CEN/TC 154/N 1093

EN 932-1:1996 ’Methods for sampling’

Adequate to declaration of performance (DoP)?

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Revision of EN 932-1 ’Methods for sampling’

Representive sampling is crucial for reliable ”assessment and verification of constancy of perfor-mance” of the aggregate product placed on the market. If the sampling can be questioned, the door is opened for laborious disputes.

The current sampling standard EN 932-1:1996 gives mainly general information about various sam-pling methods for the production process of aggregates. The standard provides great latitude in the se-lection and design of sampling method, which leaves the field open to question the sampling.

At the last 5-year review of EN 932-1 Sweden was in favour of a revision.

The revision should primarily focus on carefully specified and established methods for sampling from batches, related to the delivery of the aggregates products.

From TC 154/N 1074 ’Three fundamental issues for aggregate products’

Excerpts from Construction Products Regulation (CPR)

CHAPTER III

OBLIGATIONS OF ECONOMIC OPERATORS

Article 11

Obligations of manufacturers

1. Manufacturers shall draw up a declaration of performance in accordance with Articles 4 and 6, and affix the CE marking in accordance with Articles 8 and 9.

Manufacturers shall, as the basis for the declaration of performance, draw up technical documentation describing all the relevant elements related to the required system of assessment and verification of constancy of performance.

3. Manufacturers shall ensure that procedures are in place to ensure that series production maintains the declared performance. Changes in the product-type and in the applicable harmonised technical specifications shall be adequately taken into account.

Manufacturers shall, where deemed appropriate with regard to ensuring the accuracy, reliability and stability of the declared performance of a construction product, carry out sample testing of construction products placed or made available on the market, investigate, and, if necessary, keep a register of complaints, of non-conforming products and of product recalls, and keep distributors informed of any such monitoring.

Sampling of aggregate products placed on the market

- Aggregate products are generally produced in a continuous process, providing a uniform material stream. However, subsequent handling operations of the material within the plant will often cause segregation and increase the variability of the grading of the product.
- The characteristics of the delivered product is crucial for DoP.
- Sampling procedures near the point of delivery of the product should be preferred.
- Aggregate products are usually delivered by lorries, i.e. an appropriate sampling procedure for this case is highly wanted.

Handling of aggregate products within the plant
Stockpiling of a produced aggregate size 0/31,5

Conical stockpile, formed by the material stream from the conveyor. Segregation along the sides of the heap. The bucket of the wheel loader is loaded with material.

At the loading of the bucket the material is homogenized to some degree. The bucket load is hauled to the storing area.

Discharge of the bucket load. Segregation of material rolling down the slope of the stockpile.

Handling of aggregate products within the plant
Delivery of a produced aggregate size 0/31,5

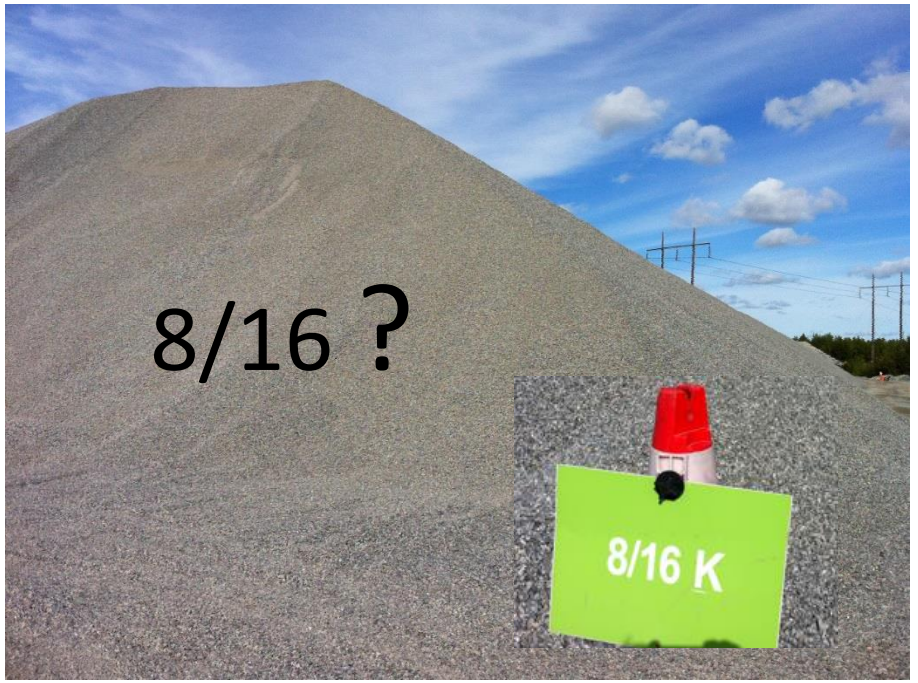
Segregated material in stockpile of a produced 0/31,5.

Loading of the bucket. The material is homogenized to some degree.

Discharge of the bucket load. The segregation is influenced by the discharge height.

Delivery of aggregate size 8/16 K (Crushed)

What sampling procedure should be used to assess and verify the constancy of performance ?



Principals of the current standard EN 932-1:1996

Excerpts from EN 932-1:1996

1 Scope

The aim of sampling is to obtain a bulk sample that is representative of the average properties of the batch.

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3 Definitions

3.4 representative sample

A bulk sample created by taking sampling increments according to a sampling plan, which makes it likely that the quality of this sample corresponds to that of the batch."

4 Principles of sampling

Sampling variation caused by the heterogenity of the batch is reduced to an acceptable level by taking an adequate number of sampling increments.

Sampling increments are selected at random from all parts of the batch that the bulk sample is to represent.

8 Sampling procedures

8.1 General

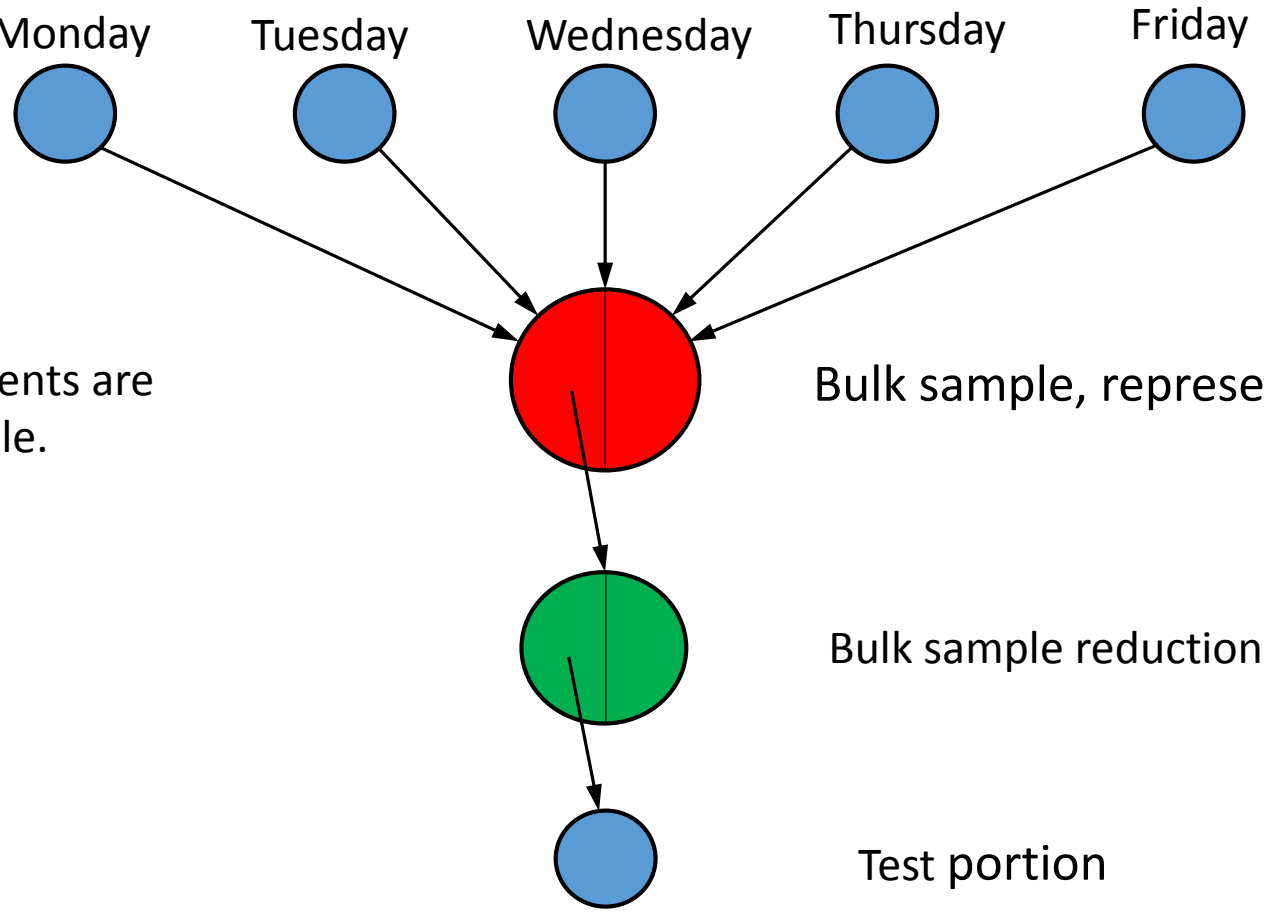
NOTE 2: Aggregates should preferably be sampled from a stationary conveyor belt or from the stream of material. Sampling increments should be taken at regular intervals throughout the period the batch is in motion.

Question

- Is the 'averaging' principle adequate for a large batch, as a batch produced during a week?

Preparation of a bulk sample for a batch, produced during a week

One sampling increment is taken each day.



Sampling increment

The five sampling increments are combined to a bulk sample.

Bulk sample, representative for the batch

Bulk sample reduction

Test portion

Assessment of a week-batch of aggregate size 8/16, *G*c80/20

One sampling increment is taken each day from the material stream

Percentage passing the *d*-sieve or 8 mm

Day of the week	Bulk sample of five sampling increments	Testing of sampling increment
Monday	x_1	18
Tuesday	x_2	**21**
Wednesday	x_3	16
Thursday	x_4	**22**
Friday	x_5	18
Average	$(x_1+x_2+x_3+x_4+x_5)/5 \approx 19$	19
Standard deviation		2,4

Assessment of test results

Bulk sample

Five sampling increments are combined to a bulk sample, representing the week-batch. The batch is conforming, since 19 % is passing the *d*-sieve. The category limit is 20 %.

Sampling increments, when tested

2 of 5 test results (or 40 %) are non-conforming.

If the parameter has a normal distribution, the *upper tolerance limit* for at least 90 % of the test results is with a confidence level of 90 %

$$19 + 2{,}7 \times 2{,}4 \approx 25\ \%$$

Example of sampling in Sweden

Single sized aggregates (D/d ≤ 2) with D ≤ 25 mm and fine aggregates

A spot sample is taken from the material stream of the conveyor belt. Adequate procedure?

Bucket with a spot sample of about 12 to 20 kg. The bucket is sent to the testing laboratory.

Example of sampling in Sweden
All-in aggregates (continued)

Sampling from a small stockpile of 10 t to 15 t during loading delivery vehicles. The stockpile is back dragged to a pad with a relatively uniform thickness of approximately 0,2 m to 0,5 m.

Example of sampling in Sweden
All-in aggregates

The flattened surface area is divided into four parts. One sampling increment is taken from each part and placed in a bucket. The four buckets are sent to the testing laboratory, where the sampling increments are combined to a bulk sample.

Sampling from a small sampling stockpile – EN 932-1:1996

8.6 Sampling of material in bucket conveyors, bucket loaders, or grabs

Each sampling increment shall consist of the entire contents of a grab or bucket.

NOTE. When this gives too large a sampling increment, it should be reduced by one of the methods described in clause **9**, or discharged to form a small stockpile and sampled according to **8.8**.

8.8 Sampling from stockpiles

Sampling increments of approximately equal size shall be taken from different points at different heights or depths, distributed over the complete stockpile (see figure 1). The location and number of sampling increments shall take into account the way in which the stockpile was built, its shape and the possibility of segregation within the stockpile. A sampling increment shall be taken using a scoop (see **A.1**), a shovel (see **A.2**) or a grab (**A.7**) from the deepest point of each hole.

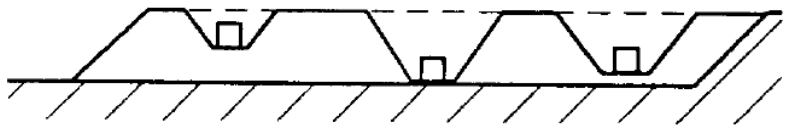


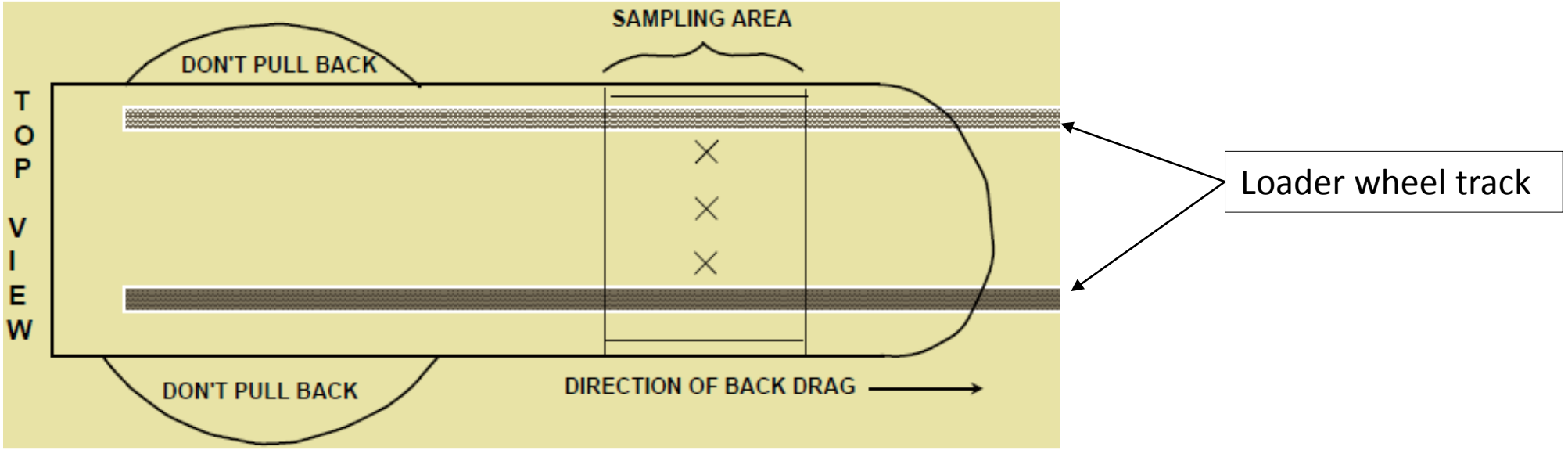
Figure 1. Sampling from flat stockpiles

Questions

- How should the small stockpile be constructed?
- Should not the sampling from the small stockpile be more accurately specified?

Sampling from a small stockpile - Georgia

Three loaded buckets are normally used. During the back dragging process the bucket should be maintained until the pile has been flattened to a relatively uniform thickness of 0,3 to 0,6 m. Three sampling increments are taken and combined to a bulk sample.



From 'Study Guide for Aggregate Certification', Georgia 2012

Recommendations

- A revision of EN 932-1 should be focused on sampling methods related to the delivery of aggregate products.
- Appropriate methods for production sampling should also be specified.
- The ’averaging’ principle to get a representative sample should be limited to a sampling unit of maximum 10 t to 15 t.
- The selected sampling methods should be carefully specified, regarding sampling unit, minimum number of sampling increments and approximate mass of each sampling increment.