DuPont Building Innovations

Influence of laboratory results on certification process

NorGeo Seminar 2014

28th of May 2014

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GTX certification systems exist all around the world

ASQUAL

CE

ZAG LJUBLJANA

ФЦС

COPRO

NorGeoSpec
2012 Product Certificate

Quality Management System.

An audit, documented in a report, has verified that this quality management system fulfills the requirements of the following standard:

DIN EN ISO 9001 : 2000
December 2000 edition

GÜTEÜBERWACHUNG ivg*** GEOKUNSTSTOFFE

РОССТРОЙ

DIN 18200

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GTX certification systems exist all around the world

- **Various certification systems exist in many different countries and very often the manufacturers are faced with the following situations**
  - The same properties are certified
  - The same products are certified
  - The same audit and same questions are asked
  - The same laboratories participate in the different systems

- **Certification bodies do not accept results and audits from other certification bodies which means high cost for the manufacturers**
- **Risk of loosing a certificate in one or more countries with the consequence of loosing the business may have considerable consequences (effort for re-certification, huge financial loss, reputation, other)**

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Certification Principles

- The certification should avoid that low quality products are sold in a specific market
- The certification should promote high quality products
- A certification should be fair and non-discriminatory

When a producer looses a certificate it should be because of bad quality and not because of measurement error !

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Certification Principles

- Most certification systems control that the announced values by the manufacturer are correct.
- In most cases the certification is independent from the specification (except NorGeo)
- Usually a list of index properties with tolerances is given and all properties need to be controlled.
- Tolerances are either fixed by the certification body or by the manufacturer.
- The variation between laboratories must be significantly lower than the tolerance fixed by the certification body.

Table 5.2 Required values corresponding to 95% confidence limits

Characteristic	Maximum tolerance[1]	Required values[2] corresponding to 95% confidence. limit				
		Specification profiles				
		1	2	3	4	5
Min. tensile strength (kN/m), $F_{a,95}$	-10%	6	10	15	20	26
Min. tensile strain at max. load (%), $\varepsilon_{a,95}$	-20%	15	20	25	30	35
Max. cone drop diameter (mm)	+20%	42	36	27	21	12
Min. energy index (kN/m), $R_{a,95}$		1.2	2.1	3.2	4.5	6.5
Min. velocity index[3] (10^{-3} m/s)	-30%	3	3	3	3	3
Max. char. opening size, O_{90}(mm)	µ 30%	0.2	0.2	0.2	0.15	0.15
Max. tolerance for mass per unit area		µ 12%	µ 12%	µ 10%	µ 10%	µ 10%
Max. tolerance for static puncture strength		-10%				

[1] The tolerance shall be stated by the manufacturer, this table gives the maximum allowable tolerance in the accompanying document to the CE-mark.
[2] The tolerances are not to be added to the required values. The nominal values + / - the tolerance shall fulfil the requirement.

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Certification Principles

- **A clear norm and/or test description must be available to ensure that everybody measures the same way and that the same result is obtained.**

- **Often heard prejudices**
  - The norms are always precise, clear and controlled by many scientific people in different countries
  - The laboratories are independent, neutral and impartial
  - Laboratories have high quality modern testing machines.
  - The scientific staff of the laboratories is well trained and organized and clearly follows the procedures and norms.
  - The Manufacturers try to sell minimum quality at highest possible price.
  - Product out of specs still is sold into the market. (Many manufacturers cheat)
  - The labs are always right

Is this correct ?

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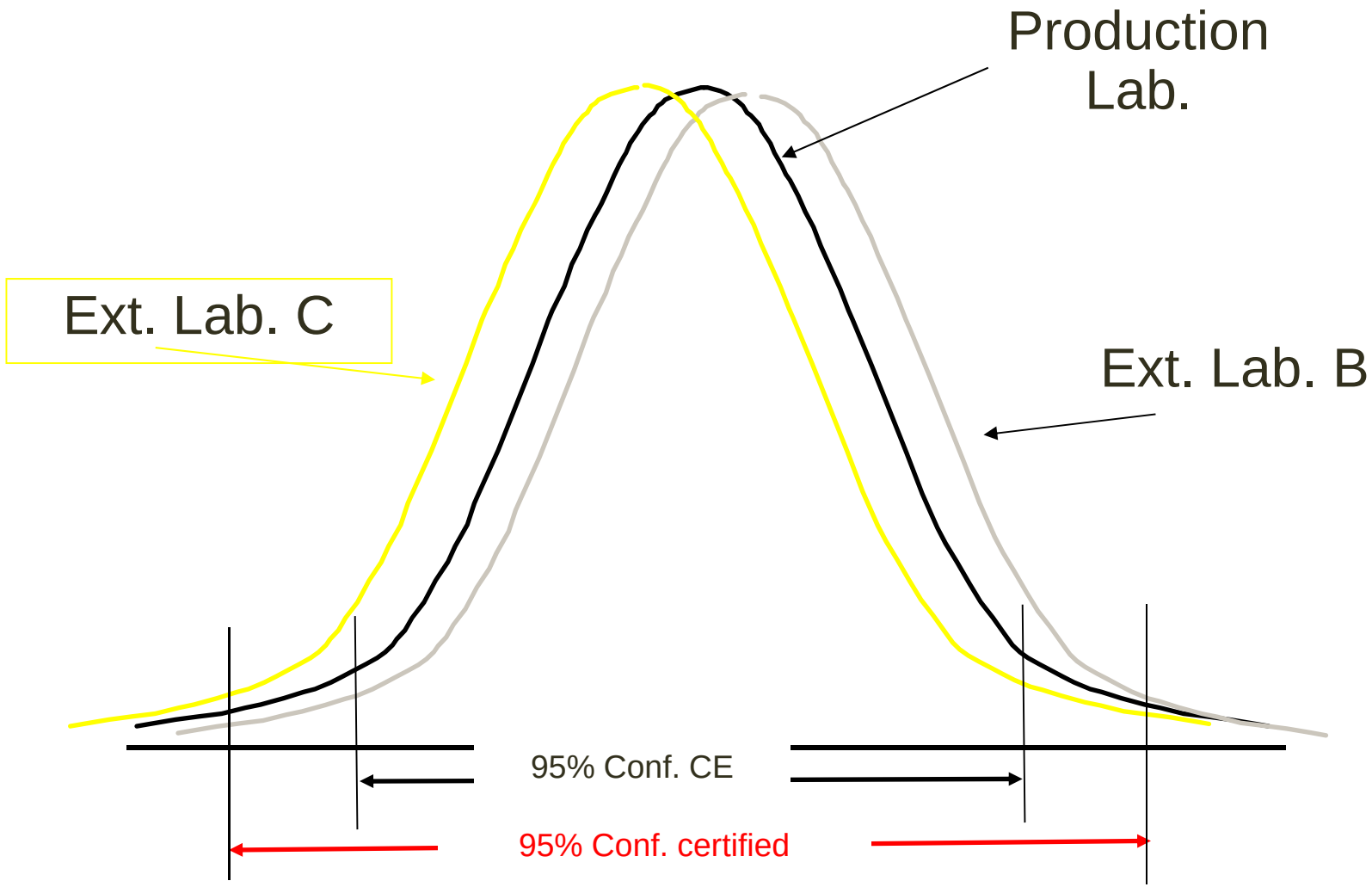
Certification



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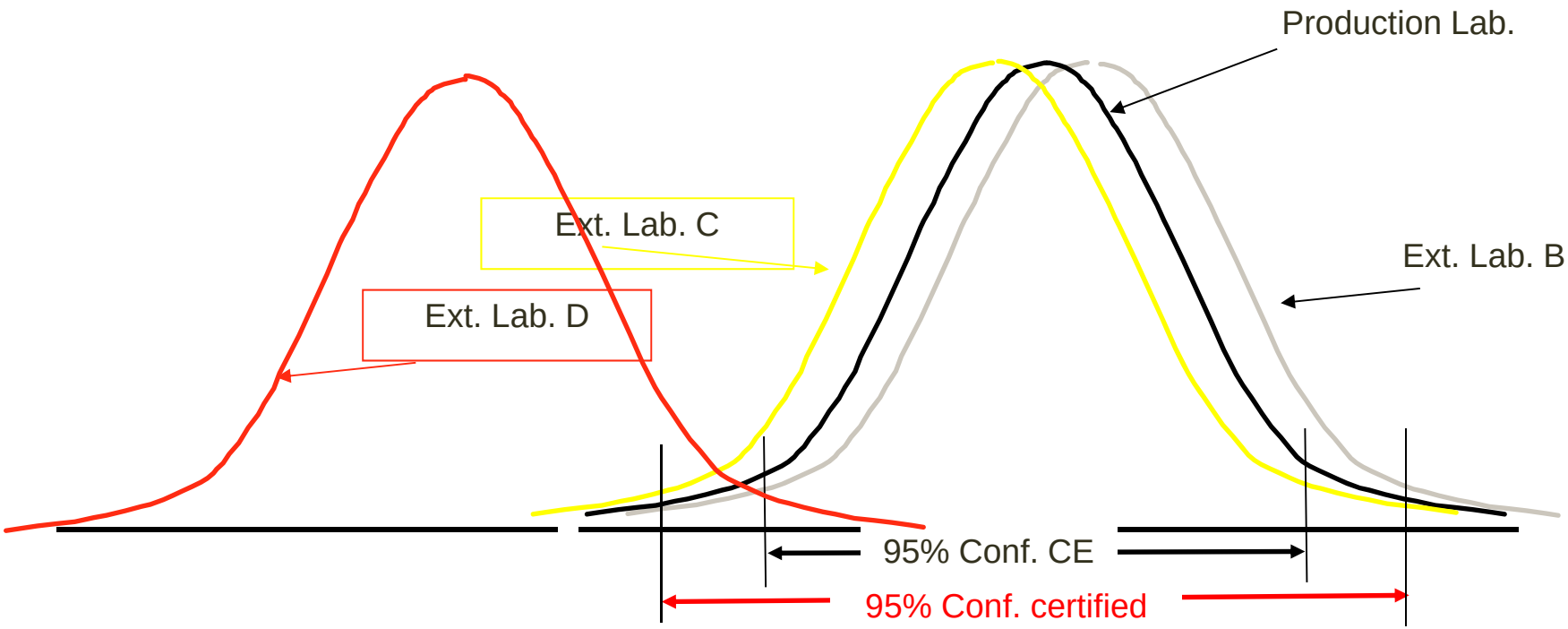
Certification



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Certified Index Tests

- **Usually Index Tests are selected that should ensure controlled quality and/or controlled performance on the site.**

- **Experience with some " simple " index tests.**

  DuPont Internal Interlab Tests

  - Tensile Strength
  - Opening Size
  - Dynamic Cone Drop

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Tensile Strength EN ISO 10319

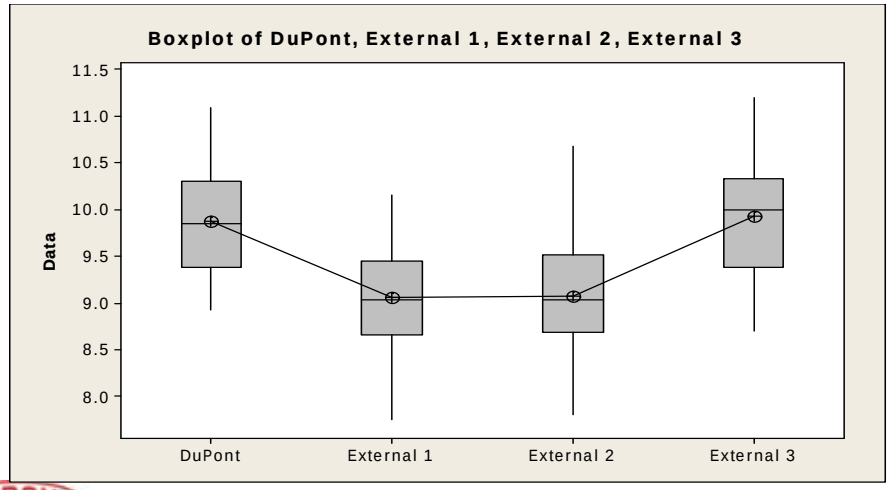
One-way ANOVA: DuPont, External 1, External 2, External 3

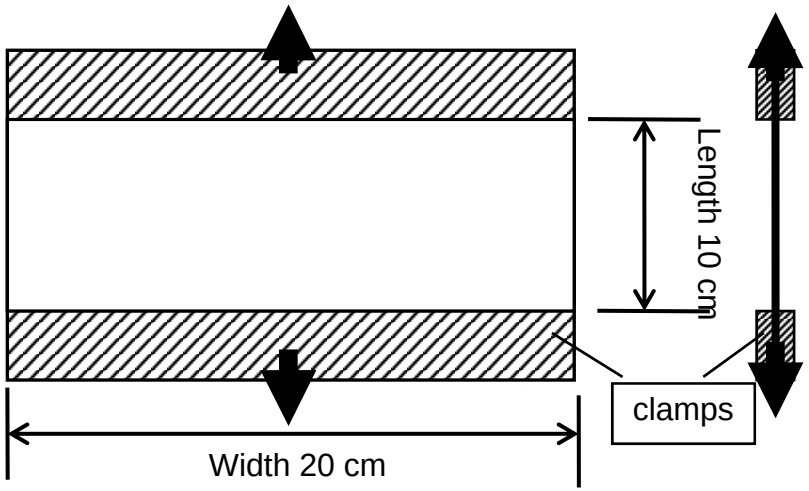
```
Source   DF       SS      MS      F      P
Factor    3   33.843  11.281  30.11  0.000
Error   190   71.186   0.375
Total   193  105.029

S = 0.6121   R-Sq = 32.22%   R-Sq(adj) = 31.15%
```

```
                                  Individual 95% CIs For Mean Based on
                                  Pooled StDev
Level         N   Mean  StDev  ------+---------+---------+---------+---
DuPont       50  9.874  0.552                          (----*----)
External 1   44  9.059  0.551  (----*----)
External 2   50  9.079  0.694   (---*----)
External 3   50  9.934  0.632                            (----*----)
                                  ------+---------+---------+---------+---
                                      9.10      9.45      9.80     10.15

Pooled StDev = 0.612
```





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Tensile Strength EN ISO 10319

- **Tensile Strength is an “old” test performed all around the world.**
- **The principle seems quite easy and usually a low tolerance (-10 %) is given.**
- **Following problems occurred.**
  - Labo 1: The standard requests to measure the extension with an extensometer between 2 reference points. In one laboratory these reference points moved before the end of the test in such a way that the signal was lost. The computer did not calculate anything beyond this point which means that both elongation and strength were too low.
  - Labo 2: When the samples are installed in the grip clamps, the closure of these resulted in relative high pre-load for stiff high modulus geotextiles. After this, the operators of the lab reset the machine putting everything to zero. Result: Lower elongation and up to 25% loss of strength for each specimen !

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Opening Size : EN ISO 12956

Required zone used in the original standard: Version 1999

Figure 2: normative part

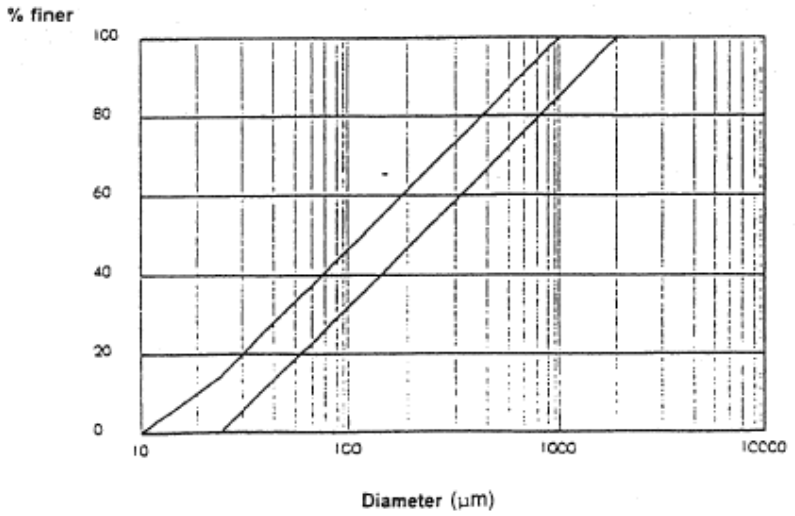
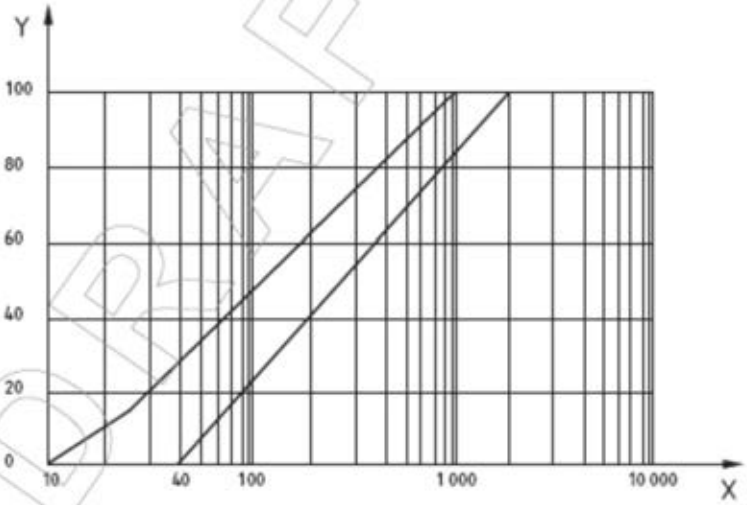


Figure 2 - The required zone of the cumulative percentage of size distribution of the granular material used

Replace figure 2 with the following



Graph used in the informative part of EN ISO 12956

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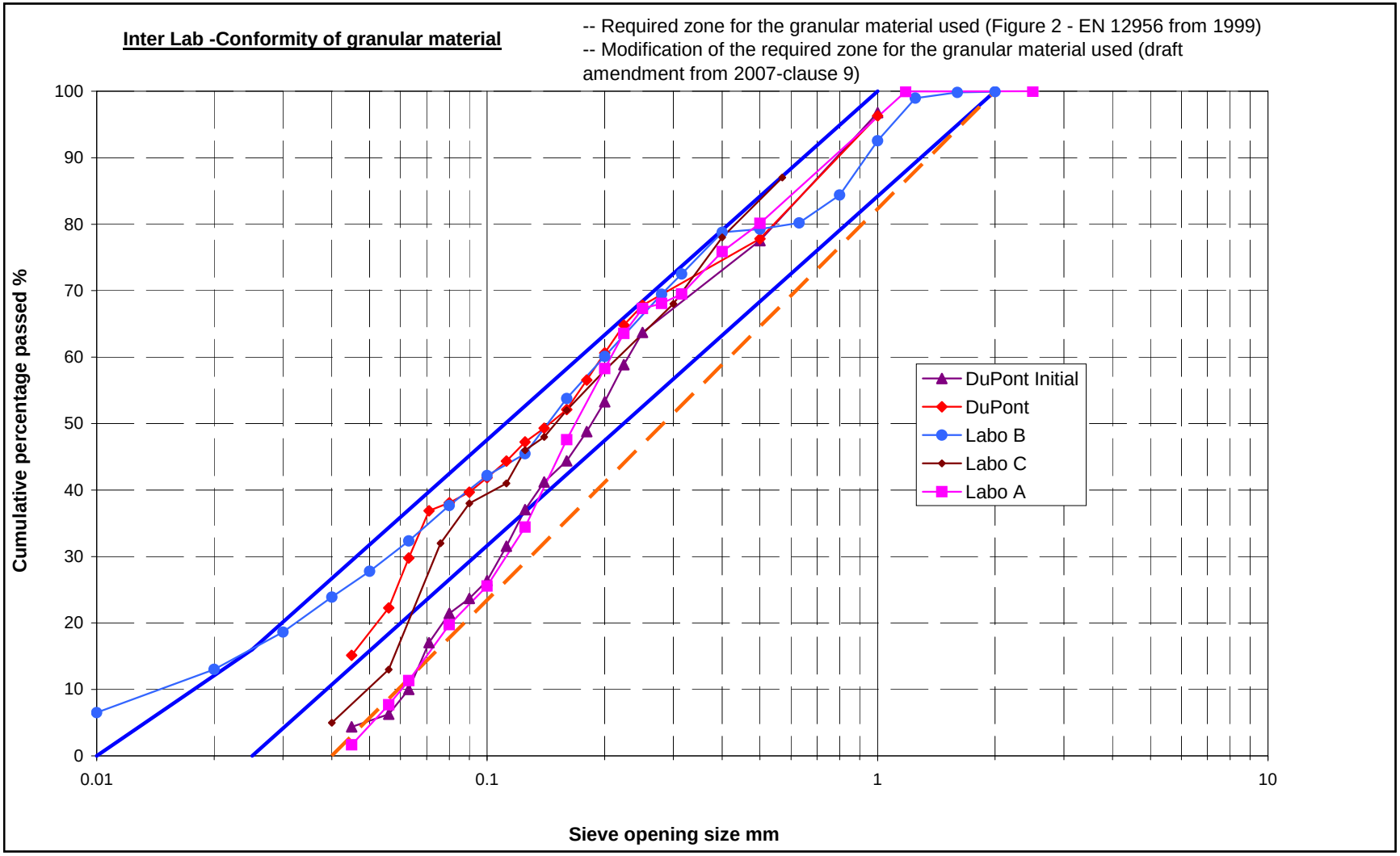
Soil used by different accredited laboratories



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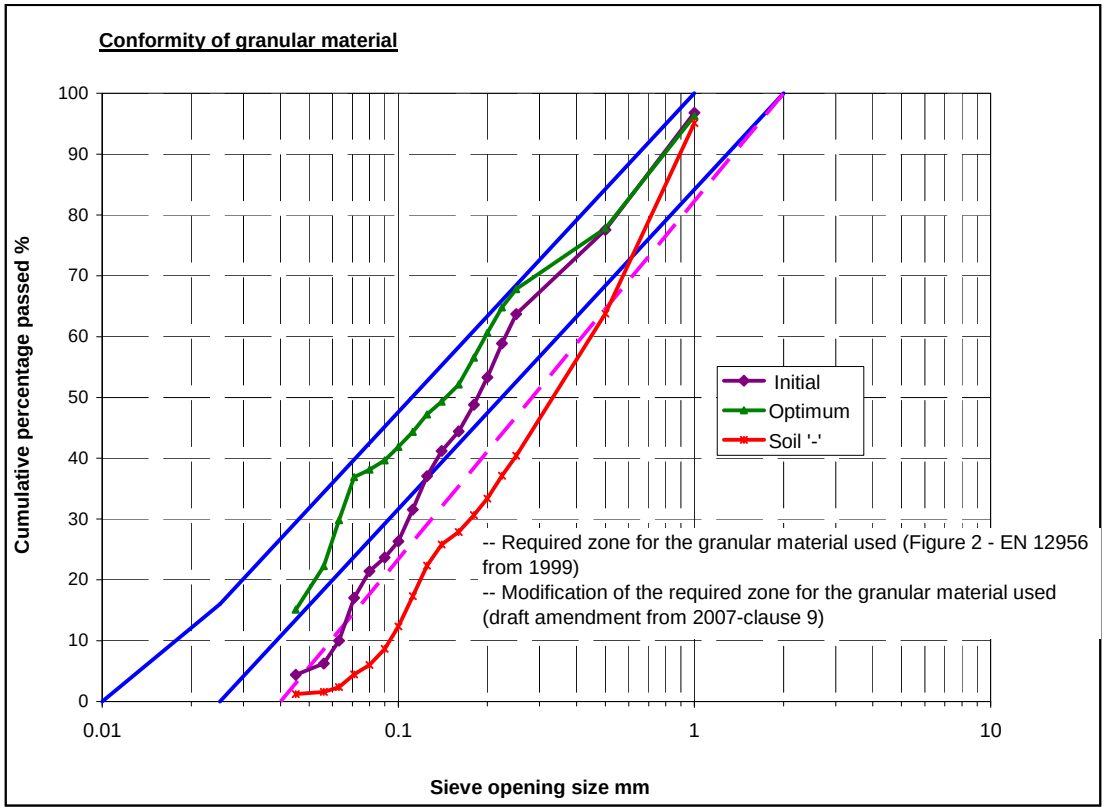
Effect of Soil Distribution

Conformity Granular material

	Initial	Optimum	Soil '-'
0.045	4.4	15.12	1.21
0.056	6.3	22.25	1.59
0.063	10.0	29.80	2.39
0.071	17.0	36.89	4.45
0.08	21.4	38.10	6.00
0.09	23.7	39.68	8.67
0.1	26.4	41.86	12.33
0.112	31.6	44.34	17.32
0.125	37.0	47.23	22.36
0.14	41.2	49.29	25.83
0.16	44.4	52.11	27.86
0.18	48.8	56.54	30.66
0.2	53.3	60.64	33.39
0.224	58.9	64.82	37.14
0.25	63.7	67.81	40.41
0.5	77.5	77.81	63.78
1	96.8	96.29	95.09

d10	63	*30*	94
d20	**77**	**53**	**119**
d60	230	197	460
d80	**871**	**559**	**759**

Cu	**3.7**	***6.7***	**4.9**



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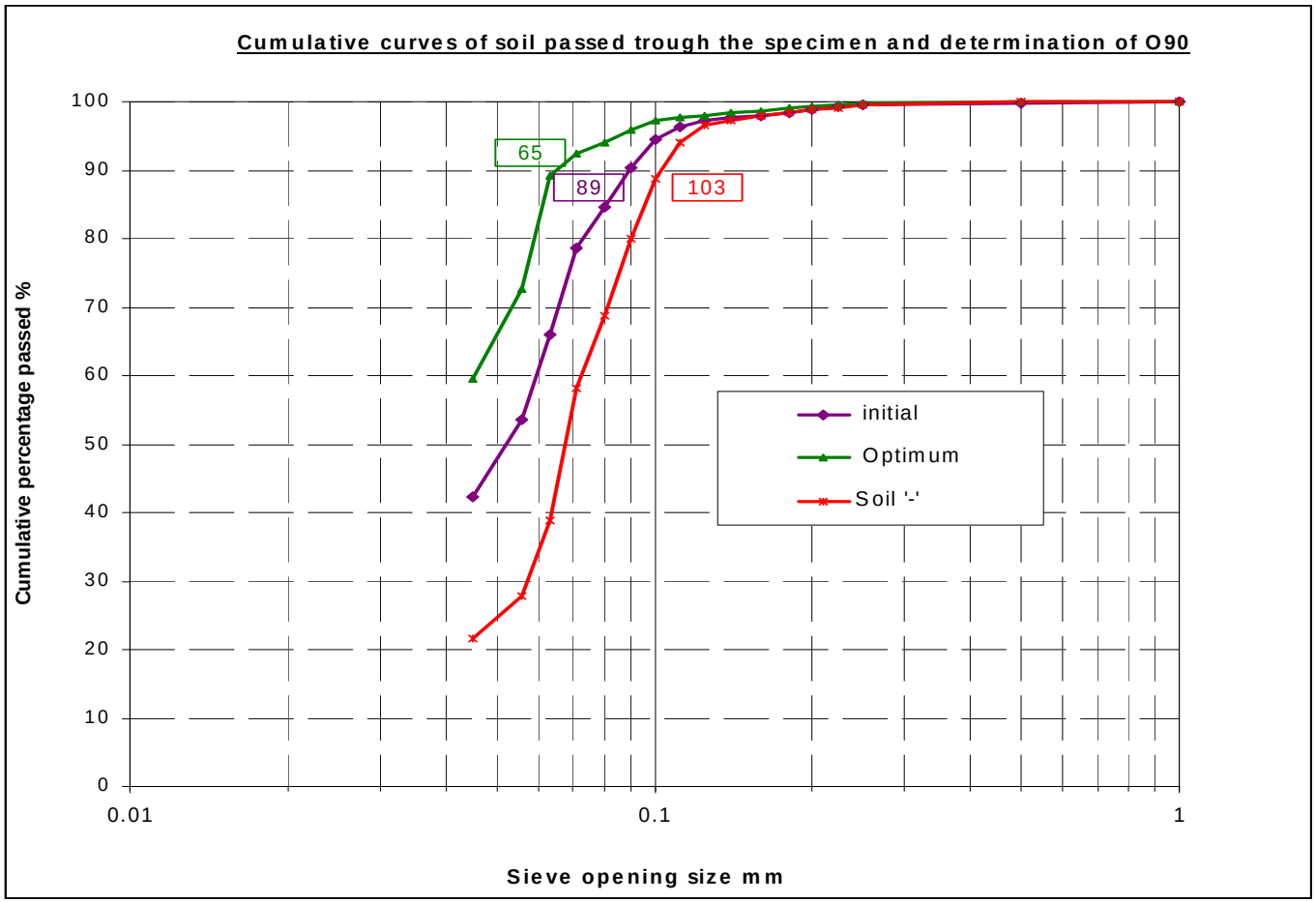
Effect of Soil Distribution



Th.B. A

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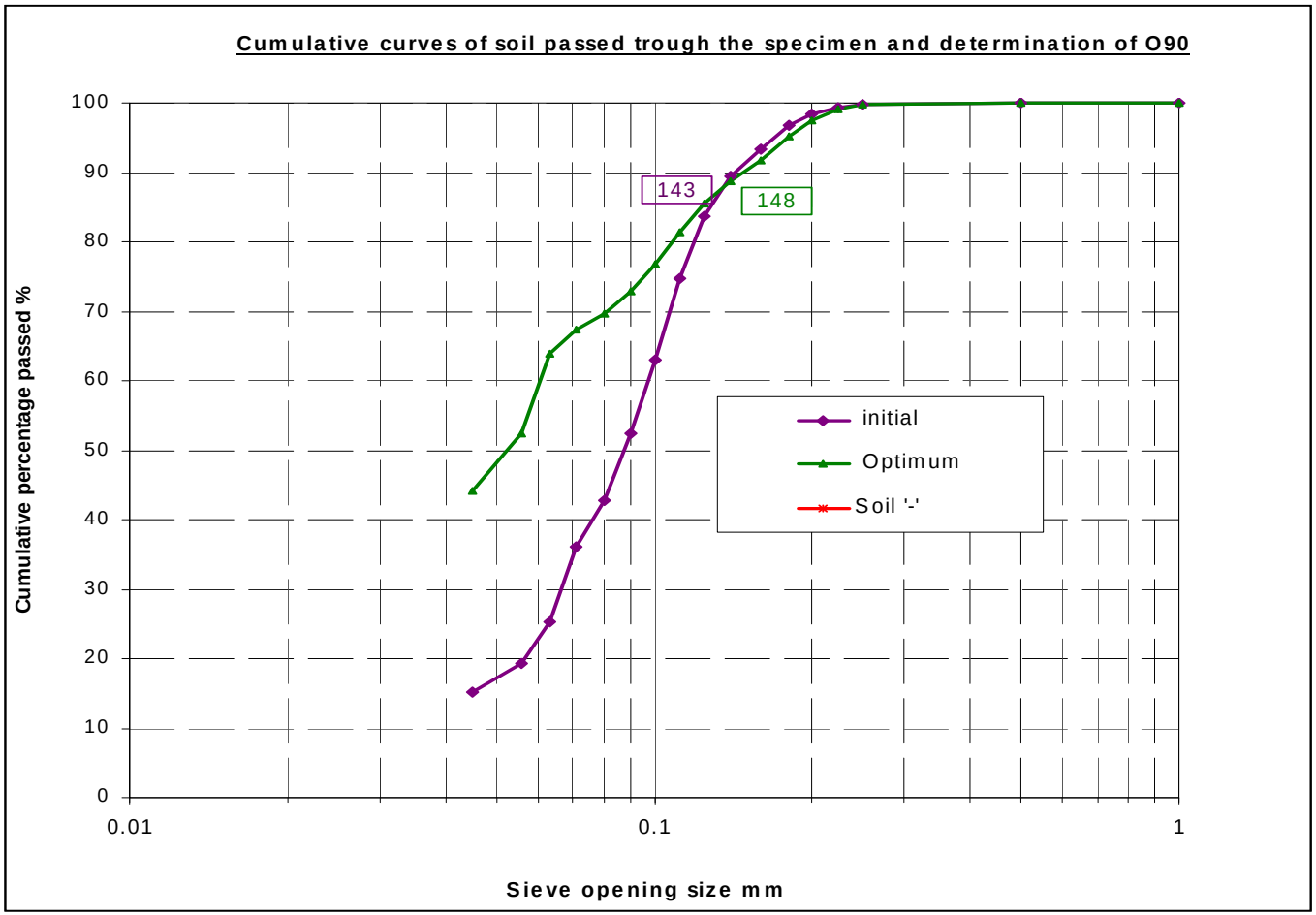
Effect of Soil Distribution



Th.B. B

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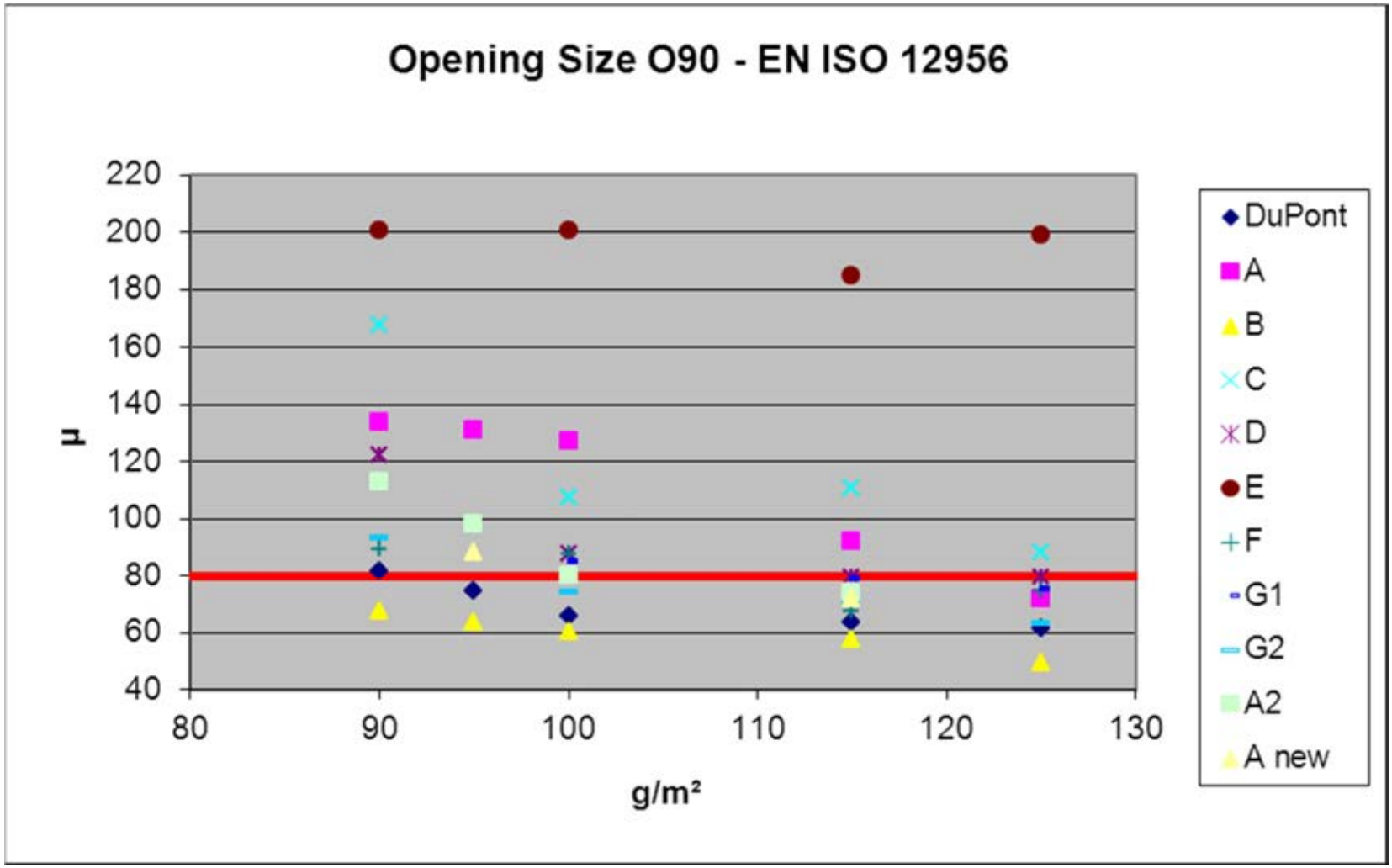
Opening Size : EN ISO 12956

Interlab Tests with different accredited laboratories (US, Asia, Europe)



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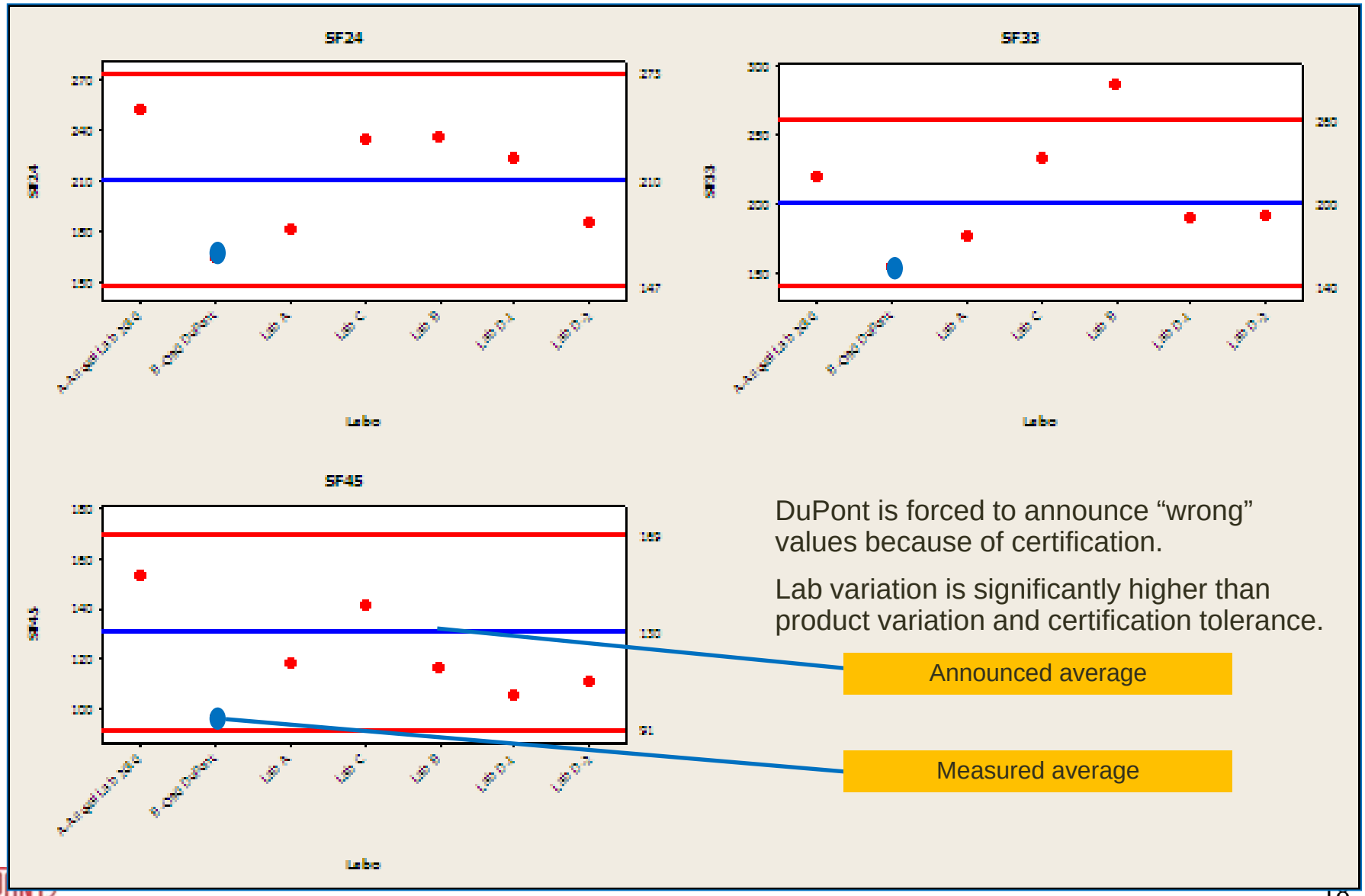
Opening Size : EN ISO 12956



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Opening Size : EN ISO 12956

- **Errors in the norm. 2 different graphs were presented and most laboratories selected the “easier” one in the informative part.**
- **Interlab tests showed that many accredited laboratories do not follow all requirements in the standard. The standard is already not precise enough but still some laboratories deviate from the requirements.**
- **Some laboratories use old equipment for soil sieve analyses that is not precise enough for good measurements.**
- **This property has a lower and higher certification limit and so often the producer is obliged to announce a “wrong” value to maintain the certification.**

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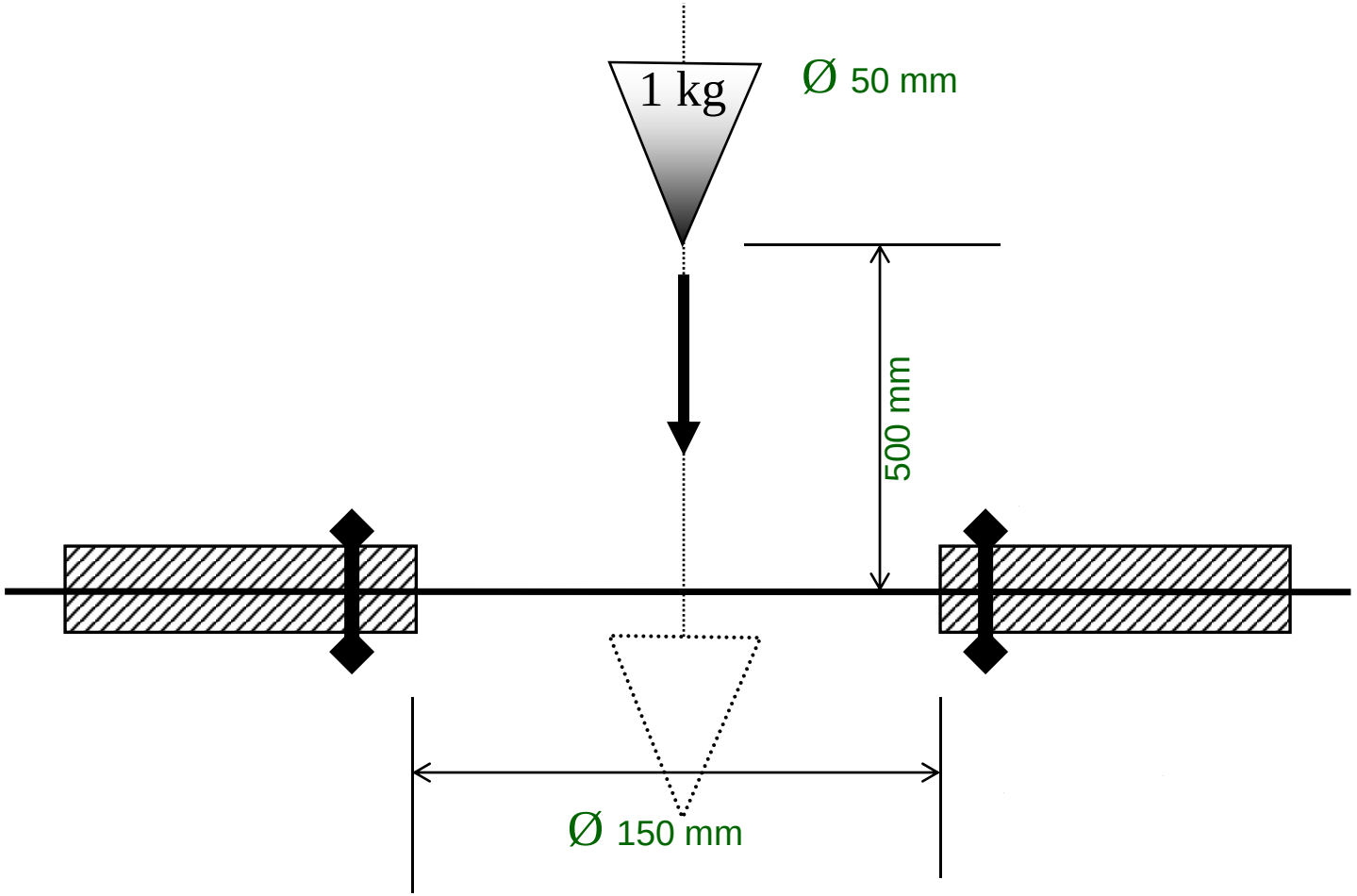
Dynamic Cone Drop - EN ISO 13433



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Dynamic Cone Drop - EN ISO 13433

- **Performance or Index Test ?**

Damage during installation tests showed absolutely no correlation between cone drop and damage.

Not on frozen ground and not on soft soils.

Why is it used then ?

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Dynamic Cone Drop - EN ISO 13433

- **Geotextiles are installed on ground or membranes but not free-hanging like in the cone drop test. (realistic result ?)**
- **Number of decimals for the average result is not indicated in the standard (what is verified in certification systems ?)**
- **“ in some cases, the cone bounces off the specimen making a new hole on its second fall. In this event, measure the size of the larger hole “ (realistic for application ? What if it falls in the same hole again ?)**
- **“ when testing woven geotextiles, it is possible that threads are shifted rather than broken. This shall be reported “ (what is the real value then ?)**
- **With higher clamping tension a hole can partially close again after removal of the cone and before the measurement can be done (what is the real value then ?)**

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Dynamic Cone Drop - EN ISO 13433

- **The cone diameter is 50 mm. Higher values than 50 mm are not possible and ≥ 50 mm is given.**
- **The best value is no hole and 0 is marked. Better values cannot be indicated (better than 0 is not possible).**
- **How should a statistical evaluation with single or average ≥ 50 or ≤ 0 single results be made ?**
- **If different results are expected (?) the test shall be made on both sides. (what result will be indicated and used for certification then ?)**
- **The measurement shall be made from the bottom of the specimen. In most cases this can be realized only with a camera installed below the equipment. Only a small portion of the hole can be inspected.**
- **Many laboratories are not equipped to measure from the bottom.**

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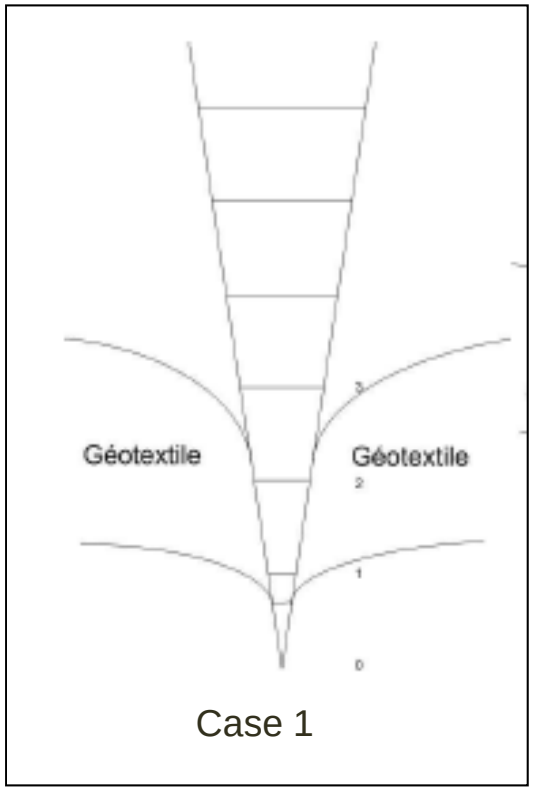
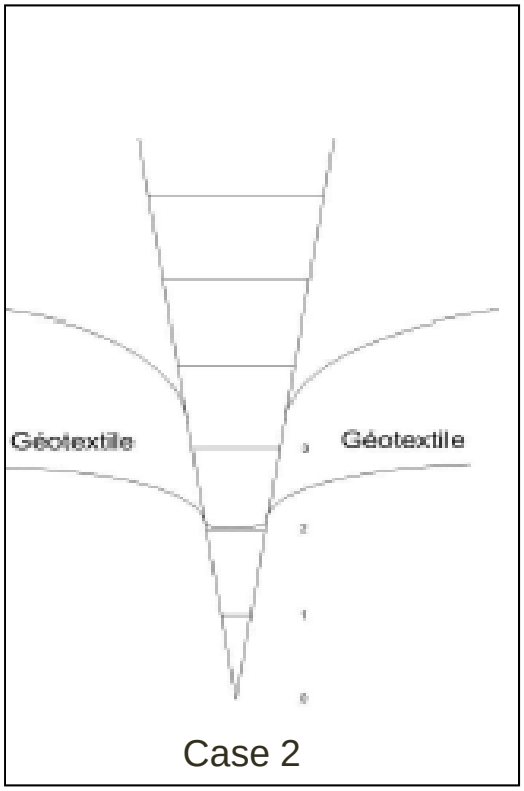
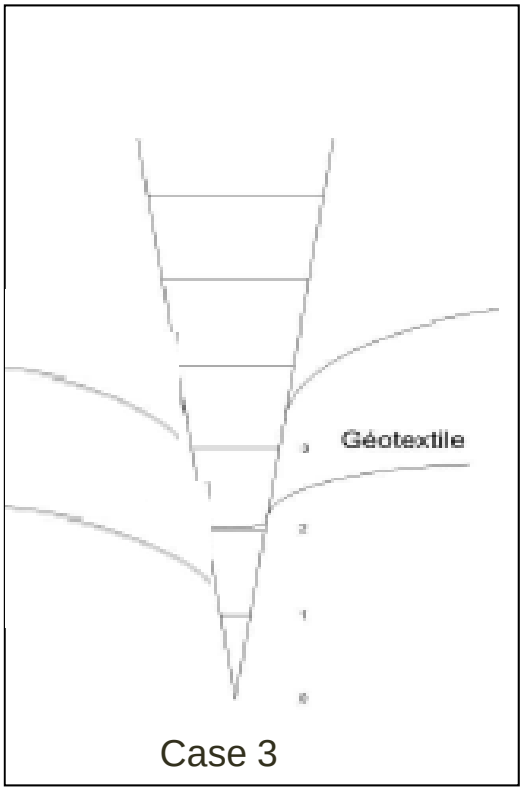
Dynamic Cone Drop - EN ISO 13433



Case 1



Case 2



Case 3

Case 1: Result is 0 even that the cone is partially passing through

Case 2: Result is 2

Case 3: Result is 1 if only the left side can be investigated. If the right side can be investigated the result will be 2

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Dynamic Cone Drop - EN ISO 13433

23 or 24 ?

23, 24 or 25 or 19 ?

?

Result often depends on the area that the camera is showing

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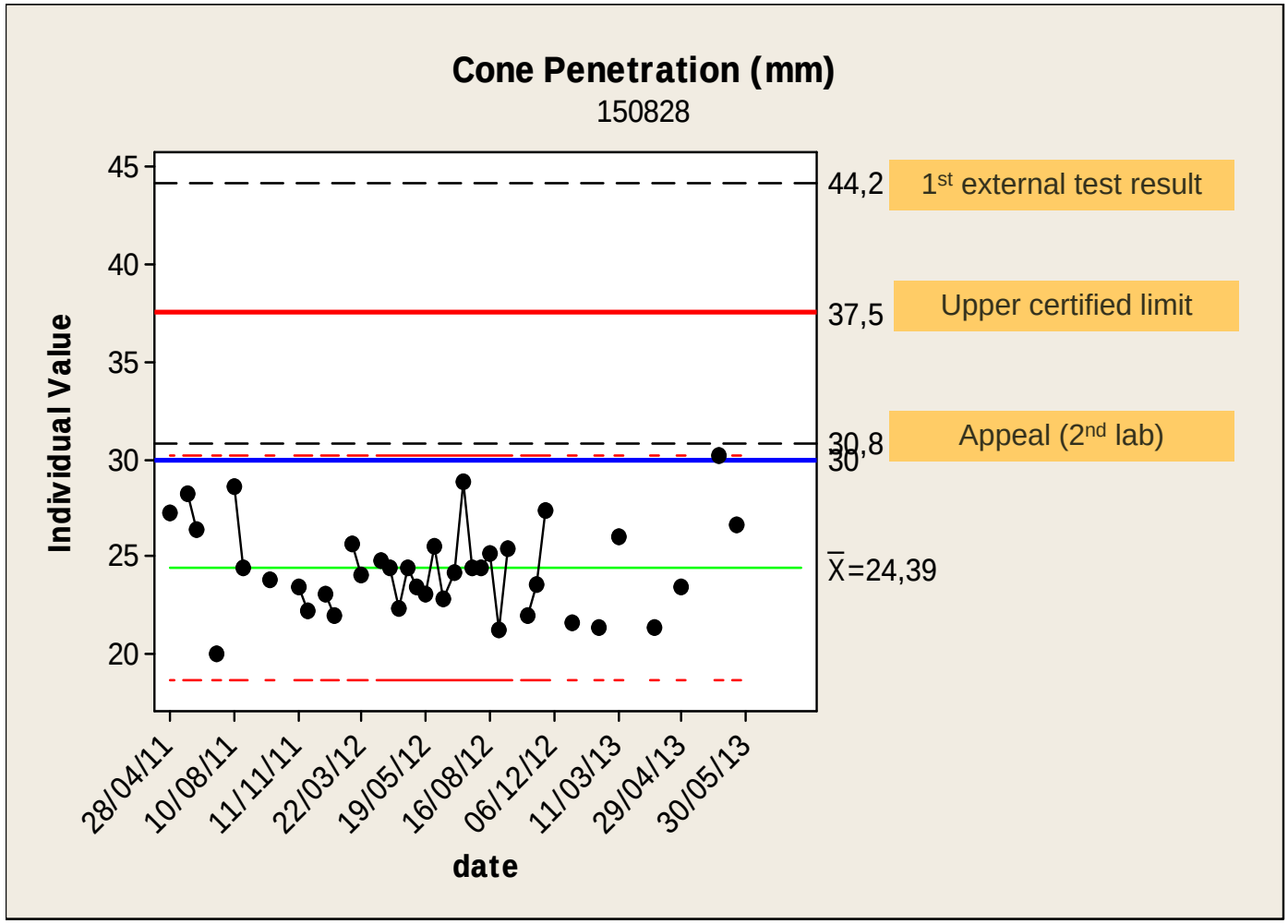
Dynamic Cone Drop - EN ISO 13433



Real Production Value

24.39

Announced Value

(Safety Margin 20 %)

30

Certification Limit

30+25% = 37.5

1st External Lab Result

44.2

Appeal (2nd Lab, same sample)

30.8

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Conclusions

- High differences exist between the different laboratories.
- The independent laboratories in some cases are deviating from the standard.
- The producers need to carefully analyze the test variability and decide on the announced value for certification. (this may mean in the worst case that they must announce “wrong” values)
- “Errors” in external certification laboratories happen and it is extremely important that an appeal with a different laboratory is possible.
- Interlab tests are the only way to detect differences in the result. Test guidelines and/or changes in the standard should be made to reduce as much as possible test variation.

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Conclusions

- **Most laboratories are very open to discuss results and procedures with the objective to improve the procedures and differences between the different laboratories.**

- **The certification bodies are responsible for the system and must organize more independent interlab tests and take the necessary corrective actions to make sure that the system works.**

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Thank You

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