

A WIRTGEN GROUP COMPANY



WIRTGEN Surface Mining Manual.

Applications and Planning Guide



Contents

1	The benefits and applications at a glance	9
1.1	Summary	10
1.2	Selective mining	13
1.3	Extracting and crushing material without blasting	14
1.4	Cutting trenches, surfaces and embankments with precision	15
1.5	Production of tunnel floors	16
1.6	Rehabilitation of haulroads	17
2	Which Surface Miner for which job?	19
2.1	Performance ranges of Surface Miners in easily crushable material	20
2.2	Assesment of rock cuttability	21
2.3	Which Surface Miner for which job?	22
3	The main technical data	31
4	Principle of operation and essential design features	37
4.1	Principle of operation	38
4.2	Machine design	41
4.3	Cutting depth control	44
4.4	Steering systems	47
5	WIRTGEN cutting technology	49
6	Cutting performance as a function of rock properties	61
7	Gradation	75
8	Planning aids for economic operation	80
8.1	Highly selective extraction	84
8.2	Machine dimensions, turning radii, discharge heights and distances, ambient conditions	85
8.2.1	Machine geometry	85
8.2.2	Cutting in a bend	85
8.2.3	Ambient temperatures	85

8.2.4	Working at higher altitudes	85
8.3	Effective performance as a function of the length of the working area	104
8.4	Working methods, manoeuvring methods and times	107
8.4.1	Working in a pit	107
8.4.2	Progressing in longitudinal direction of the opencast mine	111
8.4.2.1	Open cut operation	111
8.4.2.2	Trench construction	112
8.4.3	Progressing in transverse direction of the opencast mine	113
8.4.4	Working on benches	115
8.5	Methods and times for turning	117
8.5.1	Straightforward turning in wide working zone	117
8.5.2	Transverse cutting in front of slopes (turning radius)	119
8.5.3	Turning in working zones of medium width	121
8.5.4	Manoeuvring in narrow working zone	123
8.5.5	Turning times	125
8.6	Cutting of ramps	127
8.7	Transverse and longitudinal slopes	128
8.8	Mixing different grades	133
8.9	Selective extraction from inclined or steep seams	134
8.10	Cutting of embankments	136
8.11	Producing trenches	138
8.12	Tunnelling operations	140
8.12.1	Creating the tunnel floor	142
8.12.2	Cutting benches	144
9	Material loading	147
9.1	Choosing the loading system	148
9.2	Direct truck loading	151
9.3	Indirect loading	154
9.3.1	Sidecasting the material	154
9.3.2	Windrowing	155
9.4	Processing options depending on the various loading methods	158

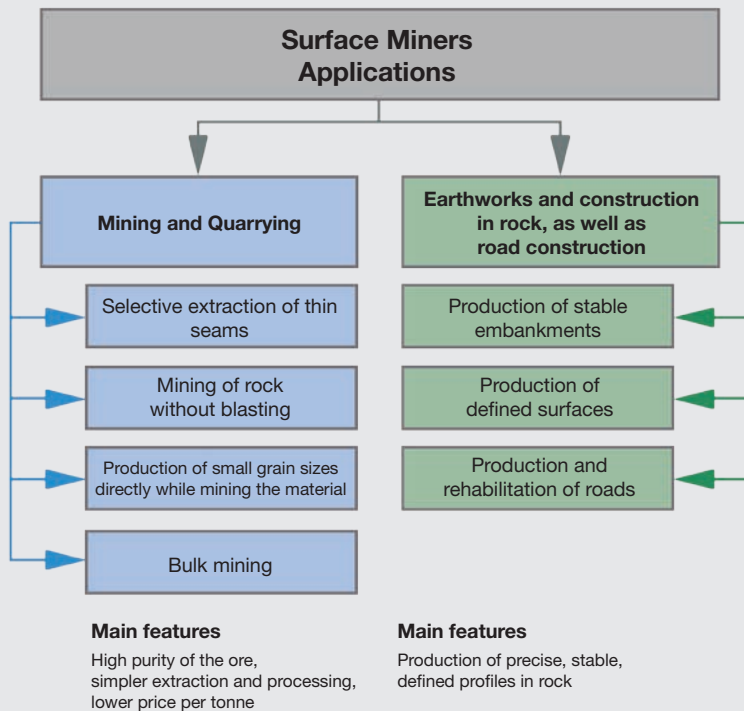
10	Tips for practical use	162
10.1	Transport and assembly	164
10.2	Preparing the working zone	166
10.3	Working without damage to the machine	167
10.3.1	Cutting along the cutting edge	167
10.3.2	Driving in bends	167
10.3.3	Travelling over long distances	168
10.3.4	Cutting with reduced cutting drum width	168
10.3.5	Conveying capacity	168
10.4	Driving in difficult conditions	169
10.5	Adjustment and control of the cutting depth	170
10.5.1	Forms of adjustment for the rigid axle	172
10.5.2	Levelling surfaces	173
10.5.3	Removing layers of defined thickness	175
10.5.4	Selective mining and creation of defined surface profiles	177
10.5.5	Copying existing surface profiles	177
10.5.6	Final lane of a work section	178
10.5.7	Working on a tall embankment without edge protection	179
10.6	Optimizing cutting performance and grain size	180
10.7	Dust suppression	181
10.8	Effective supply of materials and maintenance	182
10.8.1	Fuel	182
10.8.2	Water	182
10.8.3	Maintenance	182
10.8.4	Tool changes	183
10.8.5	Communication	183
11	Job-site examples	185

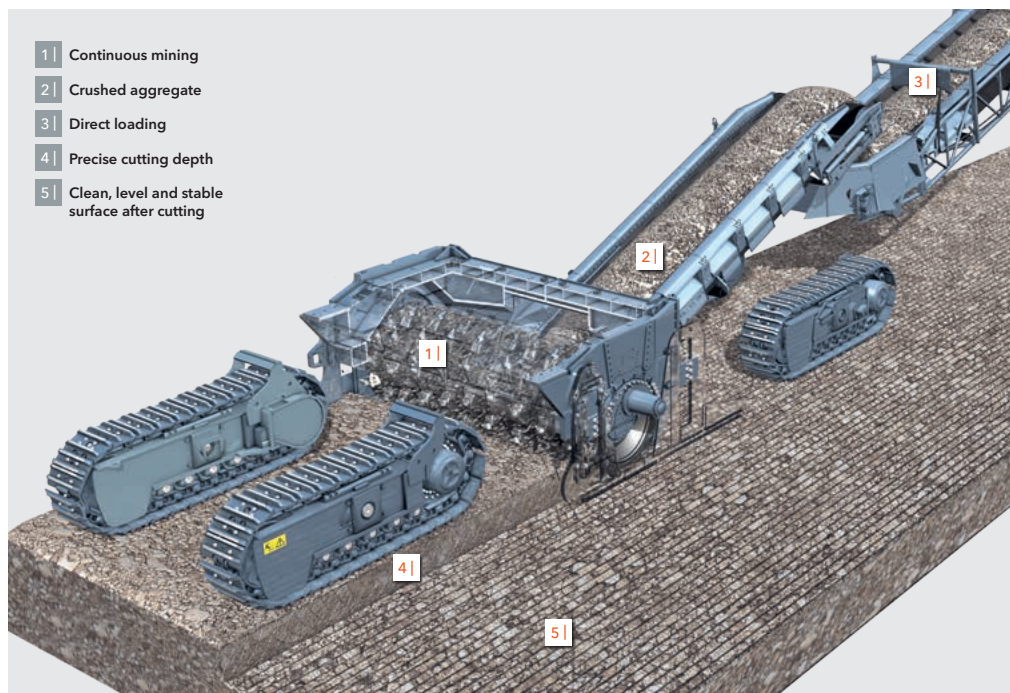
Annex	195
Conversion tables	196
Rock testing methods	200
• Point Load Test	200
• RQD value	200
• Mohs hardness scale	201
• Seismic wave velocity	202
• Cuttability and rippability of rock	203
• Specific weights, bulking coefficients and Mohs hardness of selected types of rock	204
Glossary	205

1.1 Summary

WIRTGEN Surface Miner technology yields the following essential advantages:

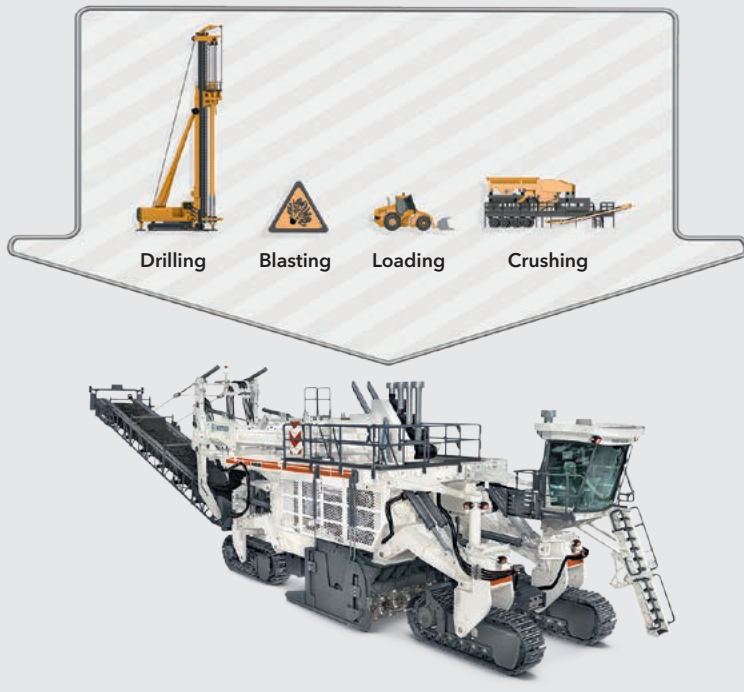
- > Mining without blasting
- > Simplified mining
- > Better quality of the removed material due to highly selective mining processes (ROM = Run-of-Mine)
- > Robust, clean cut edges and benches





Surface Miners cut, crush and load the material in a single operation with just one machine





Drilling

Blasting

Loading

Crushing

Surface Miners simplify the complex process of extracting and processing minerals. It is a production system that extracts, crushes and loads the material in a single operation.

Advantages:

- > Higher system availability
- > Lower operating costs
- > Only one machine is needed for several work steps; this simplifies coordination and planning of the mining process, machine use, operation and maintenance.

1.2 Selective mining

One of the most important features of the Surface Miners is their ability to work selectively. Thin seams interspersed with intermediate rock lay-

ers can be cut precisely and economically, for example.



Thin coal seams can be mined selectively with Surface Miners

Mining companies throughout the world are exploiting the advantages of WIRTGEN Surface Miner technology with its extremely precise control of the cutting depth to extract high-quality mined material (ROM) in coal mines, limestone mines, bauxite mines, phosphate mines and gypsum mines.

Selective mining with Surface Miners ensures that thin seams of high-grade minerals and overburden can be mined separately.

Advantages:

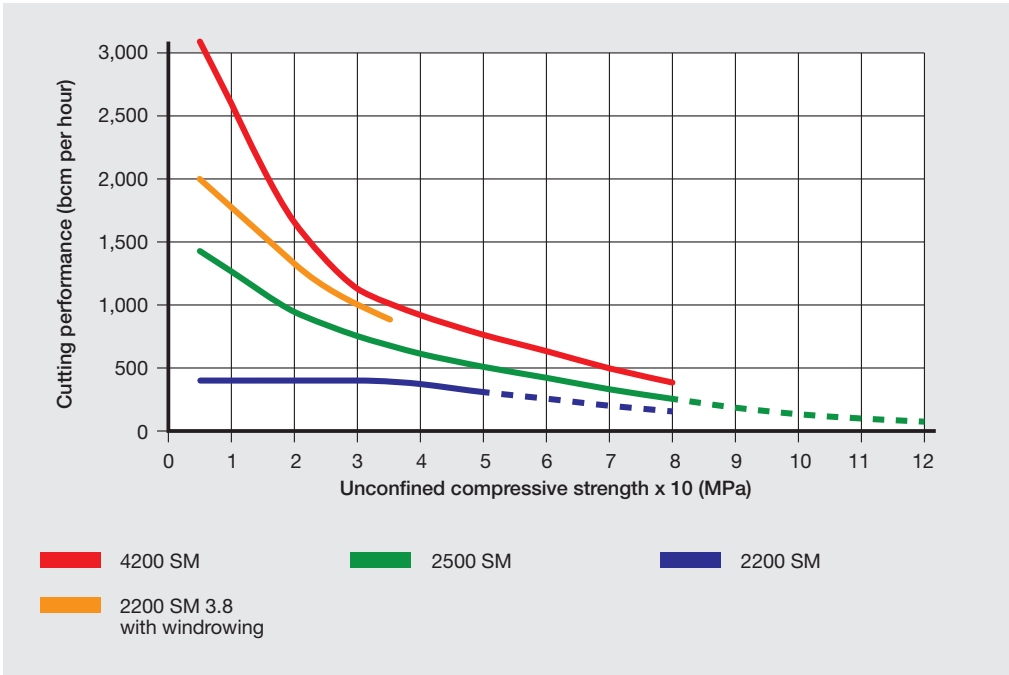
- > Better quality of the cut material
- > Higher exploitation of the deposit
- > Improved overburden-to-mineral ratio
- > Less processing required

2.1 Performance ranges of Surface Miners in crushable material

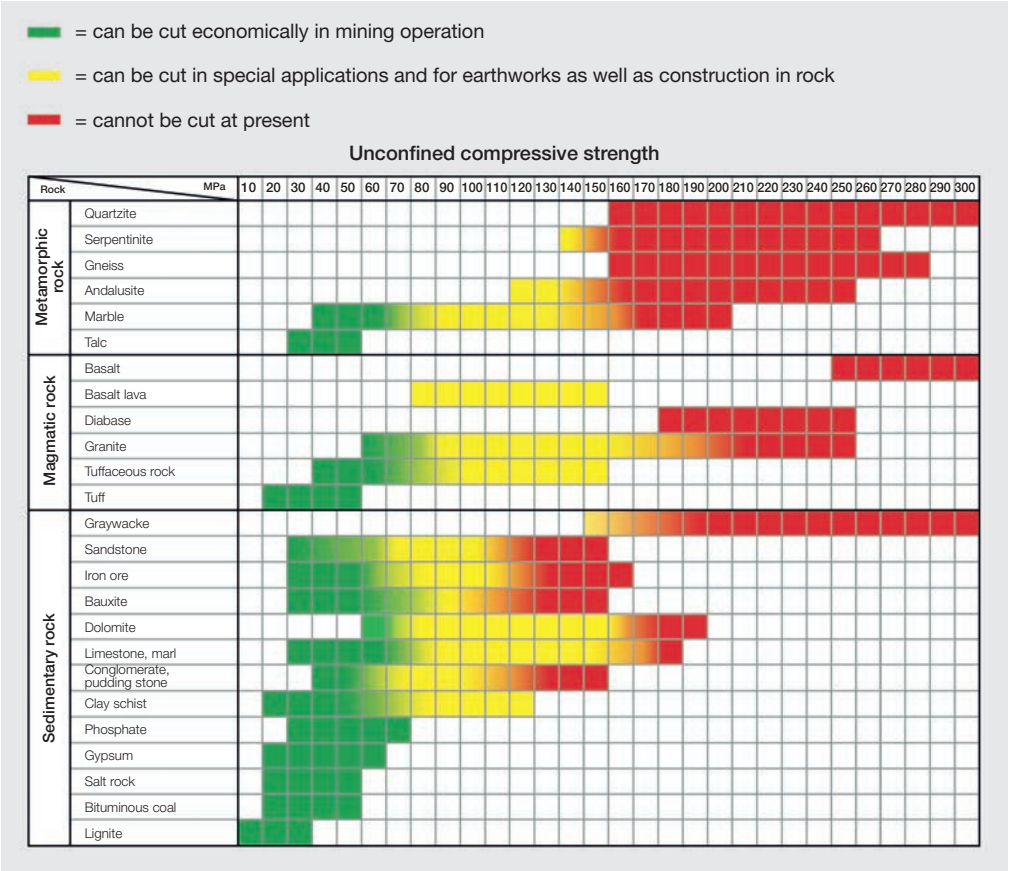
The performance, tool wear and consequently the cost-efficient mode of operation of Surface Miners are decisively dependent on the mechanical properties of the rock to be cut. In the following diagram, the performance ranges of the Surface Miners and cuttability of the various types of rock are plotted as a function of the unconfined compressive strength of the respective rock types.

The maximum cutting performances listed in the table “Performance ranges” apply for the respective unconfined compressive strengths and for highly fissured, crushed materials. The actual performance achieved may differ considerably from the values listed here. Further details on cutting performance can be found in the diagrams in chapter 6. Please contact our specialists at WIRTGEN for an estimate of performance and operating costs.

Performance ranges of the Surface Miners



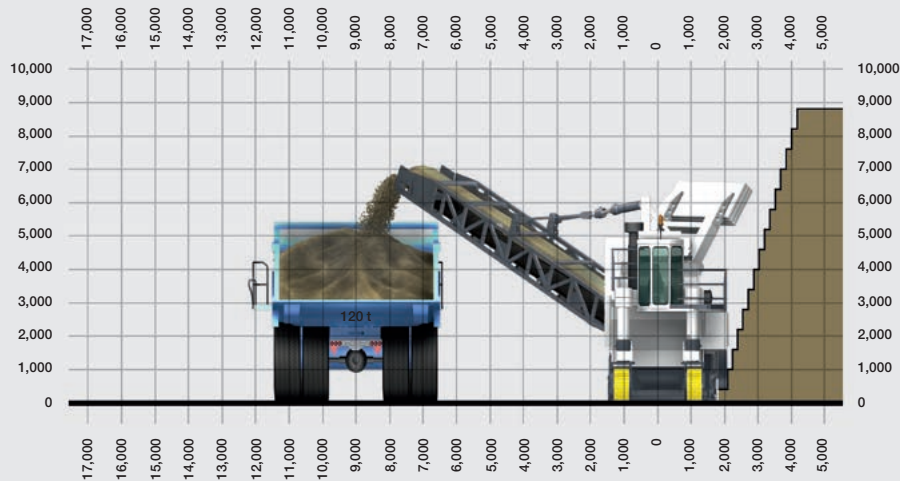
2.2 Assessment of rock cuttability



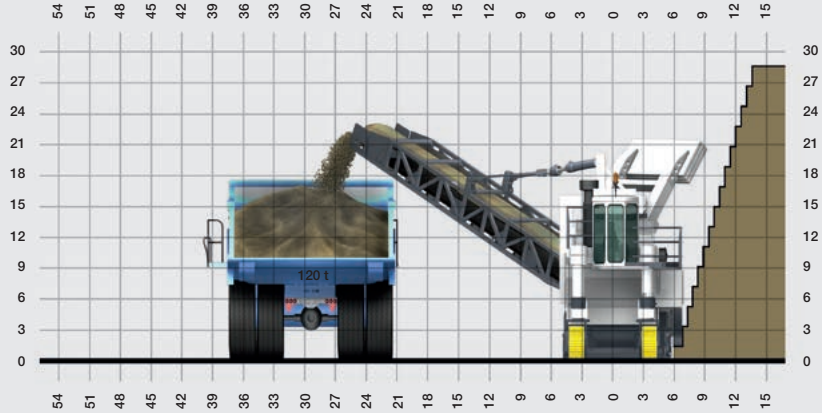
This general summary can be used to estimate the cuttability of a rock type. Queries concerning the cuttability of rock and the cutting performance to be expected with a Surface Miner should be addressed to WIRTGEN, together with data and information on the type of native rock and the open-cast mine.

Loading material onto trucks when working along embankment steeper than 54°
(discharge conveyor slewed max. 45°)

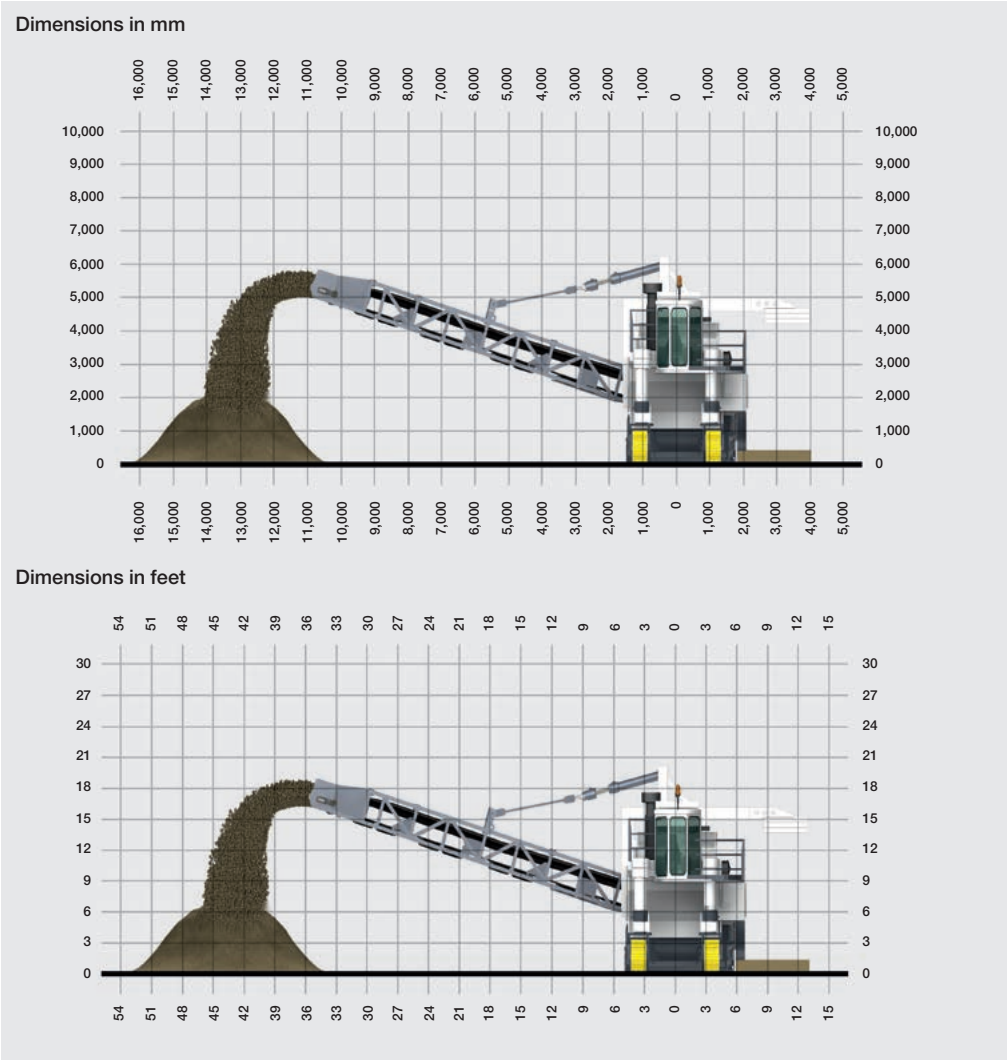
Dimensions in mm

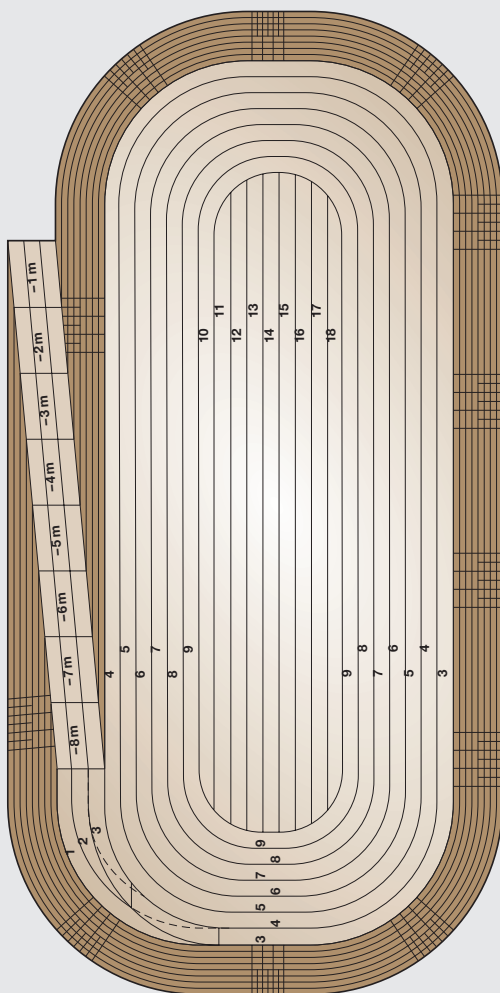


Dimensions in feet



Sidecasting material





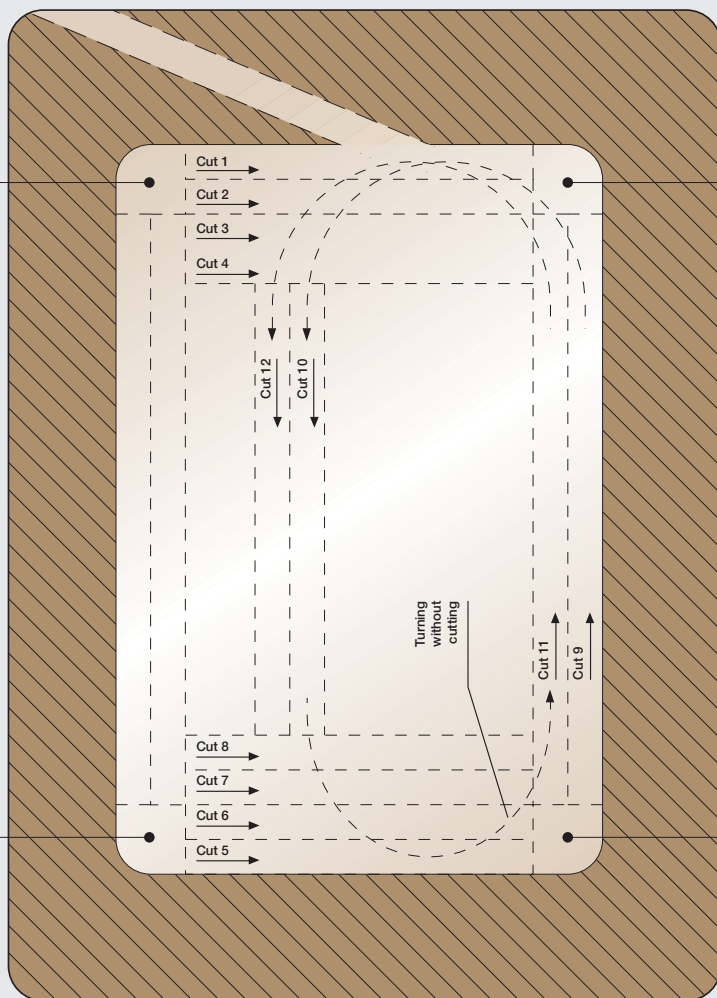
Harvest mode / working in layers (schematic illustration)

Removal with
auxiliary units

Removal with
auxiliary units

Removal with
auxiliary units

Removal with
auxiliary units



9.3 Indirect loading

9.3.1 Sidecasting

Sidecasting means that a stockpile is produced by dumping the material removed in one or more cutting operations on a stockpile via the miner's discharge conveyor. Depending on the slewing angle of the discharge conveyor, the material of between three to five adjacent cuts can be dumped on top of one another. Depending on the height of the resultant pile, the material can easily be picked up again by a front loader.

Advantage:

When sidecasting the material, the Surface Miner can continue cutting regardless of whether a truck is available for loading.



2200 SM – Sidecasting



2200 SM – Sidecasting

9.3.2 Windrowing

When working in windrowing mode, the cut material is deposited directly behind the machine without using the discharge conveyor system. This makes the cutting process independent of any loading processes (onto trucks). However, the material must subsequently be re-handled by a front loader.



2200 SM – windrowing mode



Surface Miner – windrowing mode