

Indian Standard

**GLOSSARY OF TERMS AND CLASSIFICATION
OF EARTH-MOVING MACHINERY**

PART III MOTOR AND TOWED SCRAPERS

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

GLOSSARY OF TERMS AND CLASSIFICATION OF EARTH-MOVING MACHINERY

PART III MOTOR AND TOWED SCRAPERS

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GLOSSARY OF TERMS AND CLASSIFICATION OF EARTH-MOVING MACHINERY

PART III MOTOR AND TOWED SCRAPERS

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 30 December 1968, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Earth-moving plant and machinery is being extensively used on all major irrigation projects, road construction, land reclamation and other tests involving removal and shifting of earth. Earth-moving machine has been in production in the country for over a number of years and the requirements have increased considerably in the last few years due to the overall increase in the development work and this has resulted in many manufacturers switching over their production to earth-moving plant and machinery. With the increasing use and manufacture of earth-moving machinery in the country it has been considered necessary by the Construction Plant and Machinery Sectional Committee to lay down the guide lines for present and future manufacture to ensure that there is standardization in the equipment under production or likely to be produced in future in the country.

0.2.1 As a first step towards this end, a glossary of terms relating to earth-moving machinery has been prepared with a view to unifying the various technical terms and expressions in connection with the manufacture and use of such machinery. This standard does not cover the requirements relating to design, manufacture and testing of equipment, which will be covered subsequently in separate standards.

0.3 For convenience of reference, the standard has been divided into five parts. IS:4988 (Part I)-1969* covers the definitions for the terms applicable in general to all types of earth-moving machinery and not specifically to any one equipment.

*Glossary of terms and classification of earth-moving machinery: Part I General terms.

IS:4988 (Part III) - 1968

0.3.1 The terms applicable to a specific type of machinery are covered in separate parts as below:

IS: 4988 (Part II)-1968 Glossary of terms and classification of earth-moving machinery: Part II Dozers

IS: 4988 (Part III)-1968 Glossary of terms and classification of earth-moving machinery: Part III Motor and towed scrapers

IS: 4988 (Part IV)-1968 Glossary of terms and classification of earth-moving machinery: Part IV Excavators

IS: 4988 (Part V)-1968 Glossary of terms and classification of earth-moving machinery: Part V Motor graders

0.4 In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.4.1 While formulating this standard, due consideration has also been given to the type of equipment on the future plan of production by various manufacturers. In deciding the size and output of different types of machinery, for example, dozers, scrapers, motor graders and excavators, it has been kept in view that the power for prime mover required for different categories of equipment is similar. It has been endeavoured that a prime mover which is used for light dozer would also be suitable to provide power for light motor grader or a light excavator.

1. SCOPE

1.1 This standard (Part III) gives definitions of terms applicable exclusively to motor and towed scrapers.

1.2 The standard also lays down the classification and method to be adopted in calculating the output of motor and towed scrapers.

NOTE — The definitions of terms applicable in general to all types of earth-moving machinery are covered in Part I of the standard.

2. DEFINITIONS

2.1 Apron — The front gate of a scraper body.

2.2 Apron Cutting — It is the distance from the cutting edge at the line of contact with the apron when closed, to the nearest edge of the apron when it is fully opened. This should be measured when the cutting edge is 15 cm above ground level.

2.3 Bowl—The bucket or body of a scraper used for carrying material or soil.

2.4 Depth

2.4.1 Depth of Cut—It is the distance that the front axle can be lifted vertically with the scraper-cutting edge and rear wheels on the ground. This shall be measured when the scraper is unladen, standing on horizontal ground with the tyres inflated to recommended pressures by the manufacturers.

2.4.2 Depth of Spread—It is the distance that the front axle can be lowered below ground line with scraper-cutting edge and rear wheels on the ground. This shall be measured under the conditions given in 2.9.

2.5 Efficiency—Depending upon the complexity of the task, type of soil and other environmental conditions the engineer is required to assess the likely output of the machines. This factor is called the task efficiency which under average conditions is taken as 1.

2.5.1 The output of machines is affected to a very great extent by the efficiency of operators. The efficiency of an average operator is normally taken as 0.75.

2.6 Scraper

2.6.1 Scraper Bottom Dump—A scraper which ejects the load over cutting edge.

2.6.2 Scraper Rear Dump—A two wheeled scraper that dumps load at the rear.

2.6.3 Scraper Tractor Towed—A large bowl mounted on pneumatic tyred wheels towed by a crawler or wheeled tractor which is capable of digging, loading, hauling over a considerable distance and spreading.

2.7 Soil Factor—The factor which when multiplied with the volume of loose soil (normally carried by the earth-moving machines) gives the compacted volume of earth.

2.8 Speed, Maximum—The maximum speeds of the motor scraper with its bucket (empty) shall be indicated in km per hour for the various forward and reverse gear ratios. In the case of torque convertor fitted vehicles, the measurements shall be made for minimum slip of the torque convertor.

2.9 Time

2.9.1 Cycle Time—The sum total of fixed time and travelling time is called the cycle time that is time taken by the scraper to complete one cycle of operation of loading and spreading.

2.9.2 Fixed Time — This is the time that the scraper will take in loading, changing gear and accelerating to gear speed, turning and spreading.

2.9.3 Travelling Time — This is the time the scraper will take to haul its load from the digging area after attaining the gear speed plus the time it takes to return from the spreading area to the loading area.

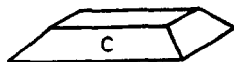
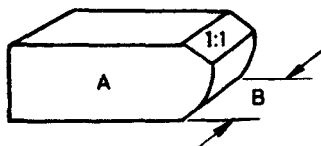
2.10 Tonnage Capacity — This is the capacity of a scraper which indicates its capacity in tonnes which it can carry safely on its pneumatic tyres.

3. CAPACITY OF SCRAPER

3.0 In case of scraper there are two types of capacities which are normally specified.

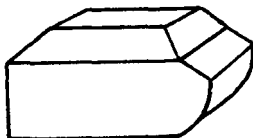
3.1 Struck Capacity (see Fig. 1) — This shall be actual volume enclosed by the bowl and apron struck off by a straight line passing along the top edge of the side plates or adjacent load carrying mechanism thereof. Struck capacity shall be given to the nearest 0.1 m³.

STRUCK
CAPACITY



(1 IN 1 SLOPE ON ALL SIDES)

HEAPED
CAPACITY



Struck capacity = (area A × width B)

Heaped capacity = (area A × width B) + volume C

FIG. 1 STRUCK AND HEAPED CAPACITY OF SCRAPER BOWL

3.1.1 When the top of the apron, in the closed position is below the top edge of the side plates, the capacity shall be limited, either by a plane from the top edge of the apron to the forward corners of the side plates, or by a plane at a slope of 1:1 extending from the top edge of the front apron to the plane formed by the top of the side sheets, whichever gives the smaller capacity.

3.1.2 To determine the 1:1 slope for the limiting plane, the scraper shall be set in its normal carrying position with apron closed.

3.1.3 Top extensions of the ejector above the side plates shall not be included in the determination of struck capacity.

3.1.4 The volume occupied by apron arms, shears, frames or other internal projections shall be disregarded in arriving at the struck capacity.

3.2 Heaped Capacity (see Fig. 1)—Heaped capacity shall be sum of struck capacity and volume enclosed by the four planes at a 1:1 slope extending upward and inward from the top of the solid portion of the ejector or near plate, and from the top edges of the side plates. Small barred or screened openings in the apron may be disregarded in determining the solid top line.

3.2.1 The scraper shall be set in the same carrying position as used for determining struck capacity.

3.2.2 For scrapers of less than 12 m^3 struck capacity, heaped capacity shall be given to the nearest 0.5 m^3 and for scrapers exceeding 12 m^3 struck capacity, heaped capacity shall be given to the nearest 1 m^3 .

3.2.3 If the top edge of the side plate (or extension thereof) front apron, or ejector is not a straight line, a mean line through its configuration shall be used to establish the plane enclosing the heaped capacity.

3.2.4 The possible interference of overhead structures such as sheaves, guides and cables with the heaped capacity shall be disregarded.

4. CLASSIFICATION

4.1 The capacity of a scraper shall be based upon its heaped capacity because it will give an idea of the ultimate output, on which the user can plan his work. While specifying the heaped capacity the angle of repose for calculating the volume of the earth above the struck capacity shall be taken as 1:1. Scrapers shall be classified into the following categories:

<i>Class</i>	<i>Heaped Capacity</i> m^3
Light	From 7 to 15
Medium	From 16 to 25
Heavy	Over 25

5. CALCULATION OF OUTPUT

5.1 The output of a scraper is calculated from the following formula:

$$\text{Output in cubic metres} = \frac{Q \times f \times E \times 60}{C}$$

where

Q = heaped capacity of bowl of scraper,

f = soil conversion factor (see Table 1),

E = a combined factor of operator efficiency and task efficiency (assume average operator's efficiency as 1.0 and normal task efficiency as 1.0), and

C = cycle time in minutes.

TABLE 1 CONVERSION FACTORS

Sl No.	MATERIAL	STATE	CONVERT TO		
			Bank	Loose	Compacted
(1)	(2)	(3)	(4)	(5)	(6)
i)	Sand	Bank	1.00	1.00	0.92
		Loose	1.00	1.00	0.92
		Compacted	1.09	1.09	1.00
ii)	Common earth	Bank	1.00	1.05	0.88
		Loose	0.95	1.00	0.84
		Compacted	1.14	1.19	1.00
iii)	Clay	Bank	1.00	1.20	0.80
		Loose	0.83	1.00	0.75
		Compacted	1.11	1.33	1.00
iv)	Rock	Bank	1.00	1.50	1.40
		Loose	0.67	1.00	0.93
		Compacted	1.11	1.07	1.00

5.1.1 Total fixed time in the scraper cycle is given in Table 2. Cycle time will have to be calculated based upon the haulage required in the specific earth-moving task.

TABLE 2 TOTAL FIXED TIME IN SCRAPER CYCLE

(Clause 5.1.1)

SL No.	ELEMENT OF FIXED TIME	TIME IN MINUTES FOR		
		Size of scraper (heaped capacity)		
		0 to 15 m ³	15 to 24 m ³	24 m ³ and above
i)	Loading	1.0	1.0	1.5
ii)	Gear changes and acceleration	0.5	1.0	1.5
iii)	Turns (2 off)	0.5	0.5	0.5
iv)	Spreading	0.5	0.5	0.5
v)	Total fixed time	2.5	3.0	4.0

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