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Edition 1

SOUTH AFRICAN NATIONAL STANDARD

Construction and management requirements for works contracts

Part 5: Earthworks activities which are to be performed by hand

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SANS 1921-5:2004
Edition 1

Table of changes

Change No.	Date	Scope

Abstract

Identifies earthworks activities and sub-activities which are performed by hand.

Keywords

backfilling, earthworks, hand, labour-intensive methods, trenches.

Acknowledgement

Standards South Africa wishes to acknowledge that this part of SANS 1921 is based on documentation prepared by the National Department of Public Works for the Expanded Public Works Programme.

Foreword

This South African standard was approved by National Committee StanSA TC 5120.61, *Construction standards*, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

SANS 1921 consists of the following parts, under the general title *Construction and management requirements for works contracts:*

Part 1: General engineering and construction works.

Part 2: Accommodation of traffic on public roads occupied by the contractor.

Part 3: Structural steelwork.

Part 4: Third-party management support in works contracts.

Part 5: Earthworks activities which are to be performed by hand.

Part 6: HIV/AIDS awareness.

Other parts: To be confirmed.

Annex A forms an integral part of this part of SANS 1921. Annex B is for information only.

Introduction

Earthworks are at the core of most civil engineering construction, especially road construction. For centuries earthworks have been executed using labour-intensive methods and there is no doubt that, technically, a wide range of earthworks can be executed in this manner. In recent decades, however, most earthworks have been executed using equipment-based methods.

The undertaking of earthworks using labour-intensive methods can be used to provide cost-effective short-term employment opportunities to unskilled and semi-skilled workers, without compromising quality. This part of SANS 1921 establishes requirements to execute earthworks using labour-intensive methods, where the employer has an objective to deliver portions of the works using labour-intensive methods.

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Construction and management requirements for works contracts

Part 5:
Earthworks activities which are to be performed by hand

1 Scope

This part of SANS 1921 identifies earthworks activities and sub-activities which are performed by hand.

NOTE This part of SANS 1921 presupposes that the cost-effectiveness and technical feasibility of labour-intensive methods and the availablility of willing labour have been established.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of SANS 1921. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this part of SANS 1921 are encouraged to take steps to ensure the use of the most recent edition of the standard indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

SANS 10403, *Formatting and compilation of construction procurement documents.*

3 Definitions

For the purposes of this part of SANS 1921, the definitions given in SANS 10403 and the following definitions apply:

3.1
boulder
material with a particle size greater than 200 mm

3.2
by hand
through the use of tools which are manually operated and powered

3.3
cobble
material with a particle size of between 60 mm and 200 mm

3.4
contractor
natural or juristic person or partnership that contracts with the employer to provide the earthworks covered by the contract

3.5
dynamic cone penetrometer
dcp
instrument used to measure the in-situ shear resistance of soil comprising a drop weight of approximately 10 kg which falls through a height of 4 690 mm and drives a cone that has a maximum diameter of 20 mm (and a cone angle of 60º with respect to the horizontal) into the material being used

3.6
employer
natural or juristic person or partnership that contracts with the contractor for the provision of earthworks

3.7
gravel
material with a particle size of between 2 mm and 60 mm

3.8
material excavatable by hand
cohesive and granular material the properties of which are such that it can be efficiently removed by hand

3.9
labour-intensive method
method involving a mix of machines and labour, where labour is preferred to the use of machines, if technically and economically feasible

3.10
specification data
provisions and variations that make this part of SANS 1921 applicable to a particular contract (see annex A)

4 Requirements

4.1 Material excavatable by hand

Unless otherwise stated in the scope of work or in the specification data (see annex A), all materials that have the following characteristics shall be deemed to be materials excavatable by hand:

a) **granular materials**:

1) where the consistency of the material, when profiled in terms of table 1, is classified as very loose, loose, medium dense or dense; or

2) where the material is a gravel that has a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 15 blows of a dcp are required to penetrate 100 mm;

b) **cohesive materials**:

1) where the consistency of the material, when profiled in terms of table 1, is classified as very soft, soft, firm, stiff or stiff to very stiff; or

2) where the material is a gravel that has a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 8 blows of a dcp are required to penetrate 100 mm.

NOTE In some instances it might be appropriate to modify the definition for materials excavatable by hand (see annex B).

Table 1 — Consistency of materials

1	2	3	4
Granular materials		**Cohesive materials**	
Consistency	**Description**	**Consistency**	**Description**
Very loose	Crumbles very easily when scraped with a geological pick	Very soft	Geological pick head can easily be pushed in as far as the shaft of the handle
Loose	Small resistance to penetration by sharp end of a geological pick	Soft	Easily indented by thumb; sharp end of a geological pick can be pushed in 30 mm to 40 mm; can be moulded by fingers with some pressure
Medium dense	Considerable resistance to penetration by sharp end of a geological pick	Firm	Indented by thumb with effort; sharp end of a geological pick can be pushed in up to 10 mm; very difficult to mould with fingers; can just be penetrated with an ordinary hand spade
Dense	Very high resistance to penetration by the sharp end of a geological pick; requires many blows for excavation	Stiff	Can be indented by thumbnail; slight indentation produced by pushing a geological pick point into soil; cannot be moulded by fingers
Very dense	High resistance to repeated blows of a geological pick	Very stiff	Indented by thumbnail with difficulty; slight indentation produced by blow of a geological pick point

4.2 Trench excavation

4.2.1 All material excavatable by hand (see 4.1) in trenches that have a depth of less than that indicated in the specification data (see annex A), shall be excavated by hand.

4.2.2 The excavation of any material in trenches shall not be performed by hand if it presents the possibility of danger or injury to workers.

4.3 Compaction of backfilling to trenches in areas not subjected to traffic

Backfilling to trenches in areas not subjected to traffic shall be placed in layers of thickness (before compaction) not exceeding 100 mm. Each layer shall be compacted using hand stampers such that

a) a Proctor density of 90 % is achieved, or

b) more than five blows of a dcp are required to penetrate 100 mm of the backfill, provided that the backfill does not comprise more than 10 % gravel of size less than 10 mm and contains no isolated boulders, or

c) the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a dcp.

4.4 Excavations other than in trenches

4.4.1 All material excavatable by hand (see 4.1) in excavations other than trenches including topsoil, shall be excavated by hand. Harder material may be loosened by mechanical means before excavation by hand.

4.4.2 The excavation of any material in excavations other than trenches shall not be performed by hand if it presents the possibility of danger or injury to workers.

4.5 Clearing and grubbing

Grass and small bushes shall be cleared by hand.

4.6 Shaping

All shaping in material excavatable by hand shall be undertaken by hand.

4.7 Loading

All loading shall be done by hand, regardless of the method of haulage.

4.8 Haul

Where the haul distance is not greater than 150 m, excavated material shall be hauled to its point of placement by means of wheelbarrows.

4.9 Off-loading

All material, however transported, shall be off-loaded by hand, unless tipper-trucks are utilized for haulage.

4.10 Spreading

All material shall be spread by hand.

4.11 Compaction

Small areas may be compacted by hand provided that the specified compaction is achieved.

4.12 Grassing

All grassing shall be undertaken by sprigging, sodding, or seeding by hand.

Annex A
(normative)

Preparation of specification data associated with this part of SANS 1921 for inclusion in the scope of work

Specification data form an essential part of this part of SANS 1921; without such data, requirements are incomplete.

The format for the specification data has been developed to be compatible with the requirements in table D.1 of SANS 10403:2003. The specification data should be incorporated in the scope of work as shown in table A.1.

Table A.1 — Incorporating this part of SANS 1921 in the scope of work associated with a project

<table>
<tr><td>1</td><td>2</td><td>3</td></tr>
<tr><td>TOPIC</td><td>ASPECT</td><td>COMMENTARY</td></tr>
<tr><td colspan="3">DESCRIPTION OF THE WORKS</td></tr>
<tr><td colspan="3">MANAGEMENT</td></tr>
<tr><td rowspan="2">Management of the works</td><td>Applicable part(s) of SANS 1921</td><td>The following parts of SANS 1921 and associated specification data are applicable:
1) SANS 1921…..
2) SANS 1921…..

The associated specification data are as follows:
<table>
<tr><td rowspan="3">Specification data pertaining to SANS 1921…</td><td>Essential data:
The requirements for ……. are …….
The requirements for ……. are …….</td></tr>
<tr><td>Variations:
1)……
2)……..</td></tr>
<tr><td>Additional clauses:
1)…….</td></tr>
</table></td></tr>
<tr><td>Particular/Generic specifications</td><td></td></tr>
</table>

Develop the specification data based on the contents of table A.2.

Table A.2 — Specification data associated with this part of SANS 1921

1	2	3
Specification data associated with this part of SANS 1921	**Guidance notes**	
	Clause number	**Consideration**
Essential data		
The depth of trenches which are to be excavated by hand is ……	5.1	State depth. Typically less than 1,5 m provided that the ground is stable.
Variations		
		State variations, if any, e.g. specific compaction requirements.
Additional clauses		
1 …… 2 ……		State additional requirements and identify other activities to be performed by hand, as required.

Annex B
(informative)

Material that can be excavated by hand

Table B.1 contains a classification for excavated materials. All soft classes of excavated materials can be removed by means of hand implements and may be classified in accordance with the provisions of tables 1 and B.2. The typical rates of excavations in trenches in respect of the different classes of soft excavation are shown in table B.3

Table B.1 — Classification of excavated materials

1	2
Classification	**Description**
Soft Class 1	Material which can be excavated by means of a suitable shovel without the use of a pick or other hand-swung tool
Soft Class 2	Material which can be readily excavated with the aid of a pick or other hand-swung tool
Soft Class 3	Material which can be excavated with difficulty with the aid of a hand-swung tool
Intermediate	Material which is difficult to excavate by hand even with the aid of a crowbar and requires the assistance of pneumatic tools for economic removal
Rock	Material which cannot be economically fragmented and loosened by hand implements and pneumatic tools except by drilling and blasting or the use of rock-breaking equipment

Table B.2 — Classification of materials in terms of consistency and shear strength

1	2	3	4	5
Materials classification	**Consistency** (as defined in table 1)		**Number of dcp blows to penetrate 100 mm[a]**	
	Granular soil	**Cohesive soil**	**Granular soil**	**Cohesive soil**
Soft Class 1	Very loose to loose	Very soft to soft	≤ 2	≤ 1
Soft Class 2	Loose to medium dense	Soft to stiff	2 – 6	1 – 5
Soft Class 3	Dense	Stiff to very stiff	7 – 15	6 – 8
Intermediate	Very dense	Very stiff	> 15	> 8
Rock	–	–	–	–

[a] Only applicable to materials comprising not more than 10 % gravel of size less than 10 mm and materials containing no cobbles or isolated small boulders.

Table B.3 — Approximate trench excavation rates

1	2	3	4	5
Excavation type	**Typical production per 6 h task** m^3			
	Depth range			
	0 – 1,0 m	**1,0 m – 1,5 m**	**1,5 m – 2,0 m**	**2,0 m – 2,5 m**
Soft class 1	3,5	3,0	2,4	1,6
Soft class 2	2,8	2,4	1,9	1,3
Soft class 3	1,7	1,5	1,2	0,8

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