

A guide to cost standards for dredging equipment 2009

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Summary

This guide is for use by all stakeholders in dredging projects, which include consultants, existing and potential clients, project financiers, insurers and dredging contractors. The publication offers a standard method to establish the capital and related costs of various types of dredging plant and equipment commonly in use. It is divided into four sections:

Chapter 1: Introduction.

Chapter 2: Description of the most common dredgers and dredging equipment used.

Chapter 3: A summary of the principles of cost standards.

Chapter 4: Cost standard tables.

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1

Introduction

1.1

Background

Dredging is a capital-intensive industry, often involving only a few main pieces of marine construction equipment on each project. It is also a civil engineering or marine activity that frequently takes place in an inhospitable environment, where site investigation costs can be high and construction risks are elevated due to the working conditions and the potential difficulties of obtaining site information. As a consequence, dredging works tend to be subject to variation, re-measurement and occasionally disputes relating to valuation. The capital and related costs of equipment are crucial to the evaluation of these matters.

The dredging industry operates in a global marketplace and the main international contractors work worldwide. From time to time, contractors form consortia for tackling large projects and plant is cross-hired between contractors to provide the most appropriate equipment or to make up for temporary shortages. Also, consultants, existing clients and potential clients throughout the world need to compare equipment costs and other criteria to evaluate tender documents.

For these reasons, the stakeholders in dredging projects, which include consultants, existing clients and potential clients, project financiers, insurers and dredging contractors – recognised the need for a standard method to establish the potential capital and related costs of the various types of dredger commonly in use. Accordingly, NIVAG¹ obtained records of typical maintenance and repair costs of different types and sizes of plant. Standardised methods were agreed for taking account of plant amortisation, which resulted in the original cost standards for dredging equipment being published.

Over time, the standards became familiar to advisers and other stakeholders evaluating costs of dredging projects in the European Union, and they became known worldwide (published under the name of NIVAG and then VG Bouw). The standards were updated annually using indices derived from the records of the European dredging companies, as well as the ship-building industry, and regularly republished to take account of changes in use, modernisation and other refinements.

CIRIA's *Cost standards for dredging equipment 2005* was a further revision of these previous cost standards, and was audited by an independent panel. The cost standards were substantially restructured to make them more user-friendly. However, users of the previous NIVAG and VG Bouw editions will find that many of the principles for developing cost were retained.

The 2009 revision of the publication has been necessitated by the extensive changes in base costs and technological improvements that have occurred over the last four years and again has been independently audited.

These CIRIA cost standards are intended to provide insight into the capital and some of the related costs of dredging equipment thereby delivering transparency to consultants, clients, project financiers and other stakeholders to dredging projects.

¹ NIVAG is the former Dutch Institute of Major Contractors

1.2

The philosophy behind the cost standards

The cost standards illustrate standardised methods for assessing the costs of the components that are unavailable from other sources, eg depreciation and interest, and maintenance and repair costs. These costs relate to plant being operated on conventional construction projects. However, the cost standards do not give the full cost of operating a particular type of dredging equipment, nor are they applicable to vessels specifically designed for mining.

Section 3.1 describes some of the other site specific or work-specific costs that would need to be assessed to arrive at a full running or standing cost for the plant. It should also be recognised that the running cost of equipment is only one component of the full cost of a dredging site and that cost structures, for example depreciation policies, vary between different companies and are often project specific.

Users of the cost standards need to recognise that there is a variation in the characteristics of different dredgers of the same type. Particularly in the larger size ranges, companies have a considerable influence in the design of the vessels and these are often aimed at specific niches in the marketplace. As a consequence, the possible variation from the average can be significant. This is clearly illustrated in the graph in Figure 1.1 showing lightweight versus hopper capacity for a set of trailing suction hopper dredgers. Similar variations in dredger characteristics are to be found for all types of dredging equipment depending on their design and functionality. These variations will alter over time as designs are modified to take account of new regulations, innovation and working practices, eg emission controls. Users of the guide should be careful to recognise these future modifications and take account of them in their estimates as appropriate.

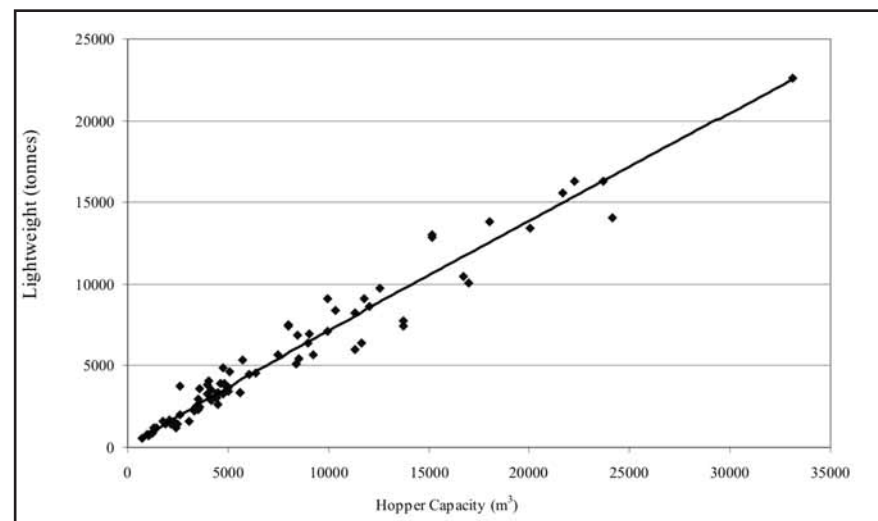


Figure 1.1

TSHD – lightweight vs hopper capacity

1.3

Layout of the cost standards

Brief descriptions of the main categories of dredging plant follow this section. These are not intended to be exhaustive, but are merely intended to guide those unfamiliar with dredging equipment to the correct sections in the publication. Those unfamiliar with dredging equipment are also recommended to undertake further reading.

Following the description of the plant (Chapter 2), there is an explanation of how the cost standards are to be applied (Chapter 3). The cost standards themselves for the main items of dredging plant are set out in Chapter 4, which includes sections on:

- 1 Trailing suction hopper dredgers.
- 2 Cutter suction dredgers.
- 3 Other suction dredgers.
- 4 Booster stations.
- 5 Backhoe, grab and bucket dredgers.
- 6 Vessels and barges.
- 7 Jack-up pontoons.
- 8 Auxiliary equipment.
- 9 Pipelines.

Definitions of the main terms used can be found in Appendix A1 following the example tables, while explanation of the parameters used in the tables are given in Chapter 3.

Appendix A2 provides example computations.

All dimensions given in the cost standards refer to the metric (SI) system.

4 Cost standard tables

Group 1 Trailing suction hopper dredgers

Table 100 Trailing suction hopper dredgers

With certificate for unrestricted navigation area ^a

Unloading through bottom doors, valves or sliding doors with or without shore discharge

Service life 18 years

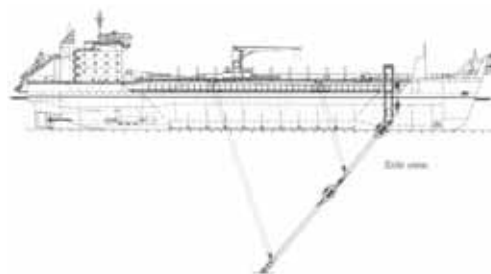
Service hours 168 hours per week

Residual value 10 % of V

Utilisation period 33 weeks

D+i 9.647 % of V per year or 0.292 % per week

Standard value $V = 6000 \times W + 1\,212\,000 \times W^{0.35} - 6\,464\,000 + 1900 \times P_t + 785 \times J_t + 910 \times S$



Hopper volume	Displacement at dredging mark ^b	Lightweight	Power dredge pumps during suction	Power jet pumps on draghead	Free sailing propulsion power	Value	Costs per week		M+R/week
		(W)	(P _t) ^b	(J _t)	(S)	(V) ^d	D+i	M+R	
cu.m	t	t	kW	kW	kW	€	€	€	% of V
900	2000	635	350	220	950	10 600 000	30 952	21 917	0.2068
1300	3000	945	600	300	1550	15 300 000	44 676	30 508	0.1994
1800	4000	1260	880	360	2200	19 800 000	57 816	38 734	0.1956
2400	5200	1640	1000	660	2500	24 200 000	70 664	42 625	0.1761
2700	5800	1800	1250	660	3550	27 200 000	79 424	45 142	0.1660
3500	7600	2400	1550	760	4000	33 600 000	98 112	50 513	0.1503
4700	9900	3050	1950	800	5100	40 900 000	119 428	56 639	0.1385
6200	13 000	3925	2400	850	6450	50 100 000	146 292	64 359	0.1285
7700	16 000	4780	2600	1000	7350	58 100 000	169 652	71 072	0.1223
9100	19 000	5635	3500	1600	9400	68 700 000	200 604	79 967	0.1164
11 000	23 000	6830	4320	1600	10 800	80 400 000	234 768	89 786	0.1117
12 500	26 000	7610	5200	1600	13 000	89 800 000	262 216	97 674	0.1088
13 500	29 000	8685	5200	1800	13 000	97 700 000	285 284	104 303	0.1068
18 000	40 000	12 100	6680	2000	16 700	128 000 000	373 760	129 730	0.1014
19 000	42 000	13 750	7000	2000	17 500	141 000 000	411 720	140 639	0.0997
22 500	48 000	15 950	7200	3000	18 000	157 000 000	458 440	154 066	0.0981
24 000	60 000	18 250	9600	4000	24 000	184 000 000	537 280	176 723	0.0960
35 000	83 000	22 440	9600	4000	24 000	212 000 000	619 040	200 220	0.0944
45 000	105 000	27 000	13 000	4500	38 000	261 000 000	762 120	241 339	0.0925

a For trailing suction hopper dredgers without a certificate for unrestricted navigation area, V should be decreased by 10 per cent. For further explanation about class, see Section A1.3.

b Displacement on dredging mark = lightweight W + deadweight.

c Unless dredge pumps during trailing have their own power supply that cannot be used for other applications, P_t is defined as 40 per cent of the main engine power but not exceeding the mechanical limitation of the dredge pump drive.

d Standard values for large TSHDs exhibit a different trend to the smaller vessels because of the inclusion of extra equipment, such as extended pipes and submerged dredge pumps.

M+R for dredgers of more than 35 000 m³ hopper volume are extrapolated on the basis of trends, due to the recent construction of these vessels there are insufficient data to base these figures on actual records.

In cases where there is a different value of V than given in the table, interpolate M+R linearly.

Table 101 Trailing suction hopper dredgers, split bottom typeWith certificate for unrestricted navigation area ^a

With or without shore discharge

Service life 18 years

Service hours 168 hours per week

Residual value 10 % of V

Utilisation period 33 weeks

D+i 9.647 % of V per year or 0.292 % per week

Standard value $V = 3700 \times W + 1\,960\,000 \times W^{0.35} - 14\,240\,000 + 1900 \times P_t + 785 \times J_t + 910 \times S$

Hopper volume	Displacement at dredging mark ^b	Lightweight	Power dredge pumps during suction	Power jet pumps on draghead	Free sailing propulsion power	Value	Costs per week		M+R/ week
		(W)	(P _t) ^c	(J _t)	(S)	(V)	D+i	M+R	
cu.m	t	t	t	t	t	€	€	€	% of V
675	1500	575	250	100	800	7 290 000	21 287	17 453	0.2394
900	2000	765	350	220	1000	10 400 000	30 368	23 706	0.2279
1125	2500	955	450	260	1300	13 200 000	38 544	29 337	0.2223
1350	3000	1145	600	300	1600	15 900 000	46 428	34 766	0.2187
1580	3500	1335	750	340	1900	18 500 000	54 020	39 994	0.2162
1800	4000	1530	900	380	2200	21 000 000	61 320	43 933	0.2092
2500	5500	2125	1300	410	3600	28 300 000	82 636	50 672	0.1791
3425	7600	2910	1600	460	4000	35 500 000	103 660	57 318	0.1615
4280	9500	3635	2000	700	5000	42 700 000	124 684	63 964	0.1498
5225	11 600	4440	2700	1000	6800	51 300 000	149 796	71 903	0.1402

a For trailing suction hopper dredgers without a certificate for unrestricted navigation area, V should be decreased by 10 per cent. For explanation about class, see Section A1.3.

b Displacement on dredging mark = lightweight W + deadweight.

c Unless dredge pumps during trailing have their own power supply that cannot be used for other applications, P_t is defined as 40 per cent of the main engine power but not exceeding the mechanical limitation of the dredge pump drive.

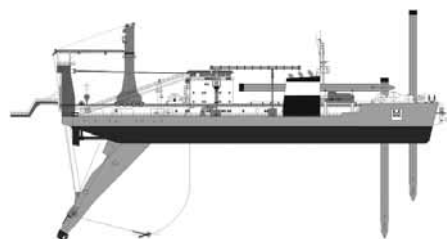
In cases where there is a different value of V than given in the table, interpolate M+R linearly.

Group 2 Cutter suction dredgers

Table 200 Cutter suction dredgers, self propelled

With certificate for unrestricted navigation area ^a

Service life	18 years
Service hours	168 hours per week
Residual value	10 % of V
Utilisation period	26 weeks
D+i	9.647 % of V per year or 0.371 % per week
Standard value	$V = 2000 \times C + 80\,000 \times W_{cgb} + 1400 \times (P + J) + 8500 \times W + 141\,000 \times W^{0.35} + 950 \times S$



Power cutter motors (C)	Weight of cutter gearbox (W _{cgb})	Power dredge and jet pumps (P+J)	Lightweight (W)	Propulsion power (S)	Remarks	Value (V)	Costs per week		M+R/ week
							D+i	M+R	
kW	t	kW	t	kW		€	€	€	% of V
1750	50	8000	4300	1750		59 500 000	220 745	79 351	0.1334
2000	55	8500	4700	2000		64 900 000	240 779	84 198	0.1297
2500	75	8000	5100	3500		71 700 000	266 007	90 302	0.1259
3000	80	7000	6250	3000		81 200 000	301 252	98 830	0.1217
4000	105	9600	6050	7400	FSC ^b	93 100 000	345 401	109 512	0.1176
6000	145	16 000	10 650	7400	FSC ^b	150 000 000	556 500	160 588	0.1071
6000	150	15 000	11 000	7000	DE ^c	158 000 000	589 890	168 667	0.1068
7600	220	16 000	13 700	7600	DE ^c	194 000 000	727 160	201 880	0.1041

a For cutter suction dredgers without a certificate for unrestricted navigation area, V should be decreased by 10 per cent. For explanation about class, see Section A1.3.

b In cases where the dredger is equipped with a flexible spud carrier, two per cent is added to the value derived from the equation.

c In cases where the dredgers' main drives are diesel-electric, six per cent is added to the value derived from the equation.

M+R for dredgers having a cutter power in excess of 5000 kW are extrapolated from trends, due to the recent construction of these vessels there are insufficient data to base these figures on actual records.

In cases where there is a different value of V than given in the table, interpolate M+R linearly.

Table 201 Cutter suction dredgers, not self propelledWith certificate for unrestricted navigation area ^a

Dredgers with a lightweight >250 tons and cutter power >200 kW

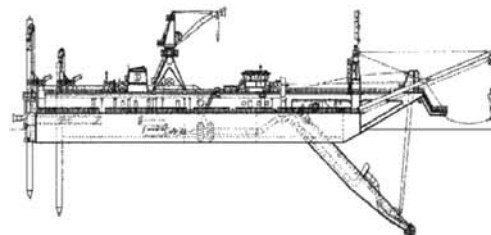
Service life 18 years

Service hours 168 hours per week

Residual value 10 % of V

Utilisation period 26 weeks

D+i 9.647 % of V per year or 0.371 % per week

Standard value $V = 3800 \times C + 20\,000 \times W_{cgb} + 1400 \times (P + J) + 9050 \times W + 15\,000 \times W^{0.35}$ 

Power cutter motors	Weight of cutter gearbox	Power dredge and jet pumps	Lightweight	Remarks	Value	Costs per week		M+R/week
(C)	(W _{cgb})	(P+J)	(W)		(V)	D+i	M+R	
kW	t	kW	t		€	€	€	% of V
250	8	850	360	–	5 680 000	17 882	20 786	0.3660
250	10	1000	380	–	6 110 000	20 405	22 026	0.3605
350	0	1675	400	–	7 420 000	27 528	25 567	0.3446
550	0	1700	520	–	9 310 000	34 540	30 103	0.3233
750	0	3300	1050	–	17 100 000	63 441	40 830	0.2388
750	30	4100	1370	–	21 800 000	80 878	46 580	0.2137
900	33	4000	2000	–	28 000 000	103 880	53 400	0.1907
1100	34	6000	2500	–	36 100 000	133 931	61 517	0.1704
1300	44	6400	2650	–	39 000 000	144 690	64 330	0.1649
1500	50	6500	2850	–	41 800 000	155 078	66 923	0.1601
1700	55	7000	3200	–	46 600 000	172 886	71 250	0.1529
2500	57	7000	3400	–	51 500 000	191 065	75 667	0.1469
3000	80	7000	4900	–	67 400 000	250 054	90 000	0.1335
3300	90	9600	6000	FSC ^b	84 040 000	311 788	104 999	0.1249
3700	100	9000	6340	DE ^c	91 540 000	342 804	112 535	0.1229

a In cases where the dredger has a certificate for restricted navigation area (coastal), V should be decreased by five per cent. Without a class certificate, V must be decreased by 10 per cent. For explanation about class, see Section A1.3.

b In cases where the dredger is equipped with a flexible spud carrier, two per cent is added to the value V.

c In cases where the dredgers' main drives are diesel-electric, six per cent is added to the value V.

In cases where there is a different value of V than given in the table, interpolate M+R linearly.

Table 202 Cutter suction dredgers (small and dismantable types)

Without class certificate

Max lightweight 250 tons

Service life 18 years

Service hours 168 hours per week

Residual value 10 % of V

Utilisation period 26 weeks

D+i 9.647 % of V per year or 0.371 % per week

Standard value $V = 3000 \times C + 1100 \times (P+J) + 4800 \times W + 230\,000 \times W^{0.20}$

Power cutter motors	Power dredge and jet pumps	Lightweight	Remarks	Value	Costs per week		M+R/week
(C)	(P+J)	(W)		V	D+i	M+R	
kW	kW	t		€	€	€	% of V
30	180	34	–	917 000	3402	4155	0.453
40	240	37	–	1 040 000	3858	4683	0.450
50	380	60	–	1 380 000	5120	6070	0.440
80	425	90	–	1 710 000	6344	7417	0.434
110	640	95	–	2 060 000	7643	8822	0.428
170	1000	180	–	3 120 000	11 575	12 706	0.407
170	800	210	UWP ^a	3 530 000	13 096	14 091	0.399
180	1100	250	UWP ^a	4 190 000	15 545	16 273	0.388

a In cases where the dredger is equipped with an underwater pump on the ladder, 15 per cent is added to the value V

The standard value V includes spud carriage, swivel bend, non-return valve, valve in discharge line, vacuum relief valve, production measuring equipment, towing equipment and central heating.

In cases where there is a different value of V than given in the table, interpolate M+R linearly.