



Exploration & Production

GENERAL SPECIFICATION

CIVIL WORKS

GS EP CIV 101

General earthworks

05	10/08	General review
04	10/07	Update of references - Revision of § 4 and 5
03	10/05	Addition of "EP" root to GS identification
02	10/04	Revised & 2, 3.2.2
01	09/03	Change of Group name and logo
00	03/01	First issue
Rev.	Date	Notes

Contents

1. Scope	4
2. Reference documents.....	4
3. Organisation of working design and execution phases	9
3.1 Basic data	9
3.2 Earthwork project study	9
3.3 Mapping Requirements:.....	9
3.4 Particular Specifications	13
4. Type, origin and quality of materials and products	14
4.1 General principles	14
4.2 Site verification	14
4.3 Organization of in situ and laboratory tests	15
4.4 Backfill Materials	16
4.5 Materials for drainage layers	17
4.6 Surfacing.....	18
4.7 Topsoil	18
4.8 Miscellaneous products	18
5. Performance of works.....	18
5.1 Pegging-out	18
5.2 Obstacles encountered during works	19
5.3 Clearing	20
5.4 Demolitions	21
5.5 Deviation of existing underground structures and utilities	23
5.6 Preparation of the area for earthworks	24
5.7 Earth moving.....	24
5.8 Pits, quarries and material deposits.....	25
5.9 Performance of excavation works.....	26
5.10 Performance of backfilling works	29
5.11 Temporary stop in earthworks	32
5.12 Soil treatments	33
5.13 Earthwork finishing	33



6. Material take off.....	34
6.1 Lengths.....	34
6.2 Areas	35
6.3 Volumes.....	35
6.4 Weights.....	35
Appendix 1 Granulometric distribution of earth	36
Appendix 2 Test for sand equivalence	37
Appendix 3 Sieve analysis.....	38
Appendix 4 Determination of Atterberg limits	39
Appendix 5 CBR test	40

1. Scope

This specification covers general earthworks including:

- Cut and fill and related works for basis of roads
- Cut and fill and related works for basis of foundations.

Earthworks carried out underwater (dredging, rock excavation, etc.) as well as underground digging are excluded.

General Specifications define what the COMPANY considers as an acceptable minimum. Nonetheless certain equipment and/or works may present particular problems. In such a case the COMPANY reserves the right to modify General Specifications or supplement them with Particular Specifications.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise specified, the applicable version of these documents, including relevant appendices and supplements, shall be the latest revision published at the EFFECTIVE DATE of the CONTRACT.

When local national standards, regulations and codes exist, all design, engineering, materials and construction shall conform to their latest requirements, which complete or modify the present specifications.

In case of lack of mandatory local national standards, international norms and standards will be applied.

In case of lack of international norms and standards, national norms and standards listed hereafter will be applied

In all cases the system adopted shall be coherent, i.e. the various texts shall present no incompatibility. Any dispute shall be resolved by basing works on the most stringent text for the CONTRACTOR and at his expense.

The list of specifications and norms quoted is not exhaustive: the CONTRACTOR shall respect the secondary standards and regulations, which cover the works described in the present specification.

Certain specifications and standards may be indicated with an issue date. This is for information only. It must be understood that the most recent issue shall be used.

Standards

Reference	Title
Eurocode 7	European standards and codes Calcul géotechnique, Partie 1 : Règles générales (Geotechnical design, Part 1 : General rules)
Fascicule n° 2 du CCTG	French standards and codes Terrassements Généraux (General Earthworks) – 14 mars 1979 (Ministère de l'Environnement et du Cadre de vie, Ministère des Transports)

Reference	Title
DTU 12	Travaux de terrassement pour le bâtiment (Earthworks for building) (Centre Scientifique et Technique du Bâtiment)
Fascicule n° 70 du CCTG	Canalisations d'assainissement et ouvrages annexes (Sewerage pipes and related works)
NF P 11-300	Exécution des terrassements – Classification des matériaux utilisables dans la construction des remblais et des couches de forme d'infrastructures routières (Earthworks – Classification of usable materials in construction of backfilling and base course of roads)
NF P 11-301	Exécution des terrassements – Terminologie. Earthworks - Terminology
NF P 98-736	Matériel de construction et d'entretien des routes. Compacteurs. Classification (Material for roads construction and maintenance. Rollers)
NF P 98-102	Assises de chaussées – Chaux aérienne calcique pour sols et route – Essai de réactivité de la chaux vive à l'eau (Roads course – Rich lime for soils and roads – Test for water reactivity of unhydrated lime)
	International Standards
ISO 9862	Geosynthetics Sampling and preparation of test specimens
ISO 9863-1	Geosynthetics - Determination of Thickness at Specified Pressures - Part 1: Single layers
ISO 9863-2	Geotextiles and Geotextile-Related Products - Determination of Thickness at Specified Pressures Part 2: Procedure for Determination of Thickness of Single Layers of Multilayer Products
ISO 9864	Geotextiles and Geotextile-Related Products - Determination of Thickness at Specified Pressures Part 2: Procedure for Determination of Thickness of Single Layers of Multilayer Products
ISO 10321	Geotextiles - Tensile Test for Joints/Seams by Wide-Width Method
ISO 11058	Geotextiles and Geotextile-Related Products - Determination of Water Permeability Characteristics Normal to the Plane, without Load
ISO 12956	Geotextiles and Geotextile-Related Products - Determination of the Characteristic Opening Size
ISO 12957-1	Geosynthetics Determination of friction characteristics Part 1: Direct shear test
ISO 12957-2	Geosynthetics Determination of friction characteristics Part 2: Inclined plane test

Reference	Title
ISO 12958	Geotextiles and Geotextile-Related Products - Determination of Water Flow Capacity in Their Plane-CORR 16433: June 2006
ISO 13426-1	Geotextiles and geotextile-related products Strength of internal structural junctions Part 1: Geocells
ISO 13426-2	Geotextiles and geotextile-related products Strength of internal structural junctions Part 2: Geocomposites
ISO 13431	Geotextiles and Geotextile-Related Products - Determination of Tensile Creep and Creep Rupture Behaviour
	American standards
ASTM D 421	Practice for Dry preparation of Soil Samples for Particle-size. Analysis and Determination of Soil Constant
ASTM D 422	Test Method for Particle-Size Analysis of Soils
ASTM D 854	Test Method for Specific Gravity of Soil Solids by Water Pycnometer
ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
ASTM D 1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 Kn-m/m ³))
ASTM D 1883	Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2167	Test Method for Density and Unit Weight of Soil in Place by Rubber Balloon Method
ASTM D 2216	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3282	Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D 4318	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils

Reference	Title
ASTM D 4253	Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4254	Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
ASTM D 4429	Standard Test Method for CBR (California Bearing Ratio) of soil in place.
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4545	Standard Practice for Determining the Integrity of Factory Seams Used in Joining Manufactured Flexible Sheet Geomembranes
ASTM D 4594	Standard Test Method for Effects of Temperature on Stability of Geotextiles
ASTM D 4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
	British standards and codes
BS 5906	Waste management in buildings code of practice
BS 6031	Code of Practice for Earthworks
BS 6068 Series	Water Quality

Professional Documents

Reference	Title
LCPC	French documents Réalisation des remblais et des couches de forme (Backfilling and base course execution) – September 92 (LCPC, Service d'Etudes Techniques des Routes et Autoroutes)
LCPC / SETRA	Note d'information technique : Reconnaissance géologique et géotechnique des tracés de routes et autoroutes (Geological and geotechnical survey for roads and highways alignment) – 1982 (Ministère de l'Urbanisme et du Logement, Ministère des Transports, LCPC)

Reference	Title
LCPC	Recommandations : Caractéristiques des matériaux de remblai supports de fondations (Characteristics of materials for backfilling supporting foundations) – 1980 (LCPC, Comité Professionnel de la prévention et du contrôle technique)
SETRA D 8629	Recommandation : Météorologie et terrassements (Meteorology and earthworks) – LCPC/SETRA 1986
Comité Français des Géotextiles et Géomembranes	Recommandations pour l'emploi des géotextiles sous remblais sur sols compressibles (Recommendations for use of bonded fibre textiles under backfilling over compressible soils)
LCPC/SETRA D9061	Guide technique : Utilisation de expansé en remblai routier (Polystyrene use in roads backfilling) – LCPC/SETRA 1990

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP CIV 102	Dredging and filling up
GS EP CIV 201	Design and construction of roads and stabilised areas
GS EP GEO 102	Onshore geotechnical soil survey
GS EP GEO 303	Onshore land surveying and positioning works

3. Organisation of working design and execution phases

3.1 Basic data

The COMPANY shall provide the Engineering CONTRACTOR with basic data, which shall enable the latter to compile the documents required by the Construction CONTRACTORS for the performance of works.

Basic data shall generally include:

- COMPANY's General Specifications
- Particular Specifications providing information relative to the project
- Technical files of basic data:
 - Site topography
 - Geological and geotechnical details
 - Hydrological and climatic details
 - Local seismicity
 - Current or previous industrial activities
 - Human activities around the site
- Regulation relative to air and water protection.

The Construction CONTRACTOR shall study the basic data and either accept them or inform the COMPANY in writing, within a time limit previously agreed on by both parties, of any observations or technical reservations which it considers of interest.

Should these observations involve supplementary studies, these shall be precisely defined along with their impact on cost and delay.

The COMPANY shall take a decision concerning these supplementary studies and give instructions to the Engineering CONTRACTOR.

3.2 Earthwork project study

Prior to execution of any work or part of work, the following documents must be established and transmitted to the COMPANY.

3.3 Mapping Requirements:

The general layouts of the site of earthworks shall be geo referenced using the Project Coordinate Reference System parameters provided by COMPANY.

The following features shall be included on each charts, but not limited to:

- A title, a graphic scale (Bar scale) and Numeric scale, specify the drawing format for which the numeric scale is applicable, a legend
- The projected Company Coordinate System Grid, the geographic coordinate system ticks and Local Engineering Grid, when applicable
- A situation Map
- The reference of the source drawings

- Full Company Coordinate system parameters, transformation parameters between the Company Coordinate system and the Local Engineering Grid when applicable

The native files shall be provided in AUTOCAD or MICROSTATION and PDF formats. The CAD files shall be georeferenced using the project coordinate system and structured thus:

- Separate layers for each feature type (contours lines, elevation roads, etc...)
- Continuous lines (e.g. contours lines) shall be drawn as continuous 2D or 3D polylines

CONTRACTOR may also propose to provide data in GIS formats (as ESRI shapefile or Geodatabase).

3.3.1 Geometrical survey

The geometrical survey to be carried out by the Engineering CONTRACTOR includes:

3.3.1.1 Location plan

The situation plan indicates the work site in the concerned area, making it possible for somebody unfamiliar with the country to locate easily the geographical zone in question.

3.3.1.2 Layout plan

The layout plan is the work plan, which defines the boundary of the work site with its topographical environment, viability and natural landmarks.

Scales of 1/5000, 1/2000, 1/1000, 1/500 may be used depending on the nature of works.

The layout plan makes it possible to easily find landmarks for the construction of all sections of the works and give planimetric data for construction.

This plan must be provided with a system of coordinates and elevation benchmarks, linked to the general systems of the country.

3.3.1.3 Longitudinal section

The longitudinal section gives all the linear and altimetric data for the works, partial and cumulative lengths between points on the axis, altitude of the natural ground, altitude of project, giving the project's stage of completion.

Generally speaking, the scale for the longitudinal section is that of the plan view for lengths. For heights it is ten times that for lengths.

As a general rule the scales for longitudinal sections are 1/2000 (or 1/1000) for lengths and 1/200 (or 1/100) for heights.

No longitudinal section is required in case of stabilized areas of non-linear shapes. Multiple cross-sections, carefully located according to the shape of the stabilized area, are used instead.

3.3.1.4 Cross-sections

The natural ground topography is defined by spot heights, established either systematically from cross-sections perpendicular to the axis of the works (the most common case), or from a series of spot heights along typical lines of natural slope change. In the latter case, interpolation is required between known spot heights on the natural ground for establishing cross-sections.

The vertical layout of the intended project is added to the cross-section drawing.

Cross-sections may be drawn and/or tabulated for data processing purposes.

3.3.1.5 Boundary posts

Boundaries shall be marked out in two ways by the Construction CONTRACTOR under the Engineering CONTRACTOR responsibility:

- By concrete or plastic posts meeting with COMPANY approval.

Concrete posts shall be either pre-cast or cast in place.

They shall have the following minimum dimensions (truncated pyramid with square base):

- Bottom base: 0.20 x 0.20 m
- Top base: 0.12 x 0.12 m
- Height: 0.30 m.

A marker shall be located in the centre of the superior base of the post and the top of this marker should be flat.

The Engineering CONTRACTOR will submit boundary posts and basic layout plan to the COMPANY. After approval they shall be handed over to the Construction CONTRACTOR.

- Wooden or iron posts for detailed layout shall be placed by the Construction CONTRACTOR for execution of the works. The positioning of the posts shall be made known to the COMPANY or its representative.

The Construction CONTRACTOR shall be able to check the accuracy of layout and levels of works from these markings.

3.3.2 Geological and geotechnical surveys

The geological survey shall supply data relative to underground structure, nature and morphology, including natural characteristics (fossil laying, karstic zones, tectonic, seismicity, etc.) and artificial characteristics (mines, water pumpi, etc.). It shall enable the Engineering CONTRACTOR to proceed with the selection of borrowed material supplies.

The geotechnical survey, to be in agreement with **GS EP GEO 102**, shall provide soil mechanics information and groundwater characteristics to the Engineering CONTRACTOR so that he may proceed with the selection of materials and earthworks sizing (slopes for excavation and backfilling, form layer, etc.).

Specific rules for situations and actions may be defined by the COMPANY in the Particular Specifications or proposed by the Construction CONTRACTOR to COMPANY approval. These rules must cover provisional actions during works and works schedule.

When Particular Specifications do not include special conditions, situations and actions to be considered in earthworks sizing must be in agreement with reference documents listed in § 2.

3.3.3 Definition of platforms and levelling

The Engineering CONTRACTOR shall define the platforms, providing planimetric and levelling data. He shall define the methods required to maintain form layer soil quality under the effects of bad weather or traffic (protection, borrowed material supplies, etc.).

The Engineering CONTRACTOR shall also define slope sections (gradients, berms, etc.) and their protection.

3.3.4 Roads to be kept, moved or demolished (see para. 5.2)

The Engineering CONTRACTOR shall provide:

- Survey of existing roads (layout, condition, etc.)
- Layout and structure of planned roads
- Layout of drainage (temporary and final drainage)
- Definition of means for road protection during works, or means for removal
- Definition of the means of maintaining road traffic while undergoing removal or reconstruction works (deviations, etc.).

3.3.5 Geometrical design, volume, earth movement

3.3.5.1 Geometrical design

The geometrical design for the earthwork project shall be carried out by the Engineering CONTRACTOR, taking into account the data provided in the geological and geotechnical surveys. Rights of way shall be indicated on the layout plans. The geometrical design should enable an evaluation of the earth material volume to be moved.

3.3.5.2 Volume calculation - Earth movement

The volumes and movements of soil masses shall be calculated from existing ground sections, taking into account possible levelling works and the project profile. A theoretical volume for quantities to be added, in the case of backfilling, or quantities to be removed, in the case of excavation, shall be used, without taking bulking factor into consideration. Excavated volumes shall be distributed into categories, depending on the nature of earth materials and the difficulty involved in handling them, as described in Section 5.9 of this document.

The number of cross-sections to be drawn shall be defined according to the required precision and in agreement with the COMPANY.

The Engineering CONTRACTOR shall carry out an earth movement study in order to establish estimations for the hypothesis envisaged and to set up the program of the works. The study is of a provisional nature. However, certain aspects of earth movements may become contractual if the quality of the works implies so, or if availability date for roads is imposed. In that case the Engineering CONTRACTOR shall stipulate the requirements for earth movement in Particular Specifications.

3.3.6 Origin of borrowed materials/Depositing of borrowed materials

(Reference to be made to Section 5.8).

The conditions for use of borrowed materials shall receive approval from the COMPANY.

3.3.7 Special conditions

In case works are undertaken on an operational industrial site, the performance of works shall be defined in agreement with the operational industry concerned along with the COMPANY (in particular Safety department).