



IMCO

INTERNATIONAL CONFERENCE ON TONNAGE MEASUREMENT, 1969

Technical Committee

PROGRESS REPORT OF THE WORKING GROUP ON GROSS AND NET TONNAGE (Part I)

1. As set up by the Technical Committee, the Working Group met from 5 to 8 June 1969 under the Chairmanship of Mr. P. Eriksson (Sweden). The following countries were represented: Denmark, France, Federal Republic of Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Union of Soviet Socialist Republics, United Kingdom and United States of America.
2. The task of the Group was to study the formulae for gross and net tonnage as set out in TM/CONF/C.2/WP.11, to propose type and numerical values for the coefficients, to determine the corresponding standard deviations and to analyse the effect of the types and individual vessels under study.
3. In order to accomplish the work, three task groups were formed as follows:-

(a) Group I for studying the formula:

$$GT = aV$$

where V = total moulded volume of the
ship in m³

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(b) Group II for studying the formulae:

$$NT = a_1 \nabla \text{ or}$$

$$NT = a_1 \nabla + a_2 P$$

where ∇ = moulded displacement in m^3

P = a function of passenger spaces
or number of passengers

(c) Group III for studying the formula:

$$NT = a_1 \nabla + a_2 P - a_3 WB$$

where WB - water ballast spaces in m^3 with a
lower limit for net tonnage of
the type

$$NT = K(a_1 \nabla + a_2 P)$$

4. Group I comprised Denmark, France, Norway, United Kingdom, United States of America with Netherlands as rapporteur; Group II comprised France, Federal Republic of Germany, Italy, Spain, United States of America, Union of Soviet Socialist Republics with United Kingdom as rapporteur; and Group III comprised Denmark, France, Japan, Norway, United Kingdom, Union of Soviet Socialist Republics with United States of America as rapporteur.

5. The Working Group accepted and expressed its appreciation of the offer of the United Kingdom and the United States delegations to carry out the computer calculations and agreed that in the exercises the IMCO sample of ship data should be used to develop coefficients. However, as this collection did not include some modern types of ship, it was also agreed that a corresponding sample collection by the United Kingdom (Annex I of TM/CONF/3) should be included.

Formula $GT = aV$

6.(a) Group I investigated whether a constant coefficient "a" would be suitable or whether a factor of the type:

$$a = A + B \log_{10} V$$

would be more acceptable with respect to small ships. It was agreed that in carrying out the computer exercise the data of open-shelter deckers should be excluded in developing the coefficients.

- (b) The computer exercise indicated that the most suitable constant coefficient was $a = 0.296$

Details are given in Annex I.

It has been agreed that the formula should further be tested on the data corrected better to represent the balance of ships of the world fleet. Details are shown at Annex I.

- (c) Group I also tested two formulae of the second type mentioned above:

$$a = 0.135 + 0.035 \log_{10} V \text{ and}$$

$$a = 0.2 + 0.02 \log_{10} V$$

Details are shown at Annex I.

Formulae $NT = a_1 V$ and $NT = a_1' V \times a_2' P$

- 7(a) Group II tested whether a constant factor " a_1 " would be suitable or whether a factor of the type:

$$a_1 = A + B \log^7$$

would be more acceptable with respect to small ships.

- (b) For a constant coefficient $a_1 = 0.29$ the results of the computer exercise are shown at Annex I. Results of other computer exercises for the minimum standard deviation are also given at Annex I for (i) the total fleet, (ii) fleet excluding all types of passenger ships and ferries and (iii) fleet excluding all types of passenger ships, ferries and bulk and ore carriers.

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- (c) For the second type of the factor the computer exercise for a multiple linear regression analysis results are shown in Annex I for (i) total fleet, (ii) fleet excluding all types of passenger ships and ferries and (iii) fleet excluding all types of passenger ships, ferries and bulk and ore carriers.
- (d) Concerning the correction factor "a₂'P" for passenger ships, Group II felt that it would be necessary to use a factor with measured volumes of passenger spaces if the formula was intended to give results "as close as possible" to existing net tonnages. However, information as to total volume of passenger spaces was not included in the IMCO data.

Italy suggested the following formula based on data of 17 passenger ships:

$$NT = 0.29 \nabla + 0.164 V_p$$

where V_p = total moulded passenger spaces in m^3

With respect to the information on 17 passenger ships submitted by Italy, the Group was of the opinion that it might not be fully representative of total passenger fleets.

The results of the study using the formula on a number of ships are given at Annex II.

- (e) Group II also discussed a formula using passenger numbers as the parameter and the Italian delegation developed the following formula:

$$NT = a_1' \nabla + a_2' \left(N_b + \frac{N_u}{C} \right)$$

where N_b = No. of berthed passengers

N_u = No. of unberthed passengers

for instance $NT = 0.29 \nabla + 4.1 \left(N_b + \frac{N_u}{10} \right)$.

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The Group considered that a formula of this type, although more simple, would not give results "as close as possible" due to the great variety in the standard of passenger spaces on ships of different types and sizes.

ANNEX I

COMPUTER EXERCISES

Fleet*: 591 vessels

Cargo	:	215
Tankers	:	108
Bulk Carriers	:	65
Ore "	:	15
Passenger	:	25
Passenger/Cargo	:	27
Refrigerated	:	54
Cross-channel	:	3
Ferry Vessels	:	20
Raised Quarterdeck	:	24

Definitions in this Annex are shown
in Annex I of TM/CONF/C.2/3.

* IMCO + UK data

Selection of Fleet Formula	GROSS TONNAGE GT			NET TONNAGE NT						
	aV	$(A+B \log_{10} V)V$	$(A+B \log_{10} V)V$	$a_1 \nabla$	(i)	(ii)	(iii)	$a_1 \nabla$	(i)	(ii)
Coefficients	0.296	A = .125 B = .035	A = 0.2 B = 0.02	0.29	0.2647	0.2604	0.2642	A=0.2775 B=0.0075	A=0.1525 B=0.0316	A=0.1699 B=0.0281
Total No. Ships	481	481	481	591	591	516	401	591	516	401*
Number of ships retained	467	470	467	560	560	489	380	557	494	401
Percentage mean deviation	0.65	2.617	3.006	-3.869	5.18	3.218	2.764	-10.337	-4.555	-0.092
SD _o	8.096	7.688	7.117	24.606	22.78	17.958	16.649	26.93	18.163	20.665
SD _m	6.070	7.228	6.450	24.239	22.18	17.666	16.417	24.90	17.586	20.665
Fleet percentage change	4.148	1.476	3.672	5.896	14.09	10.996	---	-0.601	-0.225	0.1699

* Figures not final, have to be recomputed.

ANNEX II

name of ship	Moulded displacement ∇_m	Passenger spaces V_{pm}	Present net tonnage NT present	Net tonnage NT $0.29 \nabla + 0.164 V_{pm}$	+ per cent. deviation k	k ²
Italia	10420	20641	6703	6407	-4.41	19,4481
Oceano	30260	73,264	21,402	20,790	-3.13	9,7969
Don Giovanni	32365	61,920	17,227	19,541	+13.44	180,6336
Admiral	40797	87,736	24,572	25,273	+6.92	48,0249
Admiral C	21272	33,474	12,167	11,659	-4.18	17,4724
Imperia C	27817	55,000	17,772	19,087	+3.88	14,8228
Imperia	26547	43,178	12,762	14,780	-6.26	38,9376
Imperia	5391	2830	2311	2,191	-5.20	27,0400
Albatros	11,170	15,774	6,633	5,826	-12.20	148,8640
Albatros	5823	8,222	3,176	3,037	-4.92	24,2064
Albatros	5,177	8,230	3,054	2,851	-6.65	44,5225
Albatros	1,946	3,002	1,155	1,081	-6.41	41,0881
Albatros	1,379	1,367	645	624	-3.25	10,5625
Albatros	1,178	3,150	427	469	+4.10	16,8100
Albatros	5,527	5,912	2,687	3,173	-4.24	17,9776
Albatros	780	7770	2,691	2,467	-10.75	115,3025
Albatros	5340	2859	2,005	2,016	+0.55	0,3025

Mean per cent. deviation = -2.95 SD₀ = 6.74 SD_F = 6.05

Name of ship	Moulded displacement ∇ m ³	No. of passengers		$N_b + \frac{1}{10} N_u$	Present net tonnage NT	NT formula	± per cent deviation k
		Berthed N_b	Unberthed N_u				
1 Italia	10.420	478	-	478	6703	4.946	-25.40 645
2 Oceanic	30.260	1200	-	1200	21.462	13.731	-36.00 4300
3 L.A. Vinci	32.365	1450	-	1450	17.227	15.374	-10.75 414
4 Michelangelo	40.777	1853	-	1853	24.572	19.484	-19.40 397
5 Venetico C	21.272	1300	-	1300	12.187	11.538	-5.16 37
6 Eugenio C	27.817	1750	-	1750	17.772	15.294	-13.75 1940
7 G. Marconi	26.547	1781	-	1781	15.762	15.055	-4.50 60
8 Bremers	5.391	115	-	115	2.311	2.038	-4.60 137
9 Annonia	11.170	605	-	605	6.633	5.739	-13.60 388
10 Carlo di Napoli	5.823	973	227	996	3.196	5.802	-8.150 6650
11 Arborea	5.177	663	537	717	3.054	4.406	+44.20 1960
12 F. Montagna	1.996	240	360	276	1.155	1.719	+48.40 8390
13 A. de Messina	1.379	87	913	178	645	1.135	+76.00 5800
14 Melchioria	1.578	0	1276	1276	687	936	+43.60 1910
15 Sicilia	5527	437	513	538	2.687	3.805	+42.40 1800
16 Campania R	7780	700	0	700	2.641	4.481	+65.7 4320
17 Cyprus	5340	350	555	405	2005	3.226	+61.00 5720

Mean per cent. deviation = 18.90 $SD_0 = 44.5$ $SD_m = 40.3$