O'CONNOR SUTTON CRONIN

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EXCAVATION AND LOOSE FILL SPECIFICATION

OCSC
O'CONNOR · SUTTON · CRONIN
MULTIDISCIPLINARY CONSULTING ENGINEERS

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EXCAVATION AND LOOSE FILL SPECIFICATION

1. GENERAL CONDITIONS

1.1. Contents

1.1.1.	Contents	This specification includes 1) General Conditions 2) Excavation 3) Filling 4) Compaction

1.2. Definitions

1.2.1.	ENGINEER	Engineer shall refer to OCSC unless otherwise stated.
1.2.2.	ROCK	Refers to geologically defined rock that requires mechanical excavation techniques to remove. These methods include mechanical excavators, rippers, breaking (either mechanical or by hand), chemical removal or blasting, and shall be assessed using the publication by Pettifer GS, Fookes PG (1994), titled, A revision of the Graphical Method for Assessing the Excavatability of Rock, Quarterly Journal Engineering Geology & Hydrogeology 1994 27: 145-164. Boulders in excess of 3.0m^3 or with any dimension in excess of 600mm shall also be defined as rock
1.2.3.	THINLY BEDDED ROCK	"Thinly bedded rock" shall mean stratified rock at bedding planes at not more that 150mm intervals.
1.2.4.	HARD GROUND	Hard ground areas shall be organic soil material distinct from rock which is defined as hard ripping and above on the Pettifer & Fookes scale (1984).
1.2.5.	TOPSOIL	"Topsoil" shall mean soil capable of supporting plant growth.

1.2.6.	SUB SOIL	"Sub soil" shall be defined as layer of soil under the topsoil on the surface of the ground.
1.2.7.	LEAN-MIX CONCRETE	Lean-mix concrete shall be a wet mix and shall be in accordance with OCSC's Cast Insitu Concrete Specification, I.S. EN 206-1 and Clause 4.4.1.3 (4) I.S. EN 1992-1-1 and take into account any sulphates, chlorides, or other contaminants that may be present in the ground. The minimum grade shall be C16/20.
1.2.8.	FILL MATERIAL	"Fill material" shall be material used to occupy a void and must be a type defined as suitable by this specification. Non-suitable material shall not be considered fill material.
1.2.9.	OBSTRUCTIONS	Shall mean any solid structure not of natural origin such as old foundations, basements, filling, tanks, service pipes, drains, etc.
1.2.10.	HARDCORE	"Hardcore" and "Unbound Granular Fill" under concrete floor slabs, footpaths and external concrete paved areas shall mean material in accordance with I.S. EN 13242 and SR21:2001+A1:2016 with particular reference to Clause 3.4 and Annex E, available from National Standards Authority of Ireland.
1.2.11.	UNSUITBALE MATERIAL	"Unsuitable filling material" shall mean, but not limited to, any of the following: • Contaminated material • Perishable material. • Material from marshes or bogs. • Logs, stumps, slurry and mud. • Material susceptible to spontaneous combustion. • Material in a frozen condition. • Clay of liquid limit exceeding 80% and/or plasticity index exceeding 55 as determined in accordance with BS1377, Parts 1 – 9 • Materials with a water-soluble sulphate content in excess of 0.1%. • Materials have a moisture content greater than the maximum permitted.
1.2.12.	FORMATION	Formation shall mean the loadbearing soil/rock surface directly beneath a concrete floor, pad foundation, basement slab or top of capping layer for roads and pavements. This is the bottom of the final excavation upon which the sub-base is

		laid. The formation levels are indicated on the Contract Drawings. The levels are subject to change based on the ground meeting the minimum strength criteria.
1.2.13.	SUB-FORMATION	Sub-formation level shall mean the bottom of a capping layer.
1.2.14.	EXCLUDED MATERIAL	Excluded material shall mean the following: • Materials that in combination with the ground or surface water give rise to an aggressive environment for the building structure and services below ground. • Material that is susceptible to attack from chemicals in the ground giving rise to a health hazard or damaging the structure of the fill. • Any material that may cause any damage to the structure of the fill, or surrounding materials. • Organic, chemically contaminated and/or noxious material.
1.3. **General Conditions**		
1.3.1.	SERVICES	Consult the responsible authorities before commencing excavation, about the position and type of underground services which are likely to be encountered. Use a Cable avoidance Tool or other suitable device to scan for services prior to excavation.
1.3.2.	SITE INVESTIGATION	Refer to the site investigation for enquiries with reference to the ground conditions. Where conditions are encountered that contradict the site investigation refer to the Engineer for comment.
1.3.3.	INSPECTIONS	The Engineer shall be notified when the excavations are ready for inspection and approval obtained before proceeding with construction. A minimum of two days' notice to inspect shall be provided.
1.3.4.	DUST	Dust suppression measures (e.g., damping down during dry periods), vehicle wheel washes, road sweeping and generally housekeeping to ensure that the surrounding environment is free of nuisance dust and dirt on roads.

2. EXCAVATION		
2.1. **General Excavation**		
2.1.1.	FOUNDATION EXCAVATION	Excavate to the dimensions, levels, lines and profiles shown on the drawings or as directed by the Engineer.
2.1.2.	BEARING STRATUM	Where a bearing stratum is encountered at a level different to the Engineer's drawings, the contractor will inform the Engineer and facilitate inspection. The contractor will be responsible for providing a measurement of the varied volume.
2.1.3.	FORMATION	As a minimum, the last 75mm of earth above formation level shall be left to as protection to the formation and be excavated immediately before overlying construction is commenced.
2.1.4.	EXCAVATION IN ROCK	The bottom of excavation in rock shall be trimmed.
2.1.5.	REINSTATEMENT OF EXCAVATION	Surfaces which have been deemed unsuitable during the process of the works shall be reinstated with approved filling material.
2.1.6.	BLASTING	The use of explosives is not permitted.
2.1.7.	EDGE SUPPORT	The sides of excavations shall be supported in accordance with the requirements of the contractor's Safe System of Work Plan and in accordance with all applicable Health & Safety regulations. In advance of work starting the Contractor shall submit details of its proposals for supporting the sides of all excavations which have slopes steeper than 1:2 or less if poor ground conditions exist.
2.1.8.	CLOSELY SPACED EXCAVATIONS	Where the width of undisturbed ground between two excavations will be less than 900mm the Contractor shall assume that the ground between the trenches is unstable and shall provide side support accordingly.
2.1.9.	TEMPORARY WORKS DESIGN	The adequacy of the Contractors proposed slope and whether temporary retaining works are required shall be determined by the Contractors

		Temporary Works Engineer. The temporary works engineer must be suitably qualified.
2.1.10.	TEMPORARY WORKS DESIGNER	Temporary works shall be designed by an appropriately experienced Chartered Engineer with adequate Professional Indemnity Insurance.
2.1.11.	OBSTRUCTIONS	The Contractor shall break out old foundations, walls, drains, etc. where and to the extent stated on the Drawings. The Contractor shall seal off drain ends at the site perimeter and remove any obstructions encountered under the building footprint. Contaminated ground shall also be removed.
2.1.12.	ENTERING OBSTRUCTIONS	Where old foundations, basements, filling, tanks, service pipes, drains, etc. not shown on the drawings are encountered, the Contractor shall not enter and shall obtain instructions before proceeding. Appropriate method statements and operating procedures shall be required before the Contractor undertakes any work in confined spaces/limited access areas.
2.1.13.	FILLING OF VOIDS	Where a void remains following the removal of an obstruction under the building footprint and adjacent structures then this void shall be backfilled with C16/20 lean-mix concrete.
2.1.14.	WATERWAYS	Divert all known surface water tunnels and field drains as shown on the drawings, or as agreed with the conditions.
2.1.15.	UNMARKED DRAINS	Notify the Engineer and obtain instructions on the drains and underground waterways encountered during excavation work.
2.1.16.	DISUSED DRAINS	Drains confirmed as disused by the architect or Engineer shall be remove during excavation work after tracing and diversion.
2.1.17.	DISUSED UNDERGROUND STRUCTURES	Disused underground structures encountered during the excavation work shall be removed to a minimum of 250mm below formation level.
2.1.18.	DISUSED FOUNDATIONS	Disused foundations encountered during the excavation work shall be removed to a minimum of 250mm below formation level.
2.1.19.	RE-FILLING OF DISUSED SERVICES	For excavations created by removal of disused services as described in clause 2.1.18 and 2.1.1,

		the excavation shall be filled with lean mix concrete up the underside of formation.
2.2. **Water**		
2.2.1.	GENERAL	The contractor will be responsible for keeping the excavation free from water.
2.2.2.	PUMPING STRATEGY	The Contractor is to issue, for comment, to the Engineer a detailed dewatering method statement.
2.2.3.	PUMPING OUTLET	Water shall not be pumped from the excavation directly into the permanent drainage system or any watercourse without a discharge license having been secured for such activity.
2.2.4.	CONTINUOUS PUMPING	The contractor will take measures to ensure that, in accordance with the discharge license, silt will be prevented from entering the permanent drainage system when pumping water from the excavation.
2.2.5.	TEMPORARY SUMPS	Where temporary sumps are required, they should be constructed clear of excavations for the permanent works and filled with suitable material when no longer required.
2.2.6.	DEWATERING NEAR A NEIGHBOURING PROPERTY	The Contractor shall ensure that no settlement occurs in neighbouring properties as a result of dewatering.
2.2.7.	EXCAVATION SURFACES	All surfaces of excavations shall be formed to provide adequate drainage falls at all times. Temporary drains, sumps and pumping shall be provided by the Contractor as necessary.
2.2.8.	NEIGHBOURING STRUCTURES	Excavations shall not undermine or remove support from the foundations of existing buildings. The adequacy of the temporary retaining works shall be determined by the contractor's Temporary Works Engineer and shall be agreed with the owner's engineer in advance of the works commencing.
2.2.9.	ADJACENT SERVICES	Excavations shall not encroach on adjacent services or structures or in any way jeopardise their integrity.

2.3. **Disposal of Materials**		
2.3.1.	CLASSIFICATION	During excavations, a suitability qualified professional shall be present to assess and categorise the material as it is removed using visual, field and laboratory tests as required. The contractor shall follow the EPA listed waste and landfill acceptance criteria.
2.3.2.	HANDLING PROCEDURE	The Contractor shall establish a materials handling procedure to ensure all soil is excavated in a controlled manner, in accordance with all health and safety requirements and is exported from site for recovery/disposal in accordance with all relevant legislation/regulations.
2.3.3.	UNSUITABLE MATERIALS	All excavated materials unsuitable for filling shall be removed from the site. Remove surplus excavated materials from the site.
2.3.4.	EXPORT FROM SITE	For export from the State, all TFS documentation shall be provided in advance. All surplus and unsuitable/contaminated soil and wastes requiring export from the site, for recovery or disposal offsite, shall require waste classification. Waste classification shall be carried out by a suitability qualified and experienced person via sampling and analysis following best industry practice and relevant legislation including: • List of Waste & Determining if Waste is Hazardous or Non-Hazardous (EPA, 2015); • Guidance on the classification and assessment of waste, Technical Guidance WM3 (EA et al, 2015); • EU Council Decision 2003/33/EC and 1999/31/EC (2002); • European Union (Properties of Waste which render it Hazardous) Regulations 2015 – S.I. 233 of 2015; • EC Classification, Labelling & Packaging Regulations (No. 1272/2008).
2.3.5.	EXPORT FROM STATE	Where material is to be exported out of the State it shall be carried out in accordance with all relevant legislation including:

		• Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998); • The European Communities (Transfrontier Shipment of Hazardous Waste) Regulations, 1988 (S.I. No. 248 of 1988); • The Basel Convention; • European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011).
2.3.6.	WASTE RECEIVER CONFIRMATION	Written confirmation shall be obtained from the proposed Waste Receiver in advance of materials being removed from site. All Waste Receivers and Waste Hauliers shall hold valid and appropriate permissions and shall be preapproved by the Employers Resident Engineer or the design Engineer.
2.3.7.	TEMPORARY STORAGE	Where material is awaiting classification and/or acceptance by a Waste Receiver it shall either be; left in-situ or; excavated and stockpiled. The method of storage and reporting shall be detailed in the contractors Waste management plan and soil management plan.
2.3.8.	MONITORING REQUIREMENTS	The Contractor shall ensure that all waste materials associated with the project are appropriately classified and documented in accordance with their waste management plan.
2.3.9.	DISCHARGE	Contractor is responsible for adhering to the conditions & reporting requirements as set out in any discharge license relevant to the contract.
3. FILLING		
3.1. **Fill Materials**		
3.1.1.	EXCLUDED MATERIAL	Excluded material may not be used on site.
3.1.2.	REUSE ON SITE	Where the Contractor proposes to reuse excavated spoil (including soil and concrete) within the works, the reuse must; be permitted in accordance with relevant legislation; the Planning Permission and; the material must be fit for purpose. The Engineer shall be notified by the contractor of all proposed materials to be reused on site.

3.1.3.	EXTERNALLY SOURCED	The Contractor shall obtain material for hardcore only from a supplier who has tested and certified that the hardcore is in accordance with SR21:2004+A1:2016 (as well as complying with the other relevant particular requirements of the specification). In addition to complying with Table E.1 (Annex E, SR21:2004+A1:2016 only natural crushed rock aggregate shall be used under floor slabs of buildings, footpaths and external concrete paved areas. All materials supplied to site must be accompanied with a CE mark and DOP in accordance with the Construction Products Directive.
3.1.4.	SAND BLINDING	Sand for blinding hardcore fill shall comply with the requirements of BS 882, Table 5, Type C or M. Sand blinding shall comply with the specification given in Annex E of SR21:2004+A1:2016 Sand blinding supplied to site must have a CE mark and DOP in accordance with the Construction Products Directive. Where required, fines material for blinding the top surface of the Annex E granular fill should have a grading of 0/6,3 GF80 (see Table 4), with an acid soluble sulphate content of AS0,2 and a total sulphur of S<0.1% (taking into account the recommendations of E.2.4.4).
3.1.5.	FROST SUSCEPTIBILITY	All fill materials shall be non-frost susceptible as defined in Road Research Laboratory Report No. SR829.
3.1.6.	MCV FOR COHESIVE FILL	Where cohesive fill material is to be compacted in accordance with the references given in 2.2.10 the Moisture Condition Value (MCV) value shall be between 8 and 14 for the fill.
3.1.7.	MOISTURE CONTENT	For Type 2 granular materials the moisture content during spreading and compaction shall be maintained within a range between two per cent below to one per cent above the optimum

		moisture content for compaction determined from BS 1377, Test 14.
3.1.8.	WATER	No fill shall be placed in water.
3.2. **Additional Factors**		
3.2.1.	FORMATION PREPARATION	All formations shall be trimmed, levelled and cleared of loose material in accordance with this Specification and made ready for inspection. In the case of trench-fill foundations formations shall be prepared from the ground surface without operative entry into the excavation.
3.2.2.	FORMATION INSPECTION	The Contractor shall make advance arrangements with the Engineer for inspection of formations for the all foundation and filling formations.
3.2.3.	UNEXPECTED GROUND CONDITIONS	The contractor shall inform the Engineer if the ground conditions differ from those noted in the Geotechnical Report.
3.2.4.	NEIGHBOURING STRUCTURES	The Contractor shall provide protection to neighbouring structures and place and compact fill against them in a sequence and manner that will ensure stability and avoid damage. This shall be in accordance with the agreed temporary works design.
3.2.5.	SITE-BOUND TEMPORARY WORK	The Contractor shall provide, protect, place and compact fully against structures, membranes or buried services, within the confines of the site, in sequence and manner which will ensure stability, avoid out-of-balance situations and avoid any damage. The Contractor shall design any temporary support necessary to ensure stability during filling and submit details thereof to the Engineer for review and comment.
3.2.6.	WORKING SPACE REFILL	The backfill to working spaces below the building footprint shall be lean-mix concrete with a minimum grade of C16/20 unless noted otherwise. The backfill to working spaces outside the building footprint shall be in accordance with the OCSC Specification for Civil Engineering Works. Compacted Cl. 808 fill shall not be used within 500 mm of all cement bound materials, concrete

		pavements, concrete structures or concrete products forming part of the Works.
3.2.7.	SOFT SPOTS	The Contractor shall advise the Engineer of any soft or unsuitable areas of formation.
3.2.8.	EXCESS EXCAVATION	Should the Contractor excavate beyond the net width as shown on the drawings, or should any trench slips occur, then the whole of the void thus created shall be backfilled with lean-mix concrete with a minimum grade of C16/20, unless otherwise instructed.
3.2.9.	ADDITIONAL MEASURES IN RESPECT OF SULFATE ATTACK ON BURIED CONCRETE AND STEEL	In addition to the requirements for hardcore and unbound granular fill material above, the following requirements shall be complied with in respect of fill material that may be placed close to (i.e within 500mm of) unprotected buried concrete and/or steel elements. a) Close to concrete but not to steel: the chemical requirements in Clause 801, Paragraph 2 (UK Highway Works Specification, Nov 2009) shall be complied with; b) Close to steel but not to concrete: the chemical requirements of Clause 809 (NRA Specification) shall be complied with; c) Close to steel and to concrete: the chemical requirements of Clause 809 (NRA Specification) shall be complied with and, further, the 2:1 water soil extract prepared for the determination of water-soluble sulphate content shall have a pH value of not less than 7.2.
3.2.10.	IMPORTED GRANULAR MATERIAL TESTS	A minimum of 3 No. samples shall be tested per area to be filled with imported granular material with a minimum of 1 No. sample per 100m^3 thereafter.
3.2.11.	TEST STANDARD	Testing should confirm full compliance with the requirements of SR21:2014+A1:2016.
3.2.12.	SUBMISSION OF FILL MATERIAL SAMPLES	At least 21 days before any filling is started the Contractor shall submit full details of the source and types of the proposed filling materials together with a 25kg representative sample of each type from each source. In addition, up-to-date test certificates (chemical, pyrite, sulphate,

		gradings, Optimum Moisture Content) to be representative of the actual material to be used shall be submitted to the Engineer at least 21 days in advance of the use of this material. At the same time, the Contractor shall deliver to the agreed laboratory, sufficient representative samples of each material for any of the specified tests in this specification.
3.2.13.	TESTING OF FILL MATERIAL	All tests to conform to SR21:2004+A1:2016. Where material from a quarry source is to be used as hardcore fill material under concrete floor slabs, footpaths and external concrete paved areas, it is a requirement of this specification that a suitably experienced petrographer carry out a detailed mineralogical examination specifically covering the proposed area of extraction in order to: a) ascertain the material's suitability for its end use, and b) Establish an appropriate test frequency for total sulphur from an assessment of the variability of the quarry deposit. This assessment may need to be repeated where there is a significant change in quarry characteristics.
3.2.14.	BINDING HARDCORE FILL MATERIAL	Where specified on drawings, the surface of binding hardcore fill shall be blinded with sand, moistened as necessary, before the final rolling, to produce a flat smooth surface.
3.2.15.	COLD WEATHER WORKING	No frozen materials or materials containing ice shall be used for filling. Fill shall not be placed on a frozen surface.
3.2.16.	REMEDY FOR FROST ACTION	Any material which has been affected by frost shall be removed and after thawing re-compacted in accordance with Clause 3.6 Performance and Tests.
3.2.17.	TOLERANCES	Permissible deviations from linear dimensions shall generally be to CIRIA publication C709 - Setting-out Procedures for the Modern Built Environment, 2007 from the position shown or calculable from the Drawings and with reference to the nearest datum level shall be as follows: +/- 25 mm Beneath mass concrete foundations

		+/-15 mm Beneath ground bearing slabs and RC foundations +/- 50 mm Embankments and cuttings +/- 50 mm Ground abutting external walls, but such as to ensure that finished level is not less than 150 mm below build up to the Architect's specification.

4. Compaction

4.1. General

4.1.1.	COMPACTION PLANT APPROVAL	At least 14 days before starting any filling, the Contractor shall submit full details of his proposed compaction plant. The types of plant listed in the table below will normally be acceptable. Earthmoving machines or similar will not be accepted as compaction plant.
4.1.2.	METHOD OF COMPACTION PLANT	Each layer of fill shall be spread and compacted by approved plant as specified below: Each layer shall be a maximum of 225mm, levelled and fully compacted prior to laying of the next layer. Compaction shall be in accordance with NRA Manual of Contract Documents for Roadworks (MCDRW) Series 600. Fill shall be graded in accordance with Table 6/1 of that document and compacted by a corresponding method from Table 6/4. When compacting each side of a rising wall the contractor shall ensure that each side of the wall is backfilled to the same level at the same time to ensure that no out of balance loading of the wall occurs due to the compaction.
4.1.3.	TESTING OF COMPACTION OF GRANULAR FILL	To demonstrate that adequate compaction of imported fill has been achieved plate bearing tests shall be carried out on the top of the compacted fill. The number of tests required per 100m2 of fill area shall be determined based on the overall fill depth as follows: • 1 No. for fill up to 600mm deep • 2 No. for depths of 601-900mm • 3 No. for depths of 901-1200mm

		• 1 No. test per additional 300mm of fill there-after The tests shall be located at least 1.5m from pad foundations at locations and levels to be agreed with the Engineer.
4.1.4.	COMPACTION EQUIPMENT	Notwithstanding the provisions of 4.1.2, the maximum depth of compaction layer and number of passes required for compaction shall not be less than that given in the table below

Type of Plant	**Category**		**Max Depth of Compacted Layer**	**Minimum Number of Passes**
	Variable	**Value**		
Smooth wheeled roller	Tonnes per m. width of roll	2-5 more than 5	125	10
Vibratory Roller	Static load in tonnes per m. width of vibratory roller	0.3 - 0.6 0.7 - 1.1 1.2 - 1.8 more than 1.8	75 125 150 150	16 12 8
Vibrating plate compactor	Static pressure under base plate in Kgf/cm.sq	0.1 - 0.12 0.13 - 0.14 more than 0.14	75 75 125	10 6 6
Vibro Tamper	Weight in Kgf	50 - 75 more than 75	100	3
Power Rammer	Weight in Kgf	100 more than 500	150 275	6 12
Note	In no circumstances should heavy compacting plant be operating close to adjoining building foundations where damage may occur. The Contractor shall be responsible for any damage which may occur to adjoining property resulting from these operations.			