



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 5:

Soil Stripping with Towed Earth Scrapers

Issued by the Farming and Rural Conservation Agency, Cambridge

April 2000



MAFF FOREWORD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of afteruses, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development*.

Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling “Good Practice” to operators, soil moving contractors, consultants and planning authorities.

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

This document should be cited as MAFF (2000), Good Practice Guide for Handling Soils (version 04/00). FRCA, Cambridge.

Any views expressed in the guidance are those of the consultant and do not necessarily represent the view of the Ministry of Agriculture, Fisheries and Food.

*(DETR, A Better Quality of Life, May 1999, paragraphs 6.66 and 8.50)

**MPG7 (November 1996, paragraph 3).

Acknowledgements

The Guide was written and prepared by Dr R N Humphries of Humphries Rowell Associates, Charnwood House, Loughborough, LE11 3NP, UK. The art work was by R Shenton of H J Banks & Co.

SHEET 5 SOIL STRIPPING WITH TOWED EARTH SCRAPERS

The purpose of this Guidance Sheet is to provide a model method for best practice where tracked bulldozers pulling scraper boxes are used to strip soil. This Guidance Sheet comprises 6 pages of text, 2 figures and a user response form.

The model may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked with cleats), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses a tracked bulldozer pulling an earth scraper 'box' to strip and transport soils to the replacement areas or to storage. An auxiliary bulldozer may be required to assist in the lifting of soils and the management of the soils stripping area and haul routes.

The earth scraper soil handling method can significantly affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This

is primarily caused through unavoidable repeated trafficking over the soils during the lifting and the building and excavating mounds, and on replacement; the effects of which increases with increasing soil wetness. Consequently, for satisfactory restoration there is a need for effective decompaction treatment during the replacement operation (see Sheet 19). Decompaction treatment is an obligate requirement when soils are handled by towed earth scrapers.

There are a number of key operational points during stripping to minimise the degree and extent of severe soil deformation, and to aid the effective treatment of the compaction on replacement:

- (i) To minimise compaction:
 - the adoption of an 'in-out' only at the end of strips minimises trafficking.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - the soils are to be picked up in as thick layer as possible whilst maintaining their operational efficiency, using an auxiliary bulldozer to push if necessary.
 - the soil layers should have a moisture content of 5% or greater below their lower plastic limit*. Moisture content should be assessed by oven drying* of samples taken from representative locations and mid/lower points of each soil horizon. [*Or as required in the planning conditions.]
- (ii) To minimise soil wetness and rewetting:
 - the bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture

contents. The soil profile within the active strip should be stripped to the basal layer before rainfall occurs and before stripping is suspended.

- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting earth scrapers.
- the area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- the maintenance of a transpiring crop is important, and an appropriate cropping regime should be established for the year of soil stripping. Before stripping, excess vegetation should be removed; in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

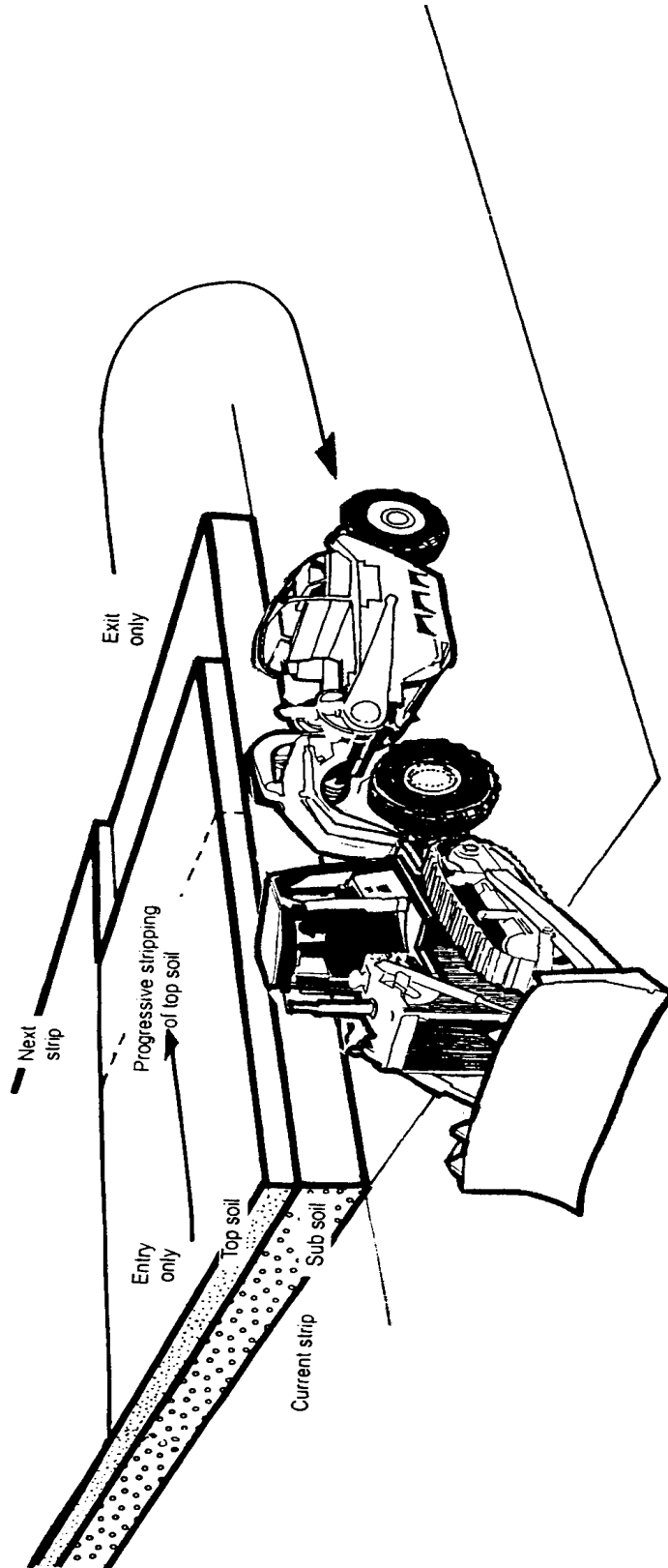
The Stripping Operation

- 5.1 The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- 5.2 Soil stripping operations should not start until the required soil moisture levels are reached (as determined by the agreed method), and should be suspended as soon as the water content returns to these levels. Prior to work commencing a Meteorological Office forecast should be obtained which gives reasonable confidence of soil stripping proceeding without interruptions from rainfall events. If significant rainfall is forecast or occurs during operations, the stripping must be suspended, and where the soil profile has been disturbed it should be removed to base level. Stripping must not restart unless the weather is expected to be dry for at least a full day.

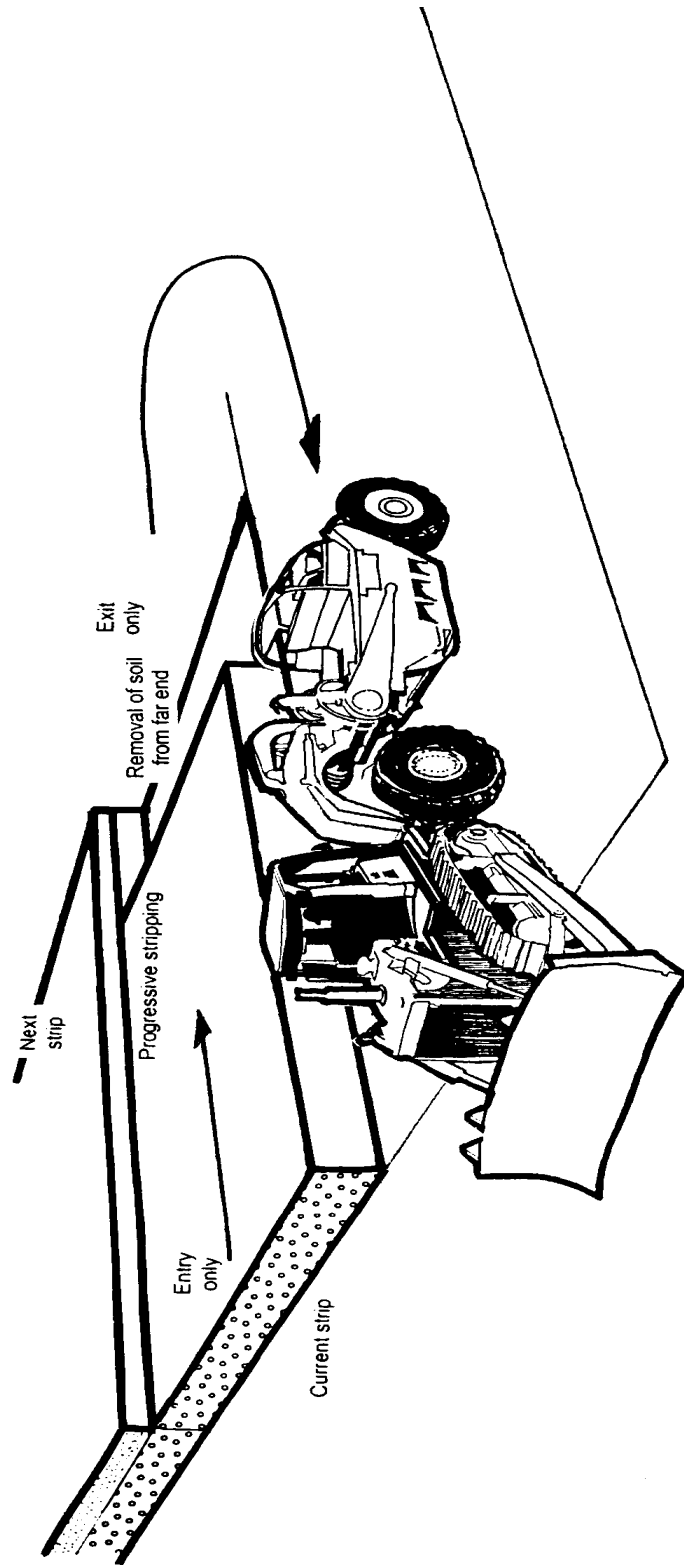
- 5.3 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable their maximum operating efficiency. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fails.
- 5.4 The operation should follow a detailed stripping plan showing soil units to be stripped, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and ranges of thickness. Detailed daily records should be kept of operations undertaken, and site and soil conditions.
- 5.5 Within each soil unit the soil layers above the base/formation layer are to be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers; each layer stripped to its natural thickness without incorporating material from the lower layer. The next strip should not be started until the current strip is completely stripped to the basal layer. This is often referred to as the 'bed or strip system'. The system involves the progressive sequential stripping of the materials in strips (Figure 5.1). Where there is a gradient to the site, the main axis of the soil strips should be along the main axis of the slope.
- 5.6 The haul routes and storage areas must be defined, and should be stripped first in a similar manner.
- 5.7 The scraper is only to travel and work on the soil layer when stripping soils, otherwise it is to travel only on the basal/formation layer. The scrapers are to enter the strip at the designated 'in' end and only exit the strip at the 'out' end (Figure 5.1). Where possible, the scrapers are to travel in the same tracks as previous passes. If a bulldozer is used to assist the scraper by pushing, this is the only other machine to operate on the soils to be stripped.

- 5.8 The initial strip width and axis is to be demarcated. The soil profile is to be stripped in strips of two to three machine widths (about 6-12m).
- 5.9 Starting at the furthest end of the strip (Figure 5.1), the soil layer is to be picked up in the thickest layer possible (not less than 150mm) over the shortest distance possible, whilst maintaining the operational efficiency of the bulldozer and scraper (using an auxiliary bulldozer to push if necessary).
- 5.10 Topsoil should be recovered to the full width of the strip without contamination with subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of the topsoil horizon should be stripped progressively along the strip before subsoil horizons are started.
- 5.11 The upper subsoil in the current strip is to be stripped and monitored in the same manner (Figure 5.2). The final 50cm of the subsoil layer should be left as a step to protect the adjacent topsoil horizon from local collapses. The process is to be repeated for the lower subsoil and any other lower layer to be recovered as a soil material.
- 5.12 On completion of the strip, the procedures are to be repeated sequentially for each subsequent strip until the area is completely stripped.
- 5.13 Where the soils are to be directly replaced without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to release the lowest layer and enable the sequential movement of materials. The stored initial soil material would normally be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain is forecast.

- 5.14 Where the stripping operation is likely to be interrupted by rain or there is likely to be over-night rain, remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.



**Figure 5.1 Soil stripping with towed
earth scrapers:
Top soil**



**Figure 5.2 Soil stripping with towed
earth scrapers:
Sub soil**

SHEET 5

Version: 04/00

FEEDBACK

It would be most helpful in assessing access to this Guidance, the use made of it and its further development if the following could be completed and returned to the FRCA:

<u>Organisation</u>	<input type="text"/>	
<u>Contact Name</u>	<input type="text"/>	
<u>Telephone/e-mail</u>	<input type="text"/>	<u>Date</u> <input type="text"/>

Is the Guidance to be used generally or for specific site/works?

General **Specific site**

If specific site – please identify

Name **County** **Country**

How was the Guidance obtained?

Internet **FRCA** **Other**

If other – please identify source

Source of Guidance

When was the Guidance obtained?

Month **Year**

Please provide any helpful comment/experience which may benefit the Guidance (use additional sheets if necessary)

<input type="text"/>
<input type="text"/>

Please copy and return to: M Stephen, Farming and Rural Conservation Agency, Rural Development Team, Government Buildings, Block C, Brooklands Avenue, Cambridge CB2 2BL, UK