-lot. The increment, each weighing about 2 kg, shall be collected with the help of a suitable sampling scoop (*see* Fig. 1).

**TABLE 2 NUMBER OF INCREMENTS TO BE COLLECTED
FROM A SUB-LOT**

WEIGHT OF THE SUB-LOT (TONNES)	MINIMUM NO. OF INCREMENTS
Up to 25	5
26 „ 50	10
51 „ 100	20
101 „ 200	30



All dimensions in millimetres.

FIG. 1 SAMPLING SCOOP

3.2.2.1 The increment shall preferably be taken from the full cross section and thickness of the stream in one operation. When the fly ash is in motion, the most reliable means of taking such increments is to sample at a point where the material discharges from the belt. The best possible increment is one, which cuts across entirely the falling stream of the material by means of a suitable receptacle passed from one side of the stream to the other without allowing the receptacle to over-flow. If the whole of the stream cannot be covered by one increment without overflowing the receptacle, the stream should be sampled systematically by taking material from all portions.

3.2.2.2 If it is not possible to sample satisfactorily at the point of discharge, the increment may be drawn from the moving belt itself. In this case the increments shall be collected from the centre and the left and the right side of the belt along the same width. To ensure that very small material is also correctly obtained in the sample the scoop should sweep the conveyor.

3.2.3 The material collected from various increments in a sub-lot shall be aggregated and mixed together to constitute a gross sample.

3.3 Sampling from Stock Pile—Stock piles vary greatly in size, particularly in height and hence the collection of representative samples from the stock piles become difficult and costly. For obtaining reliable conclusions, it is recommended that as far as possible, fly ash be sampled when in motion, that is, during loading or unloading of stock piles (see 3.3.1). When sampling of stationary stock piles becomes inevitable, trench sampling (see 3.4.1.1) may be used for stock piles up to a maximum height of 1.2 m, after levelling the stock piles to a uniform height.

3.3.1 Sampling During Loading or Unloading of Stock Pile

3.3.1.1 Sub-lots — The quantity of fly ash to be loaded into or unloaded from a stock pile shall be considered as divided into a number of sub-lots of approximately equal weight as specified in Table 1.

3.3.2 While loading or unloading the quantity of fly ash constituting a sub-lot, the number of increments specified in Table 2 shall be collected at regular intervals during the whole period of loading or unloading the sub-lot. These numbers of increments refer to only a stock pile of 1.2 m high and for higher stock piles they would be proportionately more. The increments, each weighing about 2 kg, shall be collected with the help of a suitable sampling scoop. The scoop may preferably be rectangular in shape with straight sides on three sides and open on the fourth side, and with a capacity to hold the required quantity (see Fig. 1).

3.3.3 Gross Samples — All increments collected from the same sub-lot shall be mixed together to constitute a gross sample.

3.4 Sampling a Completed Stock Pile

3.4.1 Sub-lots — The stock pile is divided into a number of sub-lots of approximately equal weight specified in 3.2.1 by suitably marking the line of demarcation on the surface of the stock pile. The fly ash surface in the sub-lot shall be levelled before sampling. The sub-lots shall be sampled by the method of trench sampling (see 3.4.1.1).

3.4.1.1 Trench sampling — Each sub-lot shall be trenched in the following manner:

- a) The direction and pattern of trenches should be at random without following definite pattern. The pattern should be changed from sub-lot to sub-lot.
- b) The trench should extend right up to the bottom of the stack until the ground level is exposed.
- c) In addition to the trenches, the sides of the stack should be opened to expose the fly ash inside the stack at places where the trench does not expose the fly ash inside.

From the entire cross-section of the exposed sides of the trenches from top to bottom, minimum number of increments, as specified in Table 2 shall be taken. The weight of each increment shall be 2 kg.

3.4.2 Gross Sample — All the increments collected from the same sub-lot shall be mixed together to constitute a gross sample.

3.5 Thus, a lot will be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be processed further individually in accordance with 4 and tested in accordance with 5.

4. REDUCTION OF A GROSS SAMPLE

4.1 Each gross sample shall be reduced separately. The entire quantity of gross sample obtained shall be mixed well and reduced in stages either by coning and quartering or by increment reduction till a quantity of 10 kg approximately is obtained. This shall be the laboratory sample.

4.1.1 Coning and Quartering — The fly ash shall be heaped into the shape of a cone by pouring one scoopful of the material after another at the apex of the cone till the entire sample has been coned. The material shall be allowed to slide down the sides of the cone only under the influence of gravity.

4.1.1.1 Flatten the cone evenly so that it forms a low circular pile. Cut the pile into four quarters along two diameters which intersect at right angles. Retain one pair of opposite quarters and reject the other. Repeat till the size of the retained sample is reduced to the required weight of 10 kg approximately.

4.1.2 Increment Reduction — The fly ash shall be mixed and spread on a smooth surface to form a uniform flat rectangle. The rectangle shall be divided into 20 equal parts, 5 lengthwise and 4 breadthwise. From each of the 20 parts so formed, equal quantities of fly ash shall be taken. The 20 increments thus collected shall be combined and mixed to give about 10 kg of the material.

5. NUMBER OF TESTS

5.1 All the laboratory samples shall be tested individually for important characteristics. For the remaining characteristics, a composite sample prepared by mixing equal quantities of fly ash from each of the laboratory samples shall be analyzed. The characteristics for which each laboratory sample is to be analyzed individually and also those for which a composite sample is to be tested shall be as given below, unless otherwise agreed to between the purchaser and the buyer:

Characteristics of Fly Ash for which	
Laboratory samples are tested individually	A composite sample is to be analyzed
Fineness	All the remaining chemical requirements as per the relevant specification
Lime reactivity	
Drying shrinkage	
Soundness	
Sulphur trioxide	
Loss on ignition	

6. REPORTING

6.1 Reporting of Physical and Chemical Composition

6.1.1 For those characteristics, where a composite sample has been tested, only one test result will be available and that result will be reported as the value of the characteristic for the lot sampled.

6.1.2 For those characteristics, where the laboratory samples have been tested individually, the individual test results shall be reported.