



Western Power
Networks Business Unit

SUBDIVISION DESIGN GUIDELINE – NUMBER 4, (Revision 0, 04/01/06)

BEDDING SAND AND BACKFILL SAND AROUND CABLES AND GENERAL BACKFILL FOR CABLE TRENCHES - MATERIAL SELECTION GUIDELINES

Background

Section 6.10 and 6.11 of Underground Distribution Schemes (UDS), General Conditions for Developers Manual states that “*All cables shall be firmly and uniformly bedded on sand free from rocks or other hard formation*” and “*The backfill shall not contain any large stones, rocks, chemically active or hydrocarbon materials and shall be carefully placed in the trench so as to avoid disturbance of the cable separation*”. However the General Conditions do not specify guidance on the selection of suitable sand and backfill materials.

BEDDING SAND AND BACKFILL SAND AROUND CABLES

1. Reasons for Specifying Sand

The use of sand as bedding and for the initial backfill is specified for the following reasons:

- Rocks, gravel, building rubble or metal may damage the cable insulation;
- Clay becomes hard when it dries and it becomes difficult to dig out the cables without damage if maintenance or upgrading of cables is required;
- Clay shrinks and swells as it dries and wets up and can impose stress on the cable insulation.

2. Objective

The objective of these material selection parameters is to provide guidance to Contractors such that they can comply with the intent with the General Conditions for Developers Manual. The material selection parameters have been selected taking into consideration the definition of sand in AS 1289.0-2000, while at the same time recognizing what materials are available and have been used in the past in Western Australia.

3. Selection Criteria

Sand used for bedding shall be clean sand free of rocks, clay lumps, tree roots, building rubble, metal, glass, sharp objects, organic solvents or other deleterious material that is likely to damage cables and shall comply with the particle size distribution requirements shown in Table-1 when tested in accordance with the latest edition of AS 1289.3.6.1

Table- 1 Particle Size Distribution Requirements for Bedding & Backfill

Sieve Size (mm)	Percentage Passing by Mass
4.75	100
2.36	95 to 100
0.075	0 to 5

All hydrocarbons contain carbon atoms, and with few exceptions, hydrogen atoms. Hydrocarbons in soil may be of natural origin (for example decayed organic matter in topsoil) or manufactured (for example petrol). Not all hydrocarbons are detrimental, e.g. the insulation on cables is normally a hydrocarbon.

Where sand has been extracted from a virgin site or licensed quarry that has not previously been used for industrial or similar purposes, then the probability of having deleterious hydrocarbons present is low and laboratory testing is not required unless there is evidence of unusual colour, texture or odour. Sand from an existing or former industrial sites may only be used for cable bedding if a suitably experienced Scientist or Engineer confirms that the hydrocarbons and other chemicals present will not damage the cable or be injurious to the health of persons laying the cable or likely to excavate the cable in the future. In those cases the contractor/developer is required to provide a certificate from the scientist or engineer confirming that the sand is approved. Samples may require agreed hydrocarbon suite of tests prior to use.

4. General cable arrangement

Typical cable arrangement on and off alignment is shown in the drawing UDS-6-1.

Cables shall be bedded with a thickness of sand prior to backfilling, bottom by 150mm and top by 300mm.

In a two layer situation, HV should be below LV, with 200mm of bedding sand between the two.

GENERAL BACKFILL FOR CABLE TRENCHES

1. Introduction

After completion of the bedding and backfill with “sand” detailed above, the balance of the trench shall be backfilled with the material excavated from the trench, provided it is free of organic matter and rocks of 75mm diameter or larger, so as not to cause subsidence or prevent ready excavation with hand shovels. If necessary, the Contractor shall import suitable, approved material.

2. Procedures for Backfilling

2.1 Non Trafficable Areas

For trenches in non trafficable areas, the final backfill material shall be placed, compacted and neatly trimmed off to the final verge level. Backfill shall be placed and compacted in layers not exceeding 150mm loose thickness for clay/cohesive materials or 300mm loose thickness for sand/gravel/cohesionless material.

Backfill under non-trafficable areas shall be compacted to not less than 95% of the maximum dry density when tested by the methods of Section 5 of AS 1289 for excavations in road verges, public open spaces. For all areas in private properties (except paved areas) the compaction shall achieve the density of the surrounding ground (with a minimum of 95% dry density ratio in accordance with Section 5 of AS 1289). For cohesive materials "standard compaction" shall be used as the reference density. For sands and gravels "modified" compaction shall be used as the reference density.

2.2 Trafficable Areas

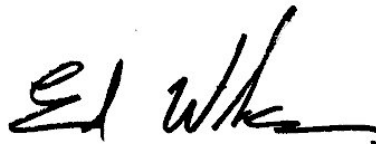
Backfill of trenches under roads, crossovers and car parks shall be entirely of sand, and shall be free of clay, vegetable or foreign material, and placed and compacted as follows:-

The backfill shall be placed, levelled and compacted to not less than 95% of the maximum modified dry density when tested by the methods of Section 5 of AS 1289.

Backfill shall be evenly placed and compacted in lifts not exceeding 300mm unless otherwise specified. The Contractor shall strictly monitor the moisture content of the fill and generally ensure that it remains in the range of 85% to 115% of the optimum moisture content as determined in accordance with the latest edition of AS 1289.5.2.1 "Methods of Testing Soil for Engineering Purposes – Soil Compaction and Density Tests". The Contractor shall be responsible to ensure that all backfill is placed with a moisture content most suited to the specific site and soil conditions. Where sand is not available, then the backfill shall be cement stabilised. The pavement above the backfill shall be reinstated to the same thickness and composition as the adjacent pavement.

2.3 Perth Standard Penetrometer

In certain conditions, in sand, the Superintendent may accept the use of a calibrated Perth Standard Penetrometer as a means of acceptance of the level of compaction of fill. In sand the minimum acceptable Density Index shall be 65 to 80 as approved by the Superintendent. The Penetrometer resistance shall be correlated with dry density ratio or density index as applicable.



Authorised by: _____
Ed Wilcox

Date Issued	Description	Revision
04/01/2006	Original Issue	0