	STANDARD OPERATING PROCEDURES	SOP 04.02
	QUALITY ASSURANCE AND QUALITY CONTROL	04
	SAMPLING – Sampling for inspection and control of the soil treatment depth during the demining machine usage	02
DOMAIN: HUMANITARIAN DEMINING		TO 523
<ul style="list-style-type: none"> • TERMS AND DEFINITIONS • GENERAL REQUIREMENTS AND ACCEPTABLE QUALITY LEVEL (AQL) • SAMPLING PLAN • LOT ACCEPTABILITY • NON-CONFORMING ITEMS - ENTITIES • QUALITY LEVEL ACCEPTANCE CRITERIA • INSPECTION LEVEL • ANALYSIS OF SOIL TREATING DEPTH MEASUREMENT RESULTS • EXAMPLES OF SAMPLING • DOCUMENTING 		
Class: Ref.no:	CROMAC DIRECTOR: Oto Jungwirth	September 2007

CONTENT

Content.....	2
Introduction.....	3
Sampling – Sampling for Inspection and Control of Soil Treatment Depth on the Projects of MSA Search	4
1 The Implementation Sphere.....	4
2 Referring to Other Standards.....	4
3 Terms and Definitions.....	4
4 General Requirements and Acceptable Quality Level (AQL).....	6
5 Sampling Plan.....	7
5.1 Lot Formation Mode.....	7
5.2 Acceptance Criteria.....	7
5.3 Non-conforming items.....	8
5.4 Sampling.....	8
5.4.1 Types of Inspection.....	8
5.5 Methods of Quality Assurance	8
5.5.1 Acceptable Quality Criteria (AQL).....	8
5.5.2 Inspection Level.....	9
5.5.3 Sample Size Code Letters.....	9
5.5.4 Treated Entity Acceptability Determination.....	9
6 Proposed Sampling Procedure Scheme.....	10
7 Depth Measurement Results Analysis.....	12
7.1 Example of Sampling During the Technical Survey Execution Using the Demining Machine as an Independent Method.....	13
8 Documenting.....	15
9 APPENDIX.....	18

INTRODUCTION

Final beneficiaries of the humanitarian demining program have to be sure that searched and demined area is completely safe for use. This requires high

management level and detailed operating procedures that provide the highest quality control over searched and demined MSA.

General principles and procedures for inspection and sampling were developed by the International Organization for Standardization (ISO), and those principles and procedures accepted are published in ISO 2859-1. ISO procedures applied to Quality Assurance (QA) and sampling (based on statistic analysis) provide the rules by which it is easier to decide on product quality. When humanitarian demining is about, "product" means searched and/or demined area.

The way the soil sample is selected influences a great deal the sampling results of searched and/or demined area. Strict procedures for representative sample selection are also required. If the procedures are not regulated and abided, the Quality Assurance can be influenced by subjective opinion of the QA Monitor and QA Officer.

This SOP regulates one of the methods of monitoring the treatment depth of mechanically treated MSA (MSA treatment is carried out using demining machines as an independent method) and that is the inspection of treated soil by attributes (right-wrong). Sampling is performed using the random sampling method based on ISO 2859-1, i.e. **HRN ISO 2859-1: «Sampling procedures for the inspection by attributes»**.

Sampling plans are indexed according to acceptable quality level (AQL) for the lot-by-lot inspection.

Sampling – sampling for inspection and control of soil treatment depth on the projects of MSA search

1 The Implementation Sphere

This SOP provides the guidelines for the implementation of Quality Assurance (QA) over searched area applying the sampling plans indexed according to acceptable quality level (AQL) for lot-by-lot inspection of treated area. It defines the terms, establishes the management system and procedures based on ISO 2859 and HRN ISO 2859-1 documents and gives instructions on implementation of those procedures.

SOP can be applied in the procedures of demined area Quality Assurance and Quality Control according to the IMAS 09.10 and IMAS 09.20.

2 Referring to Other Standards

List of normative references is given in the Appendix A. Normative references are important documents this standard pleads to and they make a part of this standard's regulations. All standards are being modified so it is required to follow the list of international standards currently in force. Members of IEC and ISO have the lists of international standards registered.

3 Terms and Definitions

Terms and definitions used in this SOP are in accordance with ISO 3534, IMAS 09.20 and HRN ISO 2859-1. Complete dictionary of all terms and definitions used in the series of IMAS are stated in IMAS 04.10.

3.1. Incorrectness: Deviation from the characteristic of quality (soil treatment depth determined by the project) that results in a fact that searched mine suspected areas do not meet the requirements set by the pilot project or the contract.

3.2. Non-conformity: deviation from the characteristic of quality that results in the fact that mechanically searched mine suspected areas do not meet certain requirements. Example: If the required soil treatment depth is 20 cm in the I soil category, that is, 10 cm in II and III soil category (see SOP 01.03 and SOP 02.) non-conformities are classified into three classes:

Non-conformity of the class A – single measured soil treatment depth is smaller than 12 cm in the I soil category and smaller than 6 cm in II and III category. AQL value is very small. Measurement whose value is smaller than the stated ones is not allowed in the selected sample. Critical defect – the sample is rejected.

Non-conformity of the class B – single measured soil treatment depth is smaller than 17 cm and bigger than 12 cm in the first soil category. In the II and III soil category it is smaller than 8 cm and bigger than 6 cm. AQL value is bigger than the one at the class A and smaller than the one at the class B. Two measurements maximum are allowed in the sample. Bigger defect (deficiency) – more than 4 measurements are present in the sample within the stated limits.

Non-conformity of the class C - single measured soil treatment depth is smaller than 20 cm and bigger than 17 cm in the I soil category. In the II and III soil category it is smaller than 10 cm and bigger than 8 cm. AQL value is bigger than the one at the class B. Four measurements maximum are allowed within the stated limits. Bigger defect – more than 5 measurements are present in the sample within the stated limits.

3.3 non-conforming item: searched area item that consists of one non-conformity at least. Non-conforming items are classified into two classes:

The item of the class A – the item that consists of one or more non-conformities of the class A but can also consist of non-conformities of the class B and/or class C.

The item of the class B – the item that consists of one or more non-conformities of the class B, it can also consist of non-conformities of the class C but it does not consist of the non-conformity of the class A.

3.4 Acceptable Quality Level (AQL): when continuous weekly (daily) mechanically treated mine suspected area is concerned, the quality level (average soil treatment depth) that, in terms of weekly (daily) inspection of quality by sampling, makes the border value of acceptable average of the process (see Point 5).

3.5 The percentage of non-conforming items: the percentage of non-conforming items (soil treatment depth smaller than the required one) in any quantity of product items given (for example: 15 measurements in searched area of the size 5 m × 10 m) is equal to the ratio of the number of non-conforming items and total number of product items (measurements of depth) multiplied by 100.

3.6 Sampling plan: special plan that shows how many items (selected entities) from every daily or weekly treated area should be inspected (sample size or a line of sample sizes) and joined criteria for defining the acceptability of daily or weekly treated (searched) area (numbers of acceptances and rejections).

3.7 Sampling scheme: the combination of sampling plans and transition procedures.

3.8 Sampling system: the collection of plans or sampling schemes. This part of ISO 2859 sampling system is indexed by lot size ranges (daily or weekly treated area), levels of survey and AQL values. Sampling system for LQ plans is given in ISO 2859-2 standard.

3.9 Inspection: the measurement process of the soil treatment depth, checking, examination, measurement or different comparison of product items (searched area) with applicable requirements.

3.10 Original inspection: the first inspection of the area of special quality, previously searched, unlike the inspection of treated area that is submitted for inspection all over again upon original non-acceptance.

- 3.11 Inspection by attributes:** the inspection during which the product item (treated entity) is evaluated simply as conformed or non-conformed, or the non-conformities per product item are being counted regarding the requirement or group of requirements given.
- 3.12 Treated MSA (product) item:** the item (the depth of mechanically treated weekly or daily area) that is inspected in order to be classified into the class of conforming or non-conforming items or in order to count the number of non-conformities on the selected area.
- 3.13 Treated MSA lot:** the collection of treated MSA (m²) items – daily or weekly mechanically treated area from which the sample should be taken and inspected in order to define the conformity with acceptance criteria.
- 3.14 Lot size:** number of product items in the lot (number of selected treated-searched entities in weekly or daily treated area using a demining machine).
- 3.15 Sample:** the sample consists of one or more entities of treated MSA taken from weekly or daily treated area (lot); the sample items are chosen at random regardless their quality. Sample size is equal to the number of product items in the sample.
- 3.16 Critical incorrectness:** medium value of soil treatment depth in selected sample is smaller than the one required by the project.

4 General Requirements and Acceptable Quality Level (AQL)

Monitoring and quality control are an important part of the humanitarian demining management process whose goal is to verify the quality of mine search on the mine search projects and establish required quality level according to the Rules and Regulations on Methods of Demining and contractual responsibilities.

Non-conformity on mine search projects is presented as the number of non-conformed soil treatment depths during the mechanical MSA treatment as an independent method regarding the soil type and present vegetation. In the tables (see Table 3-A, 3-B and 3-C) that will be applied at one-time sampling it is assumed that the non-conformities appear by accident and statistically independently.

The term “acceptable quality level – AQL” that is used in ISO 2859-1, HRN ISO 2859-1 and this SOP refers to the objective mathematical possibility of reaching the required level of average soil treatment depth during the mine search. Subjective confidence that includes human factors such as perception, assessment and opinion is not specially elaborated in this SOP.

For indexing the sampling plans and schemes given in HRN ISO 2859-1 together with the code letters (see Table 2) the acceptable quality level (AQL) is used. AQL is the mark for non-conforming items percentage value (or number of non-conformities on 100 items – can be 1, 6, 10, 20, 50, 100 or 200 m² of searched mine suspected area, see Table 1) that will, by sampling scheme which should be used, be accepted the largest number of times. When it comes to mine search projects the AQL represents reaching the required level of soil treatment depth – depth determined by the project that makes the border value of acceptable mine search average.

Sampling plans given are prepared in a way that the acceptance probability for denoted AQL value for AQL given depends on the sample size.

Efficiency and value of expert monitoring by sampling for the purpose of checking the soil treatment depth requires mine search to be “complete and controlled”. “Complete” process implies that every entity to be surveyed includes the land treated/searched using demining machine under the same conditions (daily treated area), in the same way, using the same tools. In order to avoid excessive rejection of daily searched area it is expected that the average of soil treatment depth will be less than AQL or equal to that value.

Acceptable Quality Level (AQL) to be used is defined by the contract or mine search project.

5 Sampling Plan

There is a number of sampling methodologies possible to be applied. Statistically valid sampling system is described in this paper for the needs of this Standard Operating Procedure.

Minimal overall area to be surveyed upon MSA treatment will be calculated using the numbers arising from HRN ISO 2859-1 (see Appendix A: Table 1). Certain parts of treated soil to be surveyed will be selected by QC Monitor using the random selection method.

The positions of soil treatment depth measurement in the sample are selected in a way to cover the entire sample surface (see Appendix D).

5.1 Lot Formation Mode

Daily or weekly MSA treatment (search) using demining machine as an independent method is formed into recognizable lot, sub-lot or in some other adequate form. Every lot should be treated approximately under the same conditions as much as possible (similar soil and climate conditions, the same machine type and working tools).

5.2 Lot Acceptability

Lot acceptability is determined by using sampling plan or sampling plans joined to the denoted AQL or denoted AQLs (see Tables 3-A, 3-B and 3-C).

The term “non – acceptance” is used instead of “rejection” when it relates to the result that ensues from the procedure.

QC Monitor decides how to treat non-accepted lots. Such lots can be searched once again using demining machines by treating the soil up to the depth determined by the project or by manual mine detection as a second method or perform the evaluation according to specific usability criteria once again.

5.3 Non-conforming Items – Entities

QC Monitor has the right to reject every daily entity for which it is determined during the inspection to be non-conformed, no matter whether the entity is a part of weekly sample or not, even when the lot as an entity is accepted (total weekly mechanically searched area has the average soil treatment depth equal or bigger than the one determined by the project.) Rejected entities can be remedied and inspected all over again with the approval and in a way specified by QC Monitor.

5.4 Sampling

When it is appropriate, the number of entities in a sample is selected in proportion to the size of daily or weekly treated MSA established according to the Table 1. Samples can be determined upon weekly or daily work (treating/searching) or during daily/weekly search when the works interruption is in progress for whatever reasons. In any case, the samples are selected in a random way.

5.4.1 Types of Inspection

There are three types of inspection: normal, tightened or reduced (see Table 1 and Tables 3-A, 3-B, 3-C).

At the beginning of inspection, if not decided differently, the QC Monitor conducts the normal inspection (see Appendix D). Normal, tightened or reduced inspection is executed on the following lots without any change except in cases where transfer procedures (see HRN ISO 2859-1, Point 9) require change of inspection type. Transfer procedures are applied independently for each class of conforming or non-conforming items. Rules and procedures of transfer are given in HRN ISO 2859-1.

5.5 Methods of Monitoring and Quality Control

CROMAC approves the procedures and the equipment used by the QC Monitor for checking the samples of searched soil and they will be co-ordinated with authorized demining companies. Any bigger change in the sampling process, monitoring or quality control should be verified in CROMAC and authorized demining companies should be informed on these changes in time, prior to the commencement of monitoring and quality control.

5.5.1 Quality Level Acceptability Criteria

“The entity” will be considered as “quality-treated/searched” only if the average value of measured sample is equal or bigger than soil treatment depth determined by the project. If any sample of the entity comprises one or more average measured depths smaller than the one determined by the project, that will make the “critical non-conformity” (non-acceptance/unallowed defect), the entity that comprises this sample will not pass the final inspection/quality control.

Searched soil can comprise single (soil treatment depths) non-conformities classified into three groups: A, B and C. Such cases would indicate the possible defect and create the critical defect once again. Terms for acceptance or non-acceptance of all non-conformity categories are given in the Appendix D.

At defining non-conformities, especially critical defects (incorectnesses) the machine type should be taken into consideration in relation to the machine mass (light, medium, heavy), machine working tool and soil conditions.

5.5.2 Inspection Level

QC Monitor defines required quality level for each special application regarding the machine usability assessment of the machine. That provides the QC Monitor the

possibility to demand bigger differentiation for some purposes and smaller for the other. Three levels of inspection (I, II and III) are given in the Table 1. If not defined differently, the level II is used. When the smaller sample differentiation is required the level I can be used and when the bigger differentiation is allowed, the inspection level III is used. Table 1 gives four additional special inspection levels (S-1, S-2, S-3 and S-4) and can be used when relatively small sample sizes are necessary and bigger sampling risks can be or will be allowed or are allowed. The purpose of these special inspection levels is to, where it is required, decrease the samples (for example: if it comes to quality medium and heavy machines that can continuously sustain the average of soil treatment depth over 24 cm or more; see HRN ISO 2859-1, Point 10). For the selection of sample size code letters (APPENDIX A: Table 1) the Table 2 (Level of confidence regarding the machine type and soil conditions on the project) should also be used (APPENDIX B).

5.5.3 Sample Size Code Letters

Sample sizes are marked with code letters. In order to find the applicable code letter for the special lot size and regulated inspection level the Table 1 is used (APPENDIX A).

5.5.4 Treated Entity Acceptability Determination

In order to determine the lot (entity) acceptability according to the number of non-conforming items, the one-time sampling plan is used (see Appendix C: The scheme of one-time sampling and the Tables 3-A, 3-B and 3-C). At single sampling plan the number of items inspected is equal to the sample size defined by plan. If the number of non-conforming items found in the sample is equal or smaller than the number of acceptances, entity (lot) is considered to be acceptable. If the number of non-conforming items is equal or bigger than the number of rejections, the entity (lot) is considered to be unacceptable.

6 Proposed Sampling Procedure Scheme

The special sampling plan that defines the number of treated MSA entities to be inspected (sample size) is prepared with joined criteria for acceptability determination of daily/weekly treated (searched) area.

SAMPLING PROCEDURE SCHEME

Lot formation mode

Mechanical treatment of the entire MSA (m²) on a daily/weekly basis
(equal soil conditions, equal machine type, unvaried vegetation type-SOP)

Lot Acceptability

Use of sampling plans joined to denoted AQLs
(QA Monitor decides how to treat unaccepted lots -SOP)

Searched entity non-conforming items

QA Monitor rejects every entity established to be non-conformed
- rejected entities can be remedied (regulated by SOP)

Sampling

QA Monitor selects the sample using random selection method

Quality level acceptance criteria

Entity survey is highly performed if the average value of measured
samples is equal or bigger than planned soil treating depth.

NON-CONFORMITY AND INSPECTION LEVEL

NON-CONFORMITY AND INSPECTION LEVEL

Critical non-conformity - incorrectness

If the entire lot (entity) sample comprises one or more average values of depths smaller than planned or agreed depth.

Single non-conformity indicators classes (smaller depths)

Non-conformity of the class A

Non-conformity of the class B

Non-conformity of the class C

Searched entity non-conforming items– comprise at least one non-conformity

Class A unit

Class B unit

Unit that comprises one or more non-conformities of the class A, but can also comprise non-conformities of the class B and/or C

Unit that comprises one or more non-conformities of the class B, and can also comprise non-conformities of the class C, but does not comprise non-conformities of the class A

Inspection level based on machine usability assessment and efficiency evaluation of area search according to CROMAC SOP 03.06-1

General inspection levels

I

II

III

Special inspection levels

S-1

S-2

S-3

S-4

Tables adjusted for the conditions of mechanical MSA search based on ISO 2859-1 (HRN ISO 2859-

Table 1 – Sample size code letters

Table 2 – Level of confidence

Table 3 – One-time sampling plans

7.1 Quality Control of Mechanically Treated Soil and Depth Measurement

Quality control of mechanically treated MSA during technical survey and/or demining works depends a great deal on soil conditions, vegetation conditions, climate conditions and efficiency of particular demining machine type.

Considering the fact that demining machine working tool, apart from soil treatment by digging, should provide for vegetation removal, the Monitor is obliged to also perform visual control of soil treatment «density» and vegetation removal during sampling of a daily lot. This is directly linked to machine movement speed and working tool revolutions number.

Contractor's representative is obliged to be present during sampling and he ensures demining inspection of selected sample of the size according to the Table 1 given in the Supplement A.

Upon selection of sampling scheme and combination of measurement places (Supplement D) the Monitor sets the Contractor's representative a task to search the MSA (desirable: team leader and deminer), to search selected sample combination by metal detector and mark it with a tape. Instead of meter, a normal Monitor's step can be used.

Desirable measurement place is the middle of one m² that is the end of the step. Measurements can be performed on any place inside selected m² and that will depend on presence of roots, stones, hummocks or earth thrown off. Measurement is not performed on places with visible tracks of wheels or demining machine caterpillars. The Monitor has to take care of starting level of untreated land area, that is, perform the surrounding terrain estimate.

On selected measurement place, the Monitor excavates treated soil by small telescopic spade up to the hard base i.e. untreated soil. He puts measurement bar into the place of dug up ground (Supplement E) and uses the free fall for placing the grade level on treated ground. He uses tightening device to fix the grade level position and reads measured depth off.

Measured values of soil treatment depth for separate sample are inserted into the form OEIVPU (see Point 8; Documenting).

7.2 Depth Measurement Results Analysis

1 Mean or Average Value

Arithmetic mean is generally the most efficient characteristic for the measurement results mean and that is why we most often use it in the statistic analysis. Mean or average value is an arithmetic mean of all measurement results.

$$X_{sr} = (X_1 + X_2 + \dots + X_n) / n$$

where X_1 up to X_n are the results of separate measurements (n =number of separate measurements)

2 Mean of All One Lot Sample Means

Medium value in one lot $X_{p,sr}$ of all medium values of the X_{sr} samples is equal to

$$X_{p,sr} = (X_{sr1} + X_{sr2} + \dots + X_{srk})/k$$

where k = number of samples that all have the same n number of measurements.

3 Range (R)

The range R of the set of n results is defined by difference between the biggest and the smallest result in a set, i.e.

$$R = X_{\max} - X_{\min}$$

The range is for the ease of determination very frequently used characteristic for dispersion but is efficient only for smaller number of results (up to perhaps ten measurement results).

4 Standard deviation (s)

Standard deviation is the basic characteristic of distribution dispersion and that is why we use it most often.

Standard deviation s of the set of n results $X_1, X_2 \dots X_n$ is given by the square root of the result deviation square mean from their arithmetic mean i.e.

$$s = \sqrt{(X_1 - X_{sr})^2 + (X_2 - X_{sr})^2 + \dots + (X_n - X_{sr})^2} / n$$

Standard deviation is of the same dimension as measured results.

7.3 The example of sampling during the technical survey using demining machine as an independent method

Medium soil treating depth determined by the project using demining machine as an independent method is minimum 20 cm in the I category **(a)** and minimum 10 cm in the II and III soil category **(b)** (see Soil Classification, SOP 01.03 and SOP 02).

Code Letter Determination

Daily processed-treated area is approximately 3 120 m².

Sample size code letter is defined using the Table 1 (Appendix A) in the following way:

- The size of daily lot is under the ordinal number 3 (1 201 – 3 200 m²)
- Sample size is 6 m² and the number of depth measurements in the sample is 3
- General inspection level is always selected for the commencement of monitoring the soil treatment depth in the way that follows:
 - a) if the area is treated with light machine, level II (code letter is D)
 - b) if the area is treated with heavy and medium machine, level I (code letter is C)
 - c) if the area is treated with heavy machine that reaches the average soil treatment depth over 30 cm, the special inspection level is selected (from S-1 to S-4, for stated example the code letter B is selected)

Determination of Sample Number (Sample Size) and Acceptable Quality Level (AQL)

Upon defining the code letters in the Table 1, one-time sampling plan is selected. At the beginning of demining machine operation one always proceeds from the one-time sampling plans for the normal inspection, Table 3-A (Appendix C1).

For the light machine under a) for the letter code «D» from the table 3-A for the normal inspection (see Appendix C) sample size is 5. That means, the QA Monitor chooses 5 samples of 6 m² in the lot using the random sampling method. Number of depth measurements in the sample is 3.

If the medium depth in the sample is smaller than the one defined by the project the lot is incorrect and it is rejected.

Presence of non-conformities in the class A with the acceptance number $A_c=0$ represent the incorrectness and the lot is rejected.

Non-conformity of the class A is:

- a) If the single depth in the sample is smaller than 12 cm in the first soil category, the AQL value is 0.1. From the table 3-A the lot acceptance number is $A_c=0$ and the number of rejections is $Re=1$. It means that depth smaller than 12 cm is not allowed in the sample.
- b) If the single depth in the sample is smaller than 6 cm in the II and III soil category, the AQL value is 0.1. From the table 3-A the lot acceptance number is $A_c=0$ and the number of rejections is $Re=1$. It means that depth smaller than 6 cm is not allowed in the sample.

Non-conformity of the class B is:

- a) If the single depth in the sample is smaller than 17 cm and bigger than 12 cm in the I soil category, the AQL value is 2.5. From the table 3-A the lot acceptance number is $Ac=2$ and number of rejections is $Re=3$.
- b) If the single depth in the sample is smaller than 8 cm and bigger than 6 cm in the II and III soil category, the AQL value is 2.5. From the table 3-A the lot acceptance number is $Ac=2$ and number of rejections is $Re=3$.

Non-conformity of the class C is:

- a) If the single depth in the sample is smaller than 20 cm and bigger than 17 cm in the I soil category, the AQL value is 4.5. From the table 3-A the lot acceptance number is $Ac=3$ and the number of rejections is $Re=4$.
- b) If the single depth in the sample is smaller than 10 cm and bigger than 8 cm in the II and III soil category, the AQL value is 4.5. From the table 3-A the lot acceptance number is $Ac=3$ and the number of rejections is $Re=4$.

CONCLUSION

- 1 The lot is rejected if the medium measured depth in the sample is smaller than the one defined by the project.
- 2 Singly measured depths from the class A are not allowed in the samples, the AQL is very small (it is 0.1 in most cases).
- 3 Depending on the machine type, its quality of soil treatment depth, separate non-conformities by defining the classes B and C are allowed in the samples using the general different inspection levels (I, II and III) and special inspection levels (S-1,S-2, S-3, S-4). Their number is defined by selection of AQL value for the adequate average of soil treatment depth.
- 4 The QC Monitor is obliged to inform the authorised QA Officer about lot rejection on any basis stated in this SOP as soon as possible. QA Officer further proceeds according to the Book of Rules and Regulations on the Method of Conducting Humanitarian Demining.

8 Documenting

OEIVPU

SINGLE SAMPLE REGISTRATION FORM FOR MEASURED SOIL TREATMENT DEPTHS

OEIVPU-1: Manual entry form

Date: _____ ; Sample number in line with the plan: _____ ; Sample number: _____

COMPANY	
PROJECT CODE	
PLACE	
COUNTY	
TIME OF MONITORING	FROM: _____ TO: _____
MACHINE MAKE	
MACHINE LICENCE NUMBER	
SIZE OF DAILY TREATED AREA (m²)	

MEASURED DEPTHS OF TREATED SOIL:

Combination number (Appendix D): _____ ; Sample area: _____ ; No No. Of measureme ents: _____

No.	TREATED SOIL DEPTH (cm)	No.	TREATED SOIL DEPTH (cm)	
1.		11.		
2.		12.		
3.		13.		
4.		14.		
5.		15.		
6.		16.		Xsr
7.		17.		
8.		18.		
9.		19.		S
10.		20.		
RANGE		Rmax		Rmax - Rmin
		Rmin		

Monitoring executed by:

Work site leader:

OEIVPU-2: Digital entry form with program support

Date: _____ ; Sample number in line with the plan: _____ ; Sample number: _____

COMPANY	
PROJECT CODE	
PLACE	
COUNTY	
TIME OF MONITORING	FROM: _____ TO: _____
MACHINE MAKE	
MACHINE LICENCE NUMBER	
SIZE OF DAILY TREATED AREA (m ²)	

MEASURED DEPTHS OF TREATED SOIL:

Daily treated area: _____ Sample area: _____
 No. of samples: _____ No. of measurements: _____

No.	TREATED SOIL DEPTH X _{sr}	No.	TREATED SOIL DEPTH (cm)
1.	0,00	11.	0,00
2.	0,00	12.	0,00
3.	0,00	13.	0,00
4.	0,00	14.	0,00
5.	0,00	15.	0,00
6.	0,00	16.	0,00
7.	0,00	17.	0,00
8.	0,00	18.	0,00
9.	0,00	19.	0,00
10	0,00	20.	0,00

X_{sr} of all samples
0,00

S
0,00

RANGE	R_{max}	0,00	R_{max} - R_{min}
	R_{min}	0,00	0,00

Monitoring executed by:

Work site leader:

Remark: Only the medium measurement values in one sample are entered into the table (OEIVPU) above (for the sample of 1 m² one measurement also represents the medium value of the sample), bearing in mind the set criteria of minimum depths).

9. APPENDICES

APPENDIX A

Table 1- Sample Size Code Letters

No.	Lot size (m ²)	Sample area (m ²)	No. of depth measurements	Special levels of inspection				General levels of inspection		
				S-1	S-2	S-3	S-4	I	II	III
1	200-500	1	1	A	A	A	A	A	B	C
2	501-1-200	1	1	A	A	B	B	B	C	D
3	1-201-3200	6	6	B	B	C	C	C	D	E
4	3 201-5 000	10	3	B	C	C	D	D	D	E
5	5 001-8 000	20	5	C	C	D	D	D	E	F
6	8 001-15 000	20	5	C	D	D	E	E	F	F
7	15 001-35 001	20	5	D	E	E	E	E	F	G
8	35 001-150 000	50	7	D	E	E	F	F	G	H
9	150 001 and over	50	7	E	E	F	F	G	H	J

APPENDIX B

Table 2 – Level of Confidence

No.	Soil conditions	Level of confidence/machine type		
		Small degree	Normal degree	Large degree
		Light machine	Medium machine	Heavy machine
1	Favourable soil conditions (SC1)	91%	95%	99%
2	Aggravated soil conditions (SC2)	81%	85%	89%
3	Heavy soil conditions (SC3)	71%	75%	79%

APPENDIX C

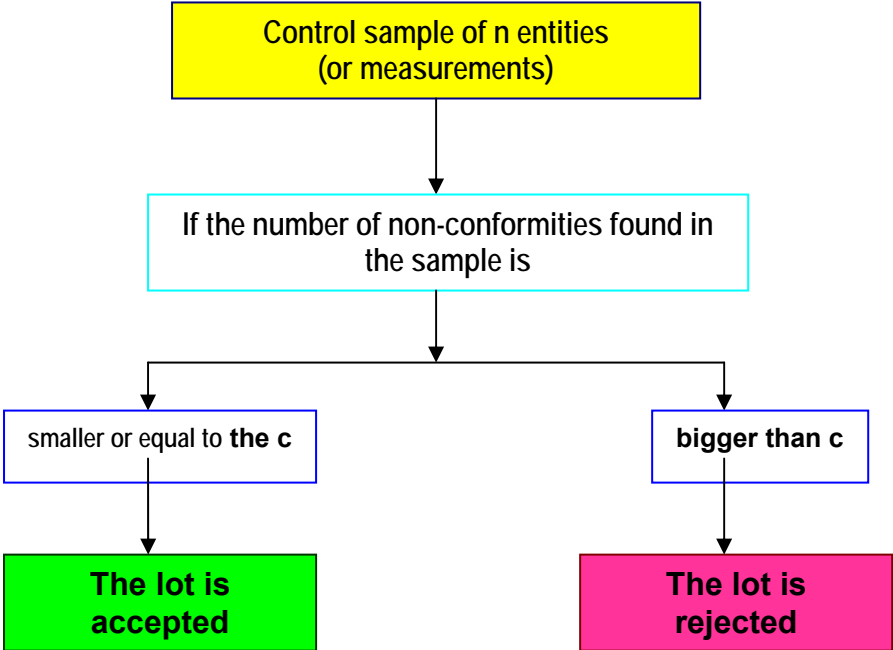


Figure 1: One-time sampling scheme

SUPPLEMENT C1 : Table 3-A - One-time sampling plans for normal inspection

Lot size code letters	Sample size	Acceptable Quality Level, AQL (normal inspection)																											
		0,01	0,015	0,025	0,04	0,065	0,1	0,15	0,25	0,4	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1000		
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
A	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15							
B	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑							
C	3	↓	↓	↓	↓	↓	↓	↓	↓	0 1	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑							
D	5	↓	↓	↓	↓	↓	↓	0 1	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑							
E	8	↓	↓	↓	↓	↓	0 1	↑	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑	↑							
F	13	↓	↓	↓	↓	0 1	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑	↑	↑							
G	36	↓	↓	↓	↓	0 1	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑	↑	↑							
H	85	↓	↓	↓	0 1	↑	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑	↑	↑	↑	↑						
J	135	0 1	0 1	0 1	↑	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑					

↓ = use the first sampling plan below the arrow



↑ = use the first sampling plan above the arrow

Ac = acceptance number

Re = rejection number

SUPPLEMENT C2: Table 3-B - One-time sampling plans for tightened inspection

Lot size code letters	Sample size	Acceptable Quality Level, AQL (tightened inspection)																											
		0,01	0,015	0,025	0,04	0,065	0,1	0,15	0,25	0,4	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1000		
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
A	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
B	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
C	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
D	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
E	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
F	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
G	36	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
H	85	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
J	135	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		

 = use the first sampling plan bellow the arrow
 = use the first sampling plan above the arrow
 Ac = acceptance number
 Re = rejection number

SUPPLEMENT C3: Table 3-C - One-time sampling plan for reduced inspection

Lot size code letters	Sample size	Acceptable Quality Level, AQL (reduced inspection)																											
		0,01	0,015	0,025	0,04	0,065	0,1	0,15	0,25	0,4	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	A		
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
A	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15							
B	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	2 4	3 5	5 6	7 8	10 11	14 15						
C	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17					
D	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	↑				
E	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	14 17	↑	↑			
F	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑		
G	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑		
H	50	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑		
J	80	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 2	1 3	1 4	2 5	3 6	5 8	7 10	10 13	↑	↑	↑	↑		

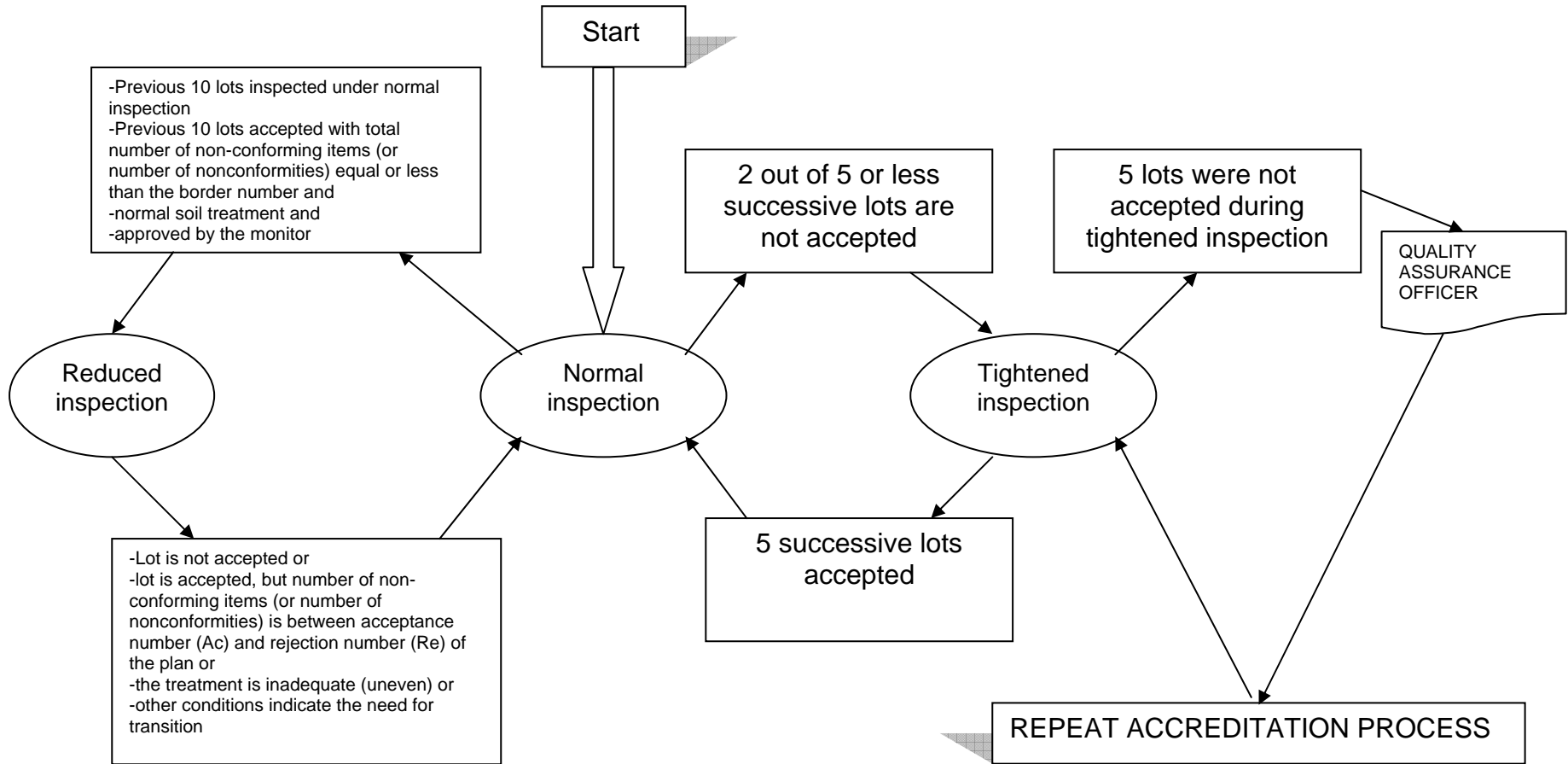
↓ = use the first sampling plan bellow the arrow

↑ = use the first sampling plan above the arrow

Ac = acceptance number

Re = rejection number

APPENDIX C4: Figure 1 - General outline of transition rule (Point 5.4.1)



Appendix D: Scheme of selection of treated MSA depth measurement spot for the lot size up to 1200 m²

Sample size : 1mx1 m; number of measurements of the depth in the sample: 1

Daily treated area

		5		
				4
3				
			2	
	1			

Method of presenting data, calculating medium values and characteristics for scattering:

$$\bar{X}_{sr} = (X_1 + X_2 + \dots + X_n)/n ; \text{ Range : } R = X_{\max} - X_{\min}$$

Example: daily treated area (see point 7.1) : up to 1200 m² (1st category land area) ; **no. of samples: 5**

Number of measurements in the sample: $n = 1$; $X_{sr, \text{sample}} = (18,2+23,5+19,0+23,0+21,0)/5 = \mathbf{20,94}$ **cm**

Sample no.	Measured depth (X _i /cm)	Range R (cm)
1	18,2	18,2
2	23,5	23,5
3	19,0	
4	23,0	
5	21,0	
X_{sr} = 20,94		5,3
		R = X_{max} - X_{min}

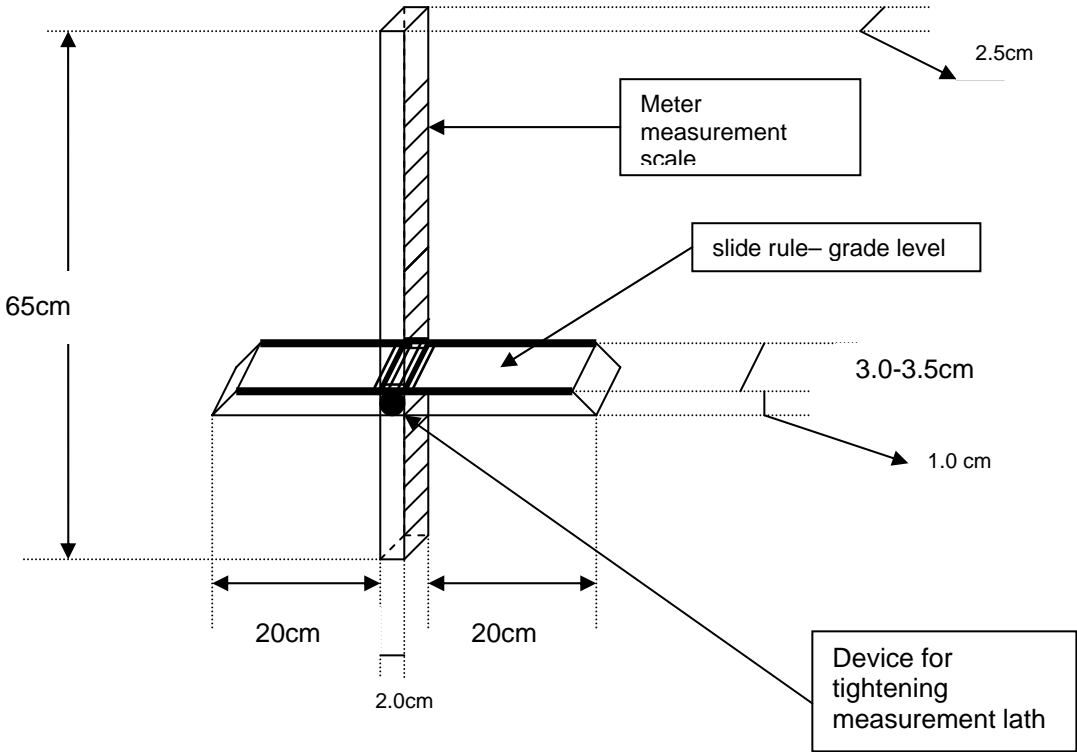
CONCLUSION:

1. Sample has no non-conformities of the class A because the smallest measured value is 18,2 > 12 cm; Ac=0
2. No non-conformities of the class B; 2 is allowed (Ac= 2)
3. There are two non-conformities of the class C (18,2 and 19 cm); 3 are allowed (Ac=3)
4. The sample is accepted.

APPENDIX E : Kit and equipment used by QC Monitor

1. Standard collapsible small spade
2. Measurement lath with slide rule –grade level
(for measurement of treated soil depth – sketch 1)
3. Standard tape measure (3 m)
4. Tape measure (up to 50 m)
5. GPS
6. Maps

Sketch 1: Measurement lath with slide rule– grade level



Material to be made: Al profiles