IQ

The Institute of Quarrying

Good Practice Guide for Handling Soils in Mineral Workings

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

Published in the UK by:

The Institute of Quarrying

McPherson House
8a Regan Way
Chetwynd Business Park
Chilwell,
Nottingham
NG9 6RZ

www.quarrying.org

The information in this publication is general guidance on the best practices and approaches to soils guidance.
Specialist advice should always be sought if you need more details about what action to take in your own circumstances.

First Edition published 2021.

For over 100 years the Institute of Quarrying has been supporting people working in the mineral extraction industry. It is the only international professional body for quarrying, construction materials and the related extractive and processing industries. IQ's focus is to be the global leader in standards for the sector, to push innovation and operational best practice, to support the industry in driving healthy, sustainable workplaces and to promote the positive impact of the industry and profession. Being a member of IQ means being part of a global community of industry professionals committed to sharing knowledge and improving industry standards.

GOOD PRACTICE GUIDE FOR HANDLING SOILS

In Mineral Workings

PART TWO: Model Methodology

- Sheet C -

Excavation of Soil Storage Mounds
with Excavators and Dump Trucks

Author: Dr R N Humphries CBiol CSci FRSB FBSSS FIQ
- Blakemere Consultants Ltd & Celtic Energy Ltd

Supporting artwork was provided by R Shelton (H J Banks & Co)
and D Fisher (Blue Room Graphics Ltd).

Version 1 | July 2021 | © Institute of Quarrying

Preface

The purpose of Sheet C of the guidance is to provide a model method of best practice where excavators and dump trucks are to be used to recover soils from storage mounds.

The guidance is intended for use by planning officials, statutory consultees, mineral operators and their supporting teams and specialist consultants, and earth-moving contractors, their site supervisors and machine operators.

Successful soil handling schemes are dependent on the soil resources being clearly identified and the conditions in which they are to be handled. This information should be contained in the Soil Resource & Management Plan (SRMP) and communicated to those involved in its implementation.

Key issues to be addressed are:

i) Avoiding conditions when soils are wet/ plastic during handling
ii) The minimisation of soil compaction caused by trafficking and soil wetness
iii) Using appropriate remedial treatments where these are necessary
iv) Minimising soil loss, and mixing of soil layers or different soil types.

The SRMP should specify the type of earth-moving machinery and soil handling practice, and the soil wetness condition (see Part One of the Guidance) to be deployed to achieve the planned after use, soil functioning, and the environmental and ecosystem services. It is to be communicated in full to all involved and in particular to the supervisors and machine operators by appropriate means; including tool-box talks and site demonstrations. Supervision by trained supervisory staff is essential, as are monitoring and reporting.

The guidance does not specify the size or model of equipment as this is left to the mineral operator and contractor to specify and provide. The machines must be of a kind which are appropriate for the task and the outcomes required, and to be able to carry out the work safely and efficiently.

Should the agreed methodology need to be modified or changed significantly, this should be agreed in advance with the mineral planning authority. The SRMP should include a mechanism whereby unexpected less significant changes can be quickly resolved through consultation between the operator, the planning authority and statutory consultee, and soil specialist.

All persons involved in the handling of soils must comply with all relevant legislation with respect to Health and Safety, in particular the Health and Safety at work Act 1974 and in the case of mineral extraction operations, The Quarries Regulations 1999 and its relevant statutory provisions; in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. These requirements take preference over any suggested practice in this Sheet and the SRMP should have taken these into account.

The users of this guidance are solely responsible for ensuring it complies with all safety legislation and good practice, including the manufacturer’s specifications for the safe operation of the specific machines being used, and that all machines are in a good condition and well maintained and are suitable for the task. It is important that those involved in the operation of earth moving machines are competent and have the necessary training and certification.

Introduction

This soil handling method uses back-acting excavators and sometimes tracked shovels to recover soils from storage mounds in combination with dump trucks to transport the soil to the replacement area. Top- and subsoil may be stored in separate mounds or in clearly defined parts of the same mound, in some circumstances where the topsoil can be easily recovered it may be laid over the subsoil.

In this soil handling option the mounds are either built as single 'tier' or as 'multi-tiers'. In the single tier only the excavator, and if used the bulldozer, traffic the soil surface of the mound. In the multi-tier, the mound is also trafficked by loaded dump trucks.

The suitability, advantages and disadvantages are discussed in Sheet B and are predetermined here by the circumstances and the decision to store the soils. The removal of soils from the store can cause additional compaction. The advantage of this model method is that it should minimize additional severe compaction of the soil as trafficking is minimized. However, where the soil has been stored in multi-tier mounds it is likely to be a need for decompaction treatment of the interface between the tiers where the dump trucks have trafficked during the excavation and loading operation.

MODEL METHODOLOGY

C.1 The timing of excavation of the soil storage mounds will be governed by the weather and soil conditions governing stripping (see Sheet A). Key operational points to minimize the risk of severe soil compaction and soil wetness are summarised in Boxes C.1 and C.2.

C.2 All machines must be in a safe and efficient working condition at all times. The machines are to only work when ground conditions enable safe and efficient operation. Otherwise the operation is to be suspended until suitable remedial measures can be put in place.

C.3 The trucks should enter the storage area and draw alongside the active excavation face. The

Box C.1 - To minimize compaction:

- The dump trucks should only operate on the 'basal'/non-soil layer, and their wheels must not on any circumstances run on to the soil in store
- The excavator should be the only machine to operate on the single tier soil mound
- The machines are to only work when ground conditions enable their efficient operation
- When excavating the multi-tier mounds, to avoid trafficking, a dozer can be used to push the upper tier down to the excavator avoiding the need for trucks trafficking on the mound otherwise excavate tier by tier starting with the uppermost with trafficking confined to the upper surface of the lower tier
- ff severe compaction has been caused then measures are required to treat it before it is loaded into the trucks by the excavator 'digging' over the affected layer (see below and Sheet N).

Box C.2 - To minimize soil wetness and rewetting:

- The mound should be shaped to shed water before rainfall occurs whenever removal 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 dump trucks.

Box C.3 - Choice of Bucket Type

For hard /stony soils toothed buckets are needed. Where the mixing of soil layers at their interface is to be minimized, a bucket with a 'blade' is preferable where the soil is 'soft' and free of large stones or stone free.

Similarly, the choice of bucket type, whether it is a standard 'digging'/bulking or wide ditching type will depend on the soil strength and stoniness.

back-acting excavator is stand on top of the mound to load trucks (**Figure C.1**) using an appropriate bucket type (Box C.3). The mound is to be dug to the base before moving progressively back along its axis.

C.4 When excavating the multi-tier mounds, where possible, to avoid trafficking a low ground pressure bulldozer can be used to push the upper tier soil down to the excavator. This avoids the need for dump trucks trafficking on the mound. Otherwise excavate tier by tier starting with the uppermost with trafficking confined to the upper surface of the lower tier. Here the excavation should be at the same height of tiers as originally built so that the same surfaces are used for trafficking to build it are again used, so as to minimize further severe compaction (**Figure C.2**). Having removed the upper tier, the trafficked layer(s) must be decompacted. This can be achieved by progressively digging the surface, as described on Sheet N, in advance of loading the next layer. It is essential that the digging is effective and this needs to be checked before soil is loaded. The process is repeated for each soil tier.

C.5 Any exposed edges/surfaces should be shaped on the onset of rain during the day. All surfaces should be shaped to shed water at the end of each day.

C.6 Work should stop in wet conditions (Box C.4) with measures undertaken to prevent ponding at the base of the mound and on the basal layer. At the start of each day ensure there is no ponding on the basal layer and operating areas.

Operational Variation

C.7 Front loading tracked machines may be used to excavate single tier soil mounds provided that they only operate on the basal layer along with the dump trucks (**Figure C.3**).

Box C.4 - Rainfall Criteria:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/ near to their moisture limit
- In light rain soil handling must cease after 15 minutes
- In heavy rain and intense showers, handling shall cease immediately

In all of the above, after rain has ceased, soil tests shall be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.

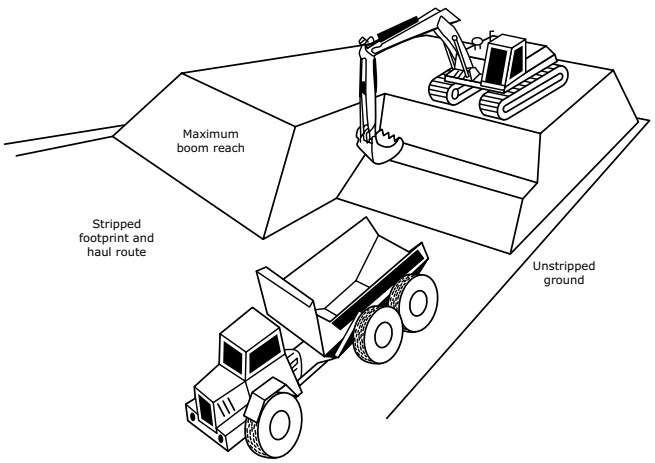

Figure C.1: Excavation of soil storage mounds with excavators and dump trucks: Single tier mounds.

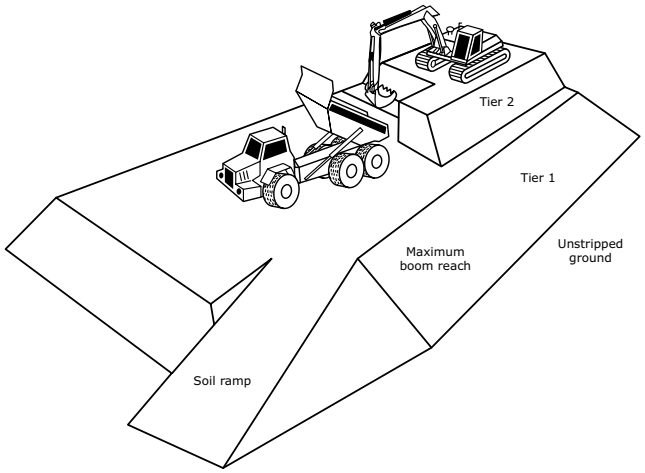

Figure C.2: Excavation of soil storage mounds with excavators and dump trucks: Multi tier mounds.

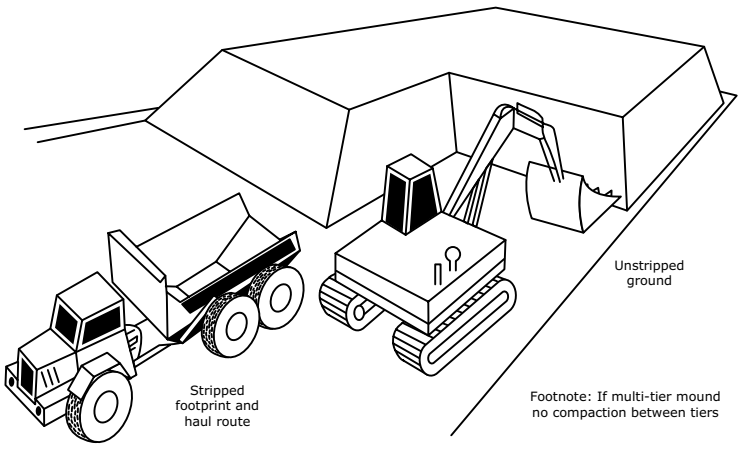

Figure C.3: Excavation of soil storage mounds with front loading shovels and dump trucks: Single and multi tier mounds.