GEF-SIEVE-Report

An exchange format for particle size analysis

Preface

The exchange of data resulting from particle size analyses is not difficult when only two parties are involved. In such a case, a spreadsheet is the most used digital format, while the format used is agreed upon between the producer of the data and the end user. However when data stem from more sources, each having a different standard, the risk of mistakes in transfer and the necessary conversions, is real.

In the series of exchange formats based on the Geotechnical Exchange Format (GEF) and realized under the auspices of CUR Building and Infra (CURB&I, before CUR – Centre for Civil Engineering Research and Codes) a further format is added to facilitate the exchange of geotechnical data. The regular user of GEF will recognize familiar elements of the format in this document.

A concept of this report has been circulated amongst the group of possible users of the format, producers as well as end users. Comments from this consultation round have been included in this version.

In order to turn the format into a real intermediate it is expected that software, existing but certainly newly developed, will include the possibility to use this format as input as well as output format for particle size data.

At the time of compiling of this manual, the research committee G007 comprised:

Dr. H. den Adel	GeoDelft
Drs. J.H.A. Bosch	TNO Bouw en Ondergrond
Ir. F.P.H. Engering	GeoDelft
Ing. A. Jonker	CUR Bouw & Infra
Ing. W.A. Nohl	Fugro Ingenieursbureau
Ing. A.E.J. Potter	V.O.T.B
T. van der Veen	A.P. van den Berg B.V.
Ing. W.F.J. Visser	TNO Bouw en Ondergrond

Project engineer(s)

Dr. H. den Adel	GeoDelft
Drs. J.H.A. Bosch	TNO Bouw en Ondergrond
Ing. W. A. Nohl	Fugro Ingenieursbureau

The software and this report are available for free at www.geffiles.nl, with the possibility to make a download. The CUR B&I-organisation guarantees that the format will be maintained; if there are any questions or tips, please contact nationale_standard@geffiles.org.

December 2006 The Board of the CURB&I

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1 Introduction

The exchange of data resulting from particle size analyses is not difficult when only two parties are involved. In such a case, a spreadsheet is the most used digital format, while the format used is agreed upon between the producer of the data and the end user. However when data stem from more sources, each having a different standard, the risk of mistakes in transfer and the necessary conversions, is real.

In the series of exchange formats based on the Geotechnical Exchange Format (GEF) and realized under the auspices of CUR (Centrum voor Uitvoering en Regelgeving) a further format is added to facilitate the exchange of geotechnical data. The regular user of GEF will recognize familiar elements of the format in this document, especially in chapter 2 and paragraph 4.1. To include all information which is used in the exchange of particle size data specific attribute groups have been added:

3 Compulsory keywords
4.2 Data on the sample
4.3 Technical data on the preparation of the sample
4.5 Technical data on the determination of the particle size distribution of the sample
4.6 Parameters calculated for the particle size distribution of the sample
4.7 The particle size distribution data

In order to include many data in one file (to prevent the necessity to create a very large number of separate files) the possibility has been created to incorporate the results of more than one sample in one file (par. 4.4, compare 4.1.1).

A concept of this report has been circulated amongst the group of possible users of the format, producers as well as end users. Comments from this consultation round have been included in this version.

In order to turn the format into a real intermediate it is expected that software, existing but certainly newly developed, will include the possibility to use this format as input as well as output format for particle size data.

2 Compulsory GEF keywords

2.1 Organisation of the file

#GEFID = 1, 1, 0
Release 1 and version 1 indicate which keywords must be recognised by GEF processing software.

2.2 Owner of the file

#FILEOWNER = name.
The name of the person that produced this file is mentioned. This is not necessarily the guy in the lab.
#FILEOWNER = Wim Nohl

2.3 Company responsible for the file

#COMPANYID = company name, VAT number, country code
The country code is the international access number when dialling a country. The VAT number is a unique identifier for an existing company, even after mergers.
#COMPANYID = GeoDelft, 8000.97.476.B.01, 31

2.4 Date of creation

#FILEDATE = yyyy, mm, dd
The Y2k compliant date on which the file was created.
#FILEDATE =2001,02,16

2.5 Project information

#PROJECTID = name of the project or code for the project
Optionally a code for the main project and for the subproject can be given.
#PROJECTID = CO, 710402, 431

2.6 Number of columns

#COLUMN = number of columns
The number of columns in the data block.
#COLUMN =4

2.7 Description of the columns

#COLUMNINFO = column number, Unit, Quantity, Quantity number
This keyword must be present for each column.
#COLUMNINFO = 1, mm, particle size upper fraction boundary, 2

In Table 2.1 a list of quantities and their corresponding numbers is defined:

Quantity	Unit	Quantity number
Particle size lower fraction boundary	mm	1
Particle size upper fraction boundary *)	mm	2
Cumulative percentage *)	%	3
Percentage	%	4
Cumulative mass	g	5
Mass	g	6
Cumulative percentage exceeding	%	13

Table 2.1 Quantities and their numbers

*: we prefer the use of particle size upper fraction boundary and cumulative percentage (quantity numbers 2 and 3).

The percentage may vary between 0 and 100. The difference between cumulative percentage and cumulative percentage exceeding is explained in Figure 2.1.

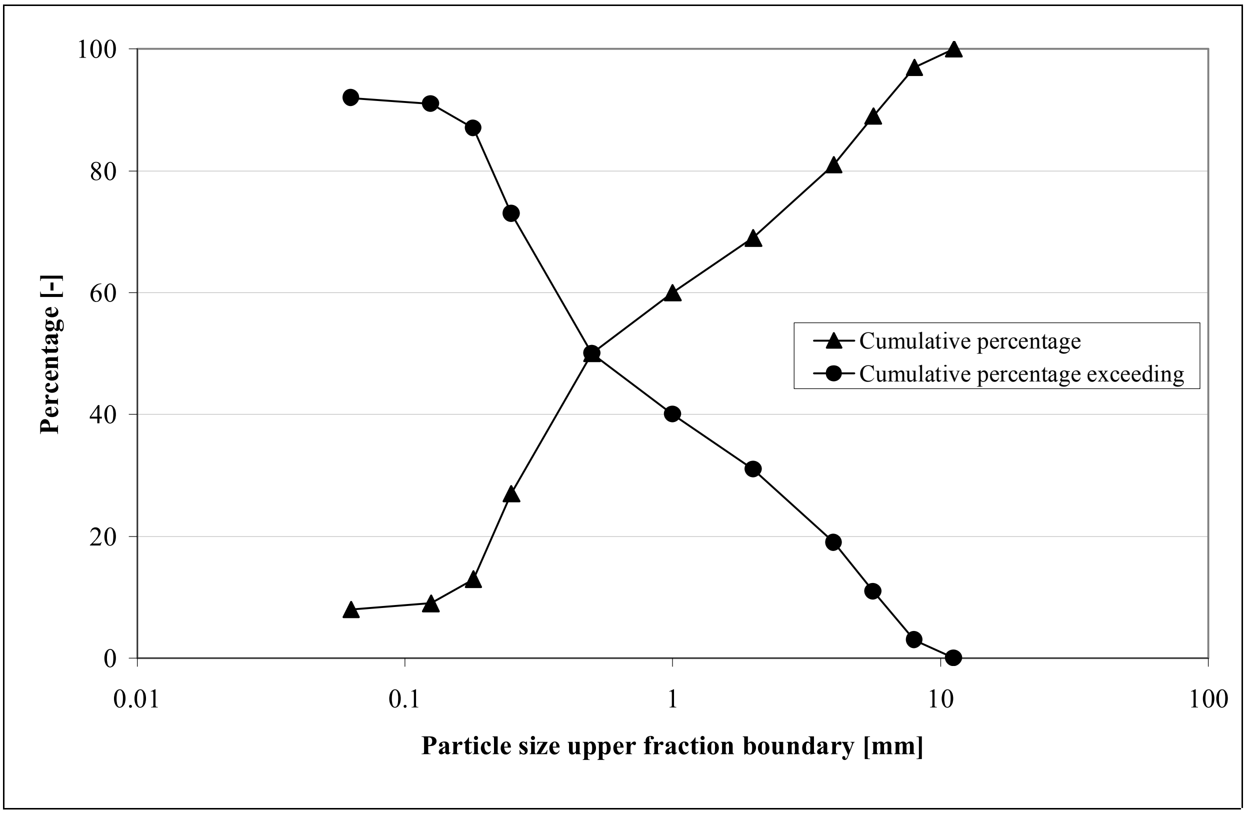

Figure 2.1 Percentage and percentage exceeding

2.8 Number of records

#LASTSCAN = number of records
The number of records is equal to the number of particle size fractions. For each fraction a line in the data block is reserved.
#LASTSCAN = 12

3 Keywords compulsory for ‘sieving’

3.1 Compulsory

Compulsory keywords should always be present.

3.1.1 Organisation and contents

#REPORTCODE = GEF-SIEVE-Report, 1, 0, 0, http://www.geffiles.org/standaard/pdf/gsr100.pdf
This keyword signifies that the organisation of the file is in accordance with this written document. When the particle size analysis of more than one sample in a boring is reported, use:
#REPORTCODE = GEF-MULTISIEVE-Report, 1, 0, 0, http://www.geffiles.org/standaard/pdf/gsr100.pdf
The MULTI is the indicator that data of more than one analysis are available.

3.1.2 Method

#MEASUREMENTCODE = method, release, version, update, documentation
The method of determination of the fractions is usually NEN3835.
#MEASUREMENTCODE = NEN3835, 1, 0, 0, NNI

3.2 Conditional

Conditional keywords should be present if one or more specific conditions are fulfilled.

3.2.1 Linked file

#PARENT = name of linked file
If a sample has been collected from a boring, the file name of the description of the boring can be given. Parent files should always be present in the same directory as its child: the file of particle size analysis. An alternative is an URL, like http://www.somewhere.eu/data/parentfile.zip[1]
#PARENT = B_FG32.gef

[1] This is a non existing URL. Please do not follow.

4 Optional keywords

4.1 Location related

4.1.1 Location

#XYID = reference system, X co-ordinate, Y co-ordinate, accuracy X, accuracy Y
The reference system is a code for a particular way to fix a location on the globe, see Table 4.1. The unit is meter.

Code	Reference system
00000	Self defined system
00001	Geographical co-ordinate system
01000	SPCS
31000	RD co-ordinate system
31001	UTM-3N co-ordinate system
31002	UTM-9N co-ordinate system
32000	Belgian Bessel
49000	Gauss-Krüger co-ordinate system

Table 4.1 Reference systems on the globe

#XYID = 31000, 85637.45, 446248.663, 0.01, 0.001
This specifies point (X=85637.45 m, Y=446248.663 m) in the RD co-ordinate system with an accuracy of 1 cm in the X- and 1 mm in the Y direction.
If a self defined system is used, it should be described in Measurementtext 7.

4.1.2 Ground level and reference system

#ZID = reference system, vertical position, accuracy
The reference system is a code for a particular way to fix a location on the globe, see Table 4.2. The unit is meter.

Code	Reference system
00000	Self defined system
00001	Low Low Water Spring
31000	NAP
32000	Ostend Level
32001	Tweede Aardkundige Waterpassing
49000	Normal Null

Table 4.2 Reference systems for the ground level

If a self defined system is used, it should be described in Measurementtext 8.
#ZID = 31000, -3.75, 0.01
This states that the ground level was –3.75 m below NAP. The accuracy is 1 cm.

4.1.3 Start level

#MEASUREMENTTEXT = 9, zero level, remarks or description
Zero level is the level from which a boring is made. It is usually described with respect to the interface between air and soil or water and soil: ground level or sea bottom. The position of this start level, measured in an absolute co-ordinate system, is given in ZID.
#MEASUREMENTTEXT = 9, ground level, starting point

4.1.4 Local co-ordinate system

#MEASUREMENTTEXT = 7, self defined co-ordinate system, description of this system
When the code of the co-ordinate system in XYID equals 0, a self defined system is used. In this keyword a rudimentary description of this self defined system has to be given.
#MEASUREMENTTEXT = 7, Fire hydrant corner Meent-Coolsingel, local co-ordinate system
Remark: The CUR committee G007 prefers the use of nationally or internationally accepted co-ordinate systems, such as the "RD coordinate system", see Table 4.1. We advise against the use of a local coordinate system.

4.1.5 Local reference system

#MEASUREMENTTEXT = 8, self defined reference system, description of this system.
When the code of the reference system in ZID equals 0, a self defined reference system is used. In this keyword a rudimentary description of this self defined system has to be given.
#MEASUREMENTTEXT = 8, copper bolt in Fortis building, local reference system
Remark: The CUR committee G007 prefers the use of nationally or internationally accepted reference systems, such as NAP, see Table 4.2. We advise against the use of a local reference system.

4.1.6 Name of the location

#MEASUREMENTTEXT = 3, location, describes the location
Location is the name of a community, village, city or region where the sample has been collected.
#MEASUREMENTTEXT = 3, Baskarp (S), describes the location

4.2 Sample related

4.2.1 Boring code

#TESTID = boring code
This is the unique identification (in a specific project, see #PROJECTID) of the boring from which one or more samples have been taken.
#TESTID = B52

4.2.2 Method for obtaining the material

#SPECIMENTEXT = 20, method, obtaining the bulk of the material
From the bulk of the material one or more samples are drawn. The bulk material may be obtained by drilling techniques, dredging, scooping or digging.
#SPECIMENTEXT = 20, Auger, obtaining the bulk of the material

4.2.3 Number of the sample

#SPECIMENTEXT = 21, code for the sample, original code of the sample
The sample may have been coded, in order to identify several samples collected in a boring.
#SPECIMENTEXT = 21, S1A, original code of the sample

4.2.4 Renumbering the sample

#SPECIMENTEXT = 22, sample renumbered, secondary code of the sample
Some people feel an irresistible urge to renumber a sample. In order to accommodate this need, feel free to use specimentext 22, if a number like S1A does not satisfy you:
#SPECIMENTEXT = 22, A1S, secondary code of the sample

4.2.5 Method of sampling

#SPECIMENTEXT = 23, method, method of sampling

The quality of a particle size distribution strongly depends on the technique of obtaining the bulk material and the sampling technique.

Sampling technique
Ackermann sampler
Begemann-continuous sampler
Pressed sampler
Piston sampler
Open sampler
SPT sampler
Other

Table 4.3 Sampling techniques

#SPECIMENTEXT = 23, Ackermann sampler, method of sampling

4.2.6 Is sample disturbed?

#SPECIMENTEXT = 24, Yes/No, Is sample disturbed?
During sampling the specimen may be disturbed.
#SPECIMENTEXT = 24, No, Is sample disturbed?

4.2.7 Sample date

#SPECIMENTEXT = 25, yyyy-mm-dd, sample date
The date is given in a Y2k compliant form.
#SPECIMENTEXT = 25, 2001-12-19, sample date

4.2.8 Top depth of the sample

#SPECIMENVAR = 21, top depth, Unit, Quantity
If a sample is collected from a boring, this keyword defines the top of the sample below the fixed horizontal level, as defined in Measurementtext 9. The value must be positive.
#SPECIMENVAR = 21, 4.51, m, top depth

4.2.9 Bottom depth of the sample

#SPECIMENVAR = 22, bottom depth, Unit, Quantity
If a sample is collected from a boring, this keyword defines the bottom of the sample below the fixed horizontal level, as defined in Measurementtext 9. The value must be positive.
#SPECIMENVAR = 22, 4.56, m, bottom depth

4.3 Preparation of the sample

Usually a sample is subjected to several operations in order to prepare it in advance of its particle size analysis. Some fractions can be removed and specific material can be disposed off.

4.3.1 Company

#MEASUREMENTTEXT = 13, company, firm where the preparation was done
Sometimes a sample is being prepared by another company than the company that performs the particle size analysis.
#MEASUREMENTTEXT = 13, Bpreped, firm where the preparation was done

4.3.2 Person responsible for preparation

#MEASUREMENTTEXT = 6, lab worker, the person that has done the preparation
This keyword provides the name of the person that has prepared the sample.
#MEASUREMENTTEXT = 6, Henk den Adel, lab worker

4.3.3 Date of preparation

#MEASUREMENTTEXT = 5, yyyy-mm-dd, preparation date
The date is given in a Y2k compliant form.
#MEASUREMENTTEXT = 5, 2001-12-19, preparation date

4.3.4 Remarks

#MEASUREMENTTEXT = 21, remarks, remarks
Remarks can be written down in the first field. Remarks are limited to 512 characters.
#MEASUREMENTTEXT = 21, sample smells like wet dog; biological activity is killed, remarks

4.3.5 Removal of carbonates

#MEASUREMENTTEXT = 22, method, description of the method for removing carbonates
The method used to remove the carbonates is stored in this keyword.
#MEASUREMENTTEXT = 22, dissolving with acid, carbonate removal

4.3.6 Removal of organic material

#MEASUREMENTTEXT = 23, method, description of the method for removing organic material
The method used to remove the organic material is stored in this keyword.
#MEASUREMENTTEXT = 23, oxidation, organic fraction removal

4.3.7 Removal of iron

#MEASUREMENTTEXT = 24, method, description of the method for removing iron
The method used to remove the iron is stored in this keyword.
#MEASUREMENTTEXT = 24, dissolving with acid, iron removal

4.3.8 Removal of salt

#MEASUREMENTTEXT = 25, method, description of the method for removing salt
The method used to remove the carbonates is stored in this keyword.
#MEASUREMENTTEXT = 25, rinsing with tap water, salt removal

4.3.9 Anti-coagulation method

#MEASUREMENTTEXT = 26, method, description of the method for anti-coagulation
Slightly cohesive material will coagulate on non-cohesive material. In order to break up these bonds, chemical agents, like soap, or mechanical methods, like grinding, rubbing or exposure to ultra sonic vibrations, may be employed.
#MEASUREMENTTEXT = 26, ultra sonic vibration, method of anti-coagulation

4.3.10 Removal of coarse material

#MEASUREMENTTEXT = 27, Yes/No, removal of coarse material
This keyword indicates whether coarse material has been removed.
#MEASUREMENTTEXT = 27, Yes, removal of coarse material

4.3.11 Method of removal of coarse material

#MEASUREMENTTEXT = 28, method, removal of coarse material
The method used to remove the coarse material is stored in this keyword. This keyword makes sense if Measurementtext 27 signifies that coarse material has been removed.
#MEASUREMENTTEXT = 28, sieving, removal of coarse material

4.3.12 Lower limit of removed coarse material

#MEASUREMENTVAR =21, size, Unit, Quantity
This keyword characterises the lower limit of the size of the coarse material being removed. This keyword makes sense if Measurementtext 27 signifies that coarse material has been removed.
MEASUREMENTVAR =21, 10, mm, lower limit for the size of the material removed

4.3.13 Percentage of removed coarse material

#MEASUREMENTVAR =22, percentage, Unit, Quantity
This keyword characterises the percentage (mass) of the coarse material being removed. This keyword makes sense if Measurementtext 27 signifies that coarse material has been removed. The percentage[2] is determined by dividing the removed mass of coarse material by the initial mass of the sample.
MEASUREMENTVAR =22, 15, %, percentage of the coarse material removed

4.3.14 Removal of fine material

#MEASUREMENTTEXT = 29, Yes/No, removal of fine material
This keyword indicates whether fine material has been removed.
#MEASUREMENTTEXT = 29, Yes, removal of fine material

4.3.15 Method of removal of fine material

#MEASUREMENTTEXT = 30, method, removal of fine material
The method used to remove the fine material is stored in this keyword. This keyword makes sense if Measurementtext 29 signifies that fine material has been removed.
#MEASUREMENTTEXT = 30, sedimentation, removal of fine material

4.3.16 Upper limit of removed fine material

#MEASUREMENTVAR =23, size, Unit, Quantity
This keyword characterises the upper limit of the size of the fine material being removed. This keyword makes sense if Measurementtext 29 signifies that fine material has been removed.
MEASUREMENTVAR =23, 0.038, mm, upper limit for the size of the material removed

4.3.17 Percentage of removed fine material

#MEASUREMENTVAR =24, percentage, Unit, Quantity
This keyword characterises the mass of the fine material being removed. This keyword makes sense if Measurementtext 29 signifies that fine material has been removed. The percentage[3] is determined by division of the removed mass of fine material by the initial mass of the sample.
MEASUREMENTVAR =24, 8, %, percentage of the fine material removed

---

[2] For gaining the percentage, multiply by 100.

[3] For gaining the percentage, multiply by 100.

4.3.18 Carbonate percentage

#SPECIMENVAR = 23, percentage $CaCO_3$, Unit, Quantity
The carbonate fraction is usually determined by dissolving carbonates with HCl (hydro chloric acid). The percentage is determined by division of the removed mass of carbonates by the initial mass of the sample.
#SPECIMENVAR = 23, 10, %, carbonate fraction

4.3.19 Percentage organic material

#SPECIMENVAR = 24, percentage organic material, Unit, Quantity
The fraction of organic material is usually determined by oxidising the organic material with H_2O_2 (hydrogen peroxide). The percentage[3] is determined by division of the removed mass of organic material by the initial mass of the sample.
#SPECIMENVAR = 24, 30, %, organic fraction

4.4 Multiple samples

Note that if multiple samples are taken –check whether MULT is used in Reportcode- the items in sections 4.2.2 until 4.2.9, sections 4.3.12 until 4.3.19 and sections 4.6.1 until 4.6.10 are basically multiple items as well. The corresponding indices for the specimenvars, specimentexts, measurementvars and analysisvars are given in Table 4.4, Table 4.5, Table 4.6 and Table 4.7.

There is a fixed relation between the number of the sample, the index of the keyword Columninfo and the variable 'k' in the last column of Table 4.4, Table 4.5, Table 4.6 and Table 4.7.

#COLUMNINFO = 2, %, cumulative percentage, 3	This is the first sample	k=1
#COLUMNINFO = 3, %, cumulative percentage, 3	This is the second sample	k=2
#COLUMNINFO = 4, %, cumulative percentage, 3	This is the third sample	k=3
#COLUMNINFO = j+1, %, cumulative percentage, 3	This is the j-th sample	k=j

Item	First sample k=1	Second sample k=2	Third sample k=3	k-th sample
Obtaining bulk of the material	20	40	60	20k
Number of the sample	21	41	61	20k+1
Renumbering the sample	22	42	62	20k+2
Sampling technique	23	43	63	20k+3
Disturbed sample	24	44	64	20k+4
Sample date	25	45	65	20k+5

Table 4.4 Index of the specimentexts when multiple samples are reported

Item	First sample	Second sample	Third sample	k-th sample
Top depth of the sample	21	41	61	20k+1
Bottom depth of the sample	22	42	62	20k+2
Carbonate fraction	23	43	63	20k+3
Organic fraction	24	44	64	20k+4

Table 4.5 Index of the specimenvars when multiple samples are reported

Item	First sample	Second sample	Third sample	k-th sample
Lower limit of removed coarse material	21	41	61	20k+1
Mass of removed coarse material	22	42	62	20k+2
Upper limit of removed fine material	23	43	63	20k+3
Mass of removed fine material	24	44	64	20k+4

Table 4.6 Index of the measurementvars when multiple samples are reported

Item	First sample	Second sample	Third sample	k-th sample
fineness number, Fm	21	41	61	20k+1
sand median, M63	22	42	62	20k+2
gravel median, M2000	23	43	63	20k+3
average grain size, D50	24	44	64	20k+4
Median grain size, Dm	25	45	65	20k+5
coefficient of uniformity, Cu	26	46	66	20k+6
coefficient of uniformity of sand, CuZND	27	47	67	20k+7
coefficient of curvature, Cc	28	48	68	20k+8
gradation, p	29	49	69	20k+9
Specific surface, U number	30	50	70	20k+10

Table 4.7 Index of the analysisvars when multiple samples are reported

4.5 Determination of the particle size distribution

4.5.1 Company

#MEASUREMENTTEXT = 31, company, firm
The company that determines the particle size distribution is not necessarily the company that has prepared the sample for the determination.
#MEASUREMENTTEXT = 31, Millisieve, Company

4.5.2 Lab worker

#MEASUREMENTTEXT = 32, lab worker, the guy that does the job
The name of the lab worker that has performed the actual test, is stored in this keyword.
#MEASUREMENTTEXT = 32, A. Bosch, Lab worker

4.5.3 Date of particle size analysis

#MEASUREMENTTEXT = 33, yyyy-mm-dd, date of the analysis
The date is given in a Y2k compliant form.
#MEASUREMENTTEXT = 33, 2001-11-25, date of the test

4.5.4 Method of the particle size analysis of coarse material

#MEASUREMENTTEXT = 34, method, method of the particle size analysis of coarse material
Coarse material[4] is defined as larger than 2 mm. The method of determining the particle size distribution, is reported in this keyword. For mechanical processes, report the type sieve, like wire mesh, punched mesh. There are other methods like sedimentation, centrifugal techniques, image processing, X-ray, deflection or absorption of light.
#MEASUREMENTTEXT = 34, wire mesh, method of the particle size analysis of coarse material

4.5.5 Standard for coarse material

#MEASUREMENTTEXT = 35, standard, standard for coarse material
The standard followed for coarse material (larger than 2 mm). ASTM, NEN 3835, DIN, BST
#MEASUREMENTTEXT = 35, NEN 3835, standard for coarse material

[4] Coarse material: larger than 2 mm. It can be characterized as gravel.
Intermediate material: between 0.063 mm and 2 mm. It can be characterized as sand.
Fine material: smaller than 0.063. It can be characterized as silt and clay.

4.5.6 Method of the particle size analysis of intermediate material

#MEASUREMENTTEXT = 36, method, method particle size analysis of intermediate material
Intermediate material is defined as larger than 0.063 mm and smaller than 2 mm. The method of determining the particle size distribution, is reported in this keyword. For mechanical processes, report the type sieve, like wire mesh, punched mesh. There are other methods like sedimentation, centrifugal techniques, image processing, X-ray, deflection or absorption of light.
#MEASUREMENTTEXT = 36, wire mesh, method of the psa of intermediate material

4.5.7 Standard for intermediate material

#MEASUREMENTTEXT = 37, standard, standard for intermediate material
The standard followed for intermediate material (between 0.063 mm and 2 mm). ASTM, NEN 3835, DIN, BST
#MEASUREMENTTEXT = 37, ASTM, standard for intermediate material

4.5.8 Method of the particle size analysis of fine material

#MEASUREMENTTEXT = 38, method, method of the particle size analysis of fine material
Fine material is define as smaller than 0.063 mm. The method of determining the particle size distribution, is reported in this keyword. For mechanical processes, report the type sieve, like wire mesh, punched mesh. There are other methods like sedimentation, centrifugal techniques, image processing, X-ray, deflection or absorption of light.
#MEASUREMENTTEXT = 38, areometer, method of the particle size analysis of fine material

4.5.9 Standard for fine material

#MEASUREMENTTEXT = 39, standard, standard for fine material
The standard followed for fine material (e.g. smaller than 0.038 mm). ASTM, NEN 3835, DIN, BST
#MEASUREMENTTEXT = 39, None, standard for fine material

4.5.10 Equipment used

#EQUIPMENT = set up
This keyword specifies the name or code of the set up used for the determination of the particle size distribution.
#EQUIPMENT = TS700

4.5.11 Protocol

#MEASUREMENTTEXT = 40, protocol, protocol followed
This keyword contains a code for the protocol, which is used for the segregation of particles into separate fractions.
#MEASUREMENTTEXT = 40, SH361, protocol followed

4.5.12 Remarks

#MEASUREMENTTEXT = 41, remarks, remarks
Remarks can be written in the first field. Remarks are limited to 512 characters, one should not opt for literary outbursts.
#MEASUREMENTTEXT = 41, considerable fine fraction, remarks

4.5.13 Value not determined

#COLUMNVOID = number of column, void value
If for whatsoever reason a value of a percentage could not be determined, a void value is listed in the data block (after #EOH=). Such a value signals that no valid data is available. We prefer a value of –1 for #columnvoid.
#COLUMNVOID = 2, -1

4.6 Parameters derived during particle size analysis

Parameters derived from the data (see section 4.7) are reported in Analysisvars. For most natural samples the graph of the particle size distribution is more or less a straight line on semi-logarithmic paper. Therefore interpolation necessary to calculate the quantities mentioned in section 4.6, should compensate for the non-linearity of the particle size distribution. We advise to use linear interpolation of the logarithm of the diameter versus the fraction.

4.6.1 Fineness number (Fijnheidsgetal)

#ANALYSISVAR = 21, F_m, -, fineness number Fm
The fineness number, F_m, is calculated by the summation of the mass percentages, remaining on the sieves C63, C31.5, C16, C8, C4 and 2mm, 1mm, 500 μm, 250 μm and 125 μm, divided by 100.
#ANALYSISVAR = 21, 4.18, -, fineness number Fm

4.6.2 Sand median (Zandmediaan)

#ANALYSISVAR = 22, M_{63}, um, sand median M63
The sand median is calculated as the average grain size in μm, of the sand fraction of a sample (63 μm - 2mm). Since a GEF file is strictly ASCII and since there is no ASCII character for the Greek letter μ, the letter u is used in stead.
#ANALYSISVAR = 22, 662, um, sand median M63

4.6.3 Gravel median (Grindmediaan)

#ANALYSISVAR = 23, M_{2000}, mm, gravel median M2000
The gravel median is calculated as the average grain size in mm, of the gravel fraction of a sample, (2 - 63 mm).
#ANALYSISVAR = 23, 5.6, mm, gravel median M2000

4.6.4 Average grain size (Gemiddelde korreldiameter)

#ANALYSISVAR = 24, D_{50}, mm, average grain size D50
The average grain size of material of all fractions, in mm.
#ANALYSISVAR = 24, 1.615, mm, average grain size D50

4.6.5 Median grain size (Mediane korreldiameter)

#ANALYSISVAR = 25, D_m, mm, median grain size Dm

$$D_m = \frac{\sum_j D_j}{9} \quad with\ j = [10,20,30,\ldots,90]$$

The median grain size is expressed in mm. The diameters D_j are to be calculated. Linear interpolation of the fraction of particles smaller than X percent and the logarithm of the particle size diameter is to be used.
#ANALYSISVAR = 25, 3.543, mm, median grain size Dm

4.6.6 Coefficient of uniformity (Gelijkmatigheidscoëfficiënt)

#ANALYSISVAR = 26, C_u, -, coefficient of uniformity of the entire sample Cu

$$C_u = \frac{D_{60}}{D_{10}}$$

D_{60} and D_{10} are the opening sizes of imaginary sieves, through which 60% respectively 10% of the material passes.
#ANALYSISVAR = 26, 16.2, -, coefficient of uniformity Cu

4.6.7 Coefficient of uniformity of sand (Gelijkmatigheidscoëfficiënt van zand)

#ANALYSISVAR = 27, C_{uZND}, -, coefficient of uniformity of sand fraction Cuznd

$$C_{u\,ZND} = \frac{D_{60}}{D_{10}}$$

D_{60} and D_{10} are the opening sizes of imaginary sieves, through which 60% respectively 10% of the sand fraction (63 μm - 2mm) passes.
#ANALYSISVAR = 27, 6.0, -, coefficient of uniformity of sand Cuznd

4.6.8 Coefficient of curvature (Krommingscoëfficiënt)

#ANALYSISVAR = 28, C_c, -, coefficient of curvature Cc

$$C_c = \frac{(D_{30})^2}{(D_{60} \times D_{10})}$$

D_{60}, D_{30} and D_{10} are the opening sizes of imaginary sieves, through which 60%, 30% and 10% of the material passes.
#ANALYSISVAR = 28, 1.1, -, coefficient of curvature Cc

4.6.9 Gradation (Gradatie)

#ANALYSISVAR = 29, p, -, gradation p

$$p = \frac{D_{90}}{D_{10}}$$

D_{90} and D_{10} are the opening sizes of imaginary sieves, through which 90% respectively 10% of the material passes.
#ANALYSISVAR = 29, 100, -, gradation p

4.6.10 Specific surface, (specifiek oppervlak zandfractie)

#ANALYSISVAR = 30, U number, -, specific surface sand fraction U
The U-number is the weighted mean ratio between the total surface of a quantity of particles and the total surface of the same quantity of particles with a uniform diameter of 10 mm. It is calculated by:

$$U = \frac{\sum_{i=1}^{n} (m_i \times u_i)}{\sum_{i=1}^{n} m_i}$$

with m_i the mass of the i-th fraction of sand, u_i the specific surface of the i-th fraction and n the number of fractions. u_i is calculated for a fraction of particle sizes d: $d_b \leq d \leq d_t$., where d_b is the lower boundary of the fraction and d_t is its upper boundary:

$$u_i = 10\left(\frac{\frac{1}{d_b} - \frac{1}{d_t}}{\ln\left(\frac{d_t}{d_b}\right)}\right)$$

The d_b and d_t are expressed in mm. **ln** stands for the natural logarithm, i.e. $\log_e$. u_i is a positive number.
#ANALYSISVAR = 30, 30, -, specific surface U

4.7 Data

There are two required columns. The first one defines the particle size of either upper or lower fraction boundary. It is calculated e.g. from the mass that passes a sieve with that dimension. The second required column is one of:

- Cumulative percentage exceeding
- Cumulative percentage
- Percentage
- Cumulative mass
- Mass

CUR committee G007 prefers cumulative percentage to be present in the data block.

This standard facilitates reporting particle sizes of multiple samples, collected from the same boring, see section 4.2.1. The maximum number of samples which can be reported in one file, is 75. The data as obtained in the actual particle size analysis, are listed in separate columns. The fractions share the same column for the corresponding particle size. If for whatever reason at specific particle size –or a range of particle sizes- the fraction could not be determined, a columnvoid value is to be inserted, see 4.5.13.
CUR committee G007 prefers a columnvoid equal to –1 for percentage or mass.

5 Example

5.1 Minimum file

#GEFID=1, 1, 0
#PROJECTID = Documentation lab sand
#FILEOWNER = Adel
#FILEDATE = 2003,06,26
#COMPANYID = GeoDelft, 8000.97.476.B.01, 31
#COLUMN = 2
#COLUMNINFO = 1, mm, particle size upper fraction boundary, 2
#COLUMNINFO = 2, -, cumulative percentage, 3
#REPORTCODE = GEF-SIEVE-Report, 1, 0, 0, http://www.geffiles.org/standaard/pdf/gsr.pdf
#MEASUREMENTCODE = NEN3835, 1, 0, 0, NNI
#LASTSCAN = 11
#EOH=

```
0.063  8.18
0.125  9.08
0.18   13.09
0.25   27.13
0.5    50.27
1.0    60.5
2.0    69.6
4.0    81.69
5.6    89.81
8.0    97.89
11.2   100.0
```

5.2 Extended file

```
#GEFID=1, 1, 0
#FILEOWNER = Wim Nohl
#COMPANYID = GeoDelft, 8000.97.476.B.01, 31
#FILEDATE =2003,06,26
#PROJECTID = CO, 710402, 431
#COLUMN = 3
#COLUMNINFO = 1, mm, particle size lower fraction boundary, 1
#COLUMNINFO = 2, -, cumulative percentage, 3
#COLUMNINFO = 3, mm, particle size upper fraction boundary, 2
#COLUMNVOID = 3, -1
#LASTSCAN = 11
#REPORTCODE = GEF-SIEVE-Report, 1, 0, 0, gsr100.doc
#MEASUREMENTCODE = IP37, 1, 0, 0, Fugro-GD
#XYID = 31000, 85637.45, 446248.663, 0.01, 0.001
#ZID = 31000, -3.75, 0.01
#MEASUREMENTTEXT = 9, ground level, starting point
#MEASUREMENTTEXT = 3, Goejanverwellesluis, describes the location
#TESTID = B52
#PARENT = B_FG32.gef
#SPECIMENTEXT = 20, Auger, obtaining the bulk material
#SPECIMENTEXT = 21, S1A, original sample code
#SPECIMENTEXT = 22, A1S, secondary sample code
#SPECIMENTEXT = 23, Ackermann sampler, type of sampling
#SPECIMENTEXT = 24, No, is sample disturbed?
#SPECIMENTEXT = 25, 2003-06-05, sample date
#SPECIMENVAR = 21, 4.51, m, top depth
#SPECIMENVAR = 22, 4.56, m, bottom depth
#SPECIMENVAR = 23, 10, %, carbonate fraction
#SPECIMENVAR = 24, 30, %, organic fraction
#MEASUREMENTTEXT = 13, Bpreped, firm where the preparation was done
#MEASUREMENTTEXT = 6, Aleid Bosch, lab worker
#MEASUREMENTTEXT = 5, 2003-06-05, preparation date
#MEASUREMENTTEXT = 21, nasty smelling sample, remarks
#MEASUREMENTTEXT = 22, dissolving with acid, carbonate removal
#MEASUREMENTTEXT = 23, oxidising, organic fraction removal
#MEASUREMENTTEXT = 24, dissolving with acid, iron removal
#MEASUREMENTTEXT = 25, rinsing with tap water, salt removal
#MEASUREMENTTEXT = 26, ultra sonic vibration, method of anti-coagulation
#MEASUREMENTTEXT = 27, Yes, removal of coarse material
#MEASUREMENTTEXT = 28, sieving, removal of coarse material
#MEASUREMENTTEXT = 31, IPCURE, Company
#MEASUREMENTTEXT = 32, Fred Jonker, Lab worker
#MEASUREMENTTEXT = 33, 2003-06-06, date of the test
#MEASUREMENTTEXT = 34, wire mesh, method for the coarse material
#MEASUREMENTTEXT = 35, NEN 3835, standard for coarse material
#MEASUREMENTTEXT = 36, wire mesh, method for the intermediate material
#MEASUREMENTTEXT = 37, ASTM, standard for intermediate material
#MEASUREMENTTEXT = 38, areometer, method for the fine material
#MEASUREMENTTEXT = 39, None, standard for fine material
#MEASUREMENTTEXT = 40, SH361, protocol
#MEASUREMENTTEXT = 41, very well rounded sand, remarks
#MEASUREMENTVAR =21, 11.2, mm, lower limit for the size of the material removed
#MEASUREMENTVAR =22, 5, %, percentage of the coarse material removed
#MEASUREMENTVAR =23, 0.063, mm, upper limit size of the fine material removed
#MEASUREMENTVAR =24, 8, %, percentage of the fine material removed
#EQUIPMENT = TS700
#ANALYSISVAR = 22, 0.36, mm, M63 i.e. sand median
#ANALYSISVAR = 23, 4.5, mm, M2000 i.e. gravel median
```

#ANALYSISVAR = 24, 0.5, mm, D50 i.e. average grain size
#ANALYSISVAR = 25, 1.54, mm, Dm i.e. median grain size
#ANALYSISVAR = 26, 7.14, -, coefficient of uniformity
#ANALYSISVAR = 27, 2.0, -, coefficient of uniformity of sand
#ANALYSISVAR = 28, 0.52, - coefficient of curvature
#ANALYSISVAR = 29, 39.3, -, gradation
#EOH=

```
0.063  8.01   0.125
0.125  9.08   0.18
0.18   13.09  0.25
0.25   27.13  0.5
0.5    50.27  1.0
1.0    60.5   2.0
2.0    69.6   4.0
4.0    80.69  5.6
5.6    86.81  8.0
8.0    92.89  11.2
11.2   95.0  -1
```

In this example the data block is aligned in columns for reasons of easy readability. Aligning is not necessary.

5.3 Multi sample

```
#GEFID=1, 1, 0
#FILEOWNER = Wim Nohl
#COMPANYID = GeoDelft, 8000.97.476.B.01, 31
#FILEDATE =  2003,06,26
#PROJECTID = CO, 710402, 431
#COLUMN = 5
#COLUMNINFO = 1, mm, particle size lower fraction boundary, 1
#COLUMNINFO = 2, mm, particle size upper fraction boundary, 2
#COLUMNINFO = 3, -, cumulative percentage, 3
#COLUMNINFO = 4, -, cumulative percentage, 3
#COLUMNINFO = 5, -, cumulative percentage, 3
#COLUMNVOID = 3, -1
#COLUMNVOID = 4, -1
#COLUMNVOID = 5, -1
#LASTSCAN = 15
#REPORTCODE = GEF-MULTISIEVE-Report, 1, 0, 0, gsr100.doc
#MEASUREMENTCODE = IP37, 1, 0, 0, Fugro-GD
#XYID = 31000, 85637.45, 446248.663, 0.01, 0.001
#ZID = 31000, -3.75, 0.01
#MEASUREMENTTEXT = 9, ground level, starting point
#MEASUREMENTTEXT = 3, Goejanverwellesluis, describes the location
#TESTID = B52
#PARENT = B_FG32.gef
#SPECIMENTEXT = 20, Auger, obtaining the bulk material
#SPECIMENTEXT = 21, S1A, original sample code
#SPECIMENTEXT = 22, A1S, secondary sample code
#SPECIMENTEXT = 23, Ackermann sampler, type of sampling
#SPECIMENTEXT = 24, No, sample disturbance
#SPECIMENTEXT = 25, 2003-06-05, sample date
#SPECIMENTEXT = 40, Auger, obtaining the bulk material
#SPECIMENTEXT = 41, S3A, original sample code
#SPECIMENTEXT = 42, A3S, secondary sample code
#SPECIMENTEXT = 43, Ackermann sampler, type of sampling
#SPECIMENTEXT = 44, No, sample disturbance
#SPECIMENTEXT = 45, 2003-06-05, sample date
#SPECIMENTEXT = 60, Auger, obtaining the bulk material
#SPECIMENTEXT = 61, S7A, original sample code
#SPECIMENTEXT = 62, A7S, secondary sample code
#SPECIMENTEXT = 63, Ackermann sampler, type of sampling
#SPECIMENTEXT = 64, No, sample disturbance
#SPECIMENTEXT = 65, 2003-06-05, sample date
#SPECIMENVAR = 21, 1.21, m, top depth
#SPECIMENVAR = 22, 1.26, m, bottom depth
#SPECIMENVAR = 23, 10, %, carbonate fraction
#SPECIMENVAR = 41, 3.24, m, top depth
#SPECIMENVAR = 42, 3.29, m, bottom depth
#SPECIMENVAR = 43, 2, %, carbonate fraction
#SPECIMENVAR = 44, 19, %, organic fraction
#SPECIMENVAR = 61, 4.51, m, top depth
#SPECIMENVAR = 62, 4.56, m, bottom depth
#SPECIMENVAR = 63, 1, %, carbonate fraction
#MEASUREMENTTEXT = 5, 2003-06-05, preparation date
#MEASUREMENTTEXT = 6, Aleid Bosch, lab worker
#MEASUREMENTTEXT = 13, Bpreped, firm where the preparation was done
#MEASUREMENTTEXT = 21, nasty smelling sample, remarks
#MEASUREMENTTEXT = 22, dissolving with acid, carbonate removal
#MEASUREMENTTEXT = 23, oxidising, organic fraction removal
#MEASUREMENTTEXT = 24, dissolving with acid, iron removal
```

#MEASUREMENTTEXT = 25, rinsing with tap water, salt removal
#MEASUREMENTTEXT = 26, ultra sonic vibration, method of anti-coagulation
#MEASUREMENTTEXT = 27, Yes, removal of coarse material
#MEASUREMENTTEXT = 28, sieving, removal of coarse material
#MEASUREMENTTEXT = 31, IPCURE, Company
#MEASUREMENTTEXT = 32, Fred Jonker, Lab worker
#MEASUREMENTTEXT = 33, 2003-06-06, date of the test
#MEASUREMENTTEXT = 34, wire mesh, method for the coarse material
#MEASUREMENTTEXT = 35, NEN 3835, standard for coarse material
#MEASUREMENTTEXT = 36, wire mesh, method for the intermediate material
#MEASUREMENTTEXT = 37, ASTM, standard for intermediate material
#MEASUREMENTTEXT = 38, aerometer, method for the fine material
#MEASUREMENTTEXT = 39, None, standard for fine material
#MEASUREMENTTEXT = 40, SH361, sequence
#MEASUREMENTTEXT = 41, very well rounded sand, remarks
#MEASUREMENTVAR =21, 11.2, mm, lower limit for the size of the coarse material removed
#MEASUREMENTVAR =22, 15, %, percentage of the coarse material removed
#MEASUREMENTVAR =23, 0.063, mm, upper limit size of the fine material removed
#MEASUREMENTVAR =24, 8, %, percentage of the fine material removed
#MEASUREMENTVAR =61, 8, mm, lower limit for the size of the coarse material removed
#MEASUREMENTVAR =62, 3, %, percentage of the coarse material removed
#EQUIPMENT = TS700
#ANALYSISVAR = 22, 564, um, M63 i.e. sand median
#ANALYSISVAR = 23, 6.3, mm, M2000 i.e. gravel median
#ANALYSISVAR = 24, 0.972, mm, D50 i.e. average grain size
#ANALYSISVAR = 25, 1.041, mm, Dm i.e. median grain size
#ANALYSISVAR = 26, 7.14, -, coefficient of uniformity
#ANALYSISVAR = 27, 2.0, -, coefficient of uniformity of sand
#ANALYSISVAR = 28, 0.52, - coefficient of curvature
#ANALYSISVAR = 29, 39.3, -, gradation
#ANALYSISVAR = 42, 120, um, M63 i.e. sand median
#ANALYSISVAR = 44, 0.015, mm, D50 i.e. average grain size
#ANALYSISVAR = 45, 0.35, mm, Dm i.e. median grain size
#ANALYSISVAR = 62, 496, um, M63 i.e. sand median
#ANALYSISVAR = 63, 5.2, mm, M2000 i.e. gravel median
#ANALYSISVAR = 64, 1.105, mm, D50 i.e. average grain size
#ANALYSISVAR = 65, 1.541, mm, Dm i.e. median grain size
#ANALYSISVAR = 66, 7.14, -, coefficient of uniformity
#ANALYSISVAR = 67, 2.0, -, coefficient of uniformity of sand
#ANALYSISVAR = 68, 0.52, - coefficient of curvature
#ANALYSISVAR = 69, 39.3, -, gradation
#EOH=

```
0.0    0.008  -1     25.3   -1
0.008  0.016  -1     37.62  -1
0.016  0.032  -1     52.1   -1
0.032  0.063  -1     64.76  -1
0.063  0.125  8.01   83.28  1.0
0.125  0.18   9.08   98.16  4.3
0.18   0.25   13.09  100.0  19.52
0.25   0.5    27.13  -1     34.66
0.5    1.0    50.27  -1     47.7
1.0    2.0    60.5   -1     67.25
2.0    4.0    69.6   -1     77.93
4.0    5.6    81.69  -1     86.0
5.6    8.0    89.81  -1     100.0
8.0    11.2   97.89  -1     -1
11.2   -1     100.0  -1     -1
```

In this example the data block is aligned in columns for reasons of easy readability. Aligning is not necessary.

6 Quick index

Description	Section	Keyword	Explanation
GEF identity	2.1	**GEFID** **EOH**	Identifier File End of header
File tracing	2.2 2.3 3.2.1 2.4 2.5	**FILEOWNER** **COMPANYID** PARENT **FILEDATE** **PROJECTID**	Owner of the file Responsible company Linked file Date of file creation Reference to project
Interpretation of the data	2.6 2.7 4.5.13	**COLUMN** **COLUMNINFO** COLUMNVOID	Number of columns Identification of a column Invalid data entry
Number of data lines	2.8	**LASTSCAN**	Number of data lines
Sieve fingerprint	3.1.1	**REPORTCODE**	Type of report
Method of measurement	3.1.2	**MEASUREMENTCODE**	Type of measurement
Location information	4.1.1 4.1.2 4.1.6 4.1.4 4.1.5 4.1.3	XYID ZID MEASUREMENTTEXT 3 MEASUREMENTTEXT 7 MEASUREMENTTEXT 8 MEASUREMENTTEXT 9	Location of a sample Datum for ground level Name of the location Self defined coordinate system Self defined reference system Zero level
Identification of sample	4.2.1 4.2.8 4.2.9 4.2.2 4.2.3 4.2.4 4.2.5 4.2.6 4.2.7	TESTID SPECIMENVAR 21 SPECIMENVAR 22 SPECIMENTEXT 20 SPECIMENTEXT 21 SPECIMENTEXT 22 SPECIMENTEXT 23 SPECIMENTEXT 24 SPECIMENTEXT 25	Boring code Top depth of the sample Bottom depth of the sample Drilling method Original code of the sample Secondary code of the sample Type of sample Is sample disturbed? Sample date
Preparation of sample	4.3.18 4.3.19 4.3.3 4.3.2 4.3.1 4.3.4 4.3.5 4.3.6 4.3.7 4.3.8 4.3.9 4.3.10 4.3.11 4.3.14 4.3.15 4.3.12 4.3.13 4.3.16 4.3.17	SPECIMENVAR 23 SPECIMENVAR 24 MEASUREMENTTEXT 5 MEASUREMENTTEXT 6 MEASUREMENTTEXT 13 MEASUREMENTTEXT 21 MEASUREMENTTEXT 22 MEASUREMENTTEXT 23 MEASUREMENTTEXT 24 MEASUREMENTTEXT 25 MEASUREMENTTEXT 26 MEASUREMENTTEXT 27 MEASUREMENTTEXT 28 MEASUREMENTTEXT 29 MEASUREMENTTEXT 30 MEASUREMENTVAR 21 MEASUREMENTVAR 22 MEASUREMENTVAR 23 MEASUREMENTVAR 24	Percentage $CaCO_3$ Percentage organic material Preparation date Who did the preparation Preparation firm remarks Method for remov. carbonates Method for remov. organic mat Method for removing iron Method for removing salt Method for anti-coagulation Removal of coarse material Method remov of coarse mat Removal of fine material Method of remov of fine mat Lower lim removed coarse mat Percentage of removed coarse Upper limit of removed fines Percentage of removed fines

Description	Section	Keyword	Explanation
Actual measurement	4.5.10	EQUIPMENT	Description test set up
	4.5.1	MEASUREMENTTEXT 31	Company psd determination
	4.5.2	MEASUREMENTTEXT 32	The guy that does the job
	4.5.3	MEASUREMENTTEXT 33	Date of the analysis
	4.5.4	MEASUREMENTTEXT 34	Method psa coarse material
	4.5.5	MEASUREMENTTEXT 35	Standard for coarse material
	4.5.6	MEASUREMENTTEXT 36	Method psa intermed. material
	4.5.7	MEASUREMENTTEXT 37	Standard intermediate material
	4.5.8	MEASUREMENTTEXT 38	Method psa fine material
	4.5.9	MEASUREMENTTEXT 39	Standard for fine material
	4.5.11	MEASUREMENTTEXT 40	Protocol
	4.5.12	MEASUREMENTTEXT 41	Remarks
Analysis of data	4.6.1	ANALYSISVAR 21	Fineness number F_m
	4.6.2	ANALYSISVAR 22	Sand median M_{63}
	4.6.3	ANALYSISVAR 23	Gravel median M_{2000}
	4.6.4	ANALYSISVAR 24	Average grain size D_{50}
	4.6.5	ANALYSISVAR 25	Median grain size D_m
	4.6.6	ANALYSISVAR 26	Coefficient of uniformity C_U
	4.6.7	ANALYSISVAR 27	Coef. of uni. sand $C_{U,ZND}$
	4.6.8	ANALYSISVAR 28	Coefficient of curvature C_c
	4.6.9	ANALYSISVAR 29	Gradation p
	4.6.10	ANALYSISVAR 30	Specific surface sand U
Multiple samples	4.4		Numbering keywords
Data	4.7	Data block	

Keywords with a **bold** typeface are compulsory.