STANDARD FOR THE TONNAGE MEASUREMENT OF SHIPS

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Standard for the Tonnage Measurement of Ships

Record of Updates

Date of Memorandum	Update No.	Sections Amended
June 9, 2000	1	2.5.6 (a) and (b), 2.7.3 and Figure 2.10
October 31, 2000	2	3.2 (definition of tonnage block coefficient), 3.7, (a), (g) and (h)

TABLE OF CONTENTS

Tables

Figures

Foreword

This Standard is issued by the Department of Transport (referred to as the Department) for the measurement of ships in accordance with the *Ship Registration and Tonnage Regulations* made pursuant to the *Canada Shipping Act*.

The issue of this TP 13430 on February 25, 2000 replaces the previous publication, TP 12234 - *A Guide for the Tonnage Measurement of Ships*, in its entirety.

For ships whose tonnage was determined on or after October 17, 1994 but before February 25, 2000, reference should be made to TP 12234. For ships whose tonnage was determined before October 17, 1994, reference should be made to TP 5008.

The remuneration of Tonnage Measurers is dealt with in the *Ship's Tonnage Survey and Measurement Fees Regulations.*

The matter of interpretation with respect to tonnage measurement is the responsibility of the Department. Direct queries in this regard may be addressed to the nearest Transport Canada Centre where TP 13533 *"A Guide for Tonnage Measurers" is also available.*

GLOSSARY OF TERMS

Name/Abbreviation	Definition
Authorized Representative	See Sections 2 and 9 of the *Canada Shipping Act*. This person is responsible for all matters relating to a ship and is usually the owner or charterer.
CSA	*Canada Shipping Act*, R.S.C. 1985, c. S-9
1969 Convention	*International Convention On Tonnage Measurement Of Ships, (1969)*
SOLAS	*International Convention for the Safety of Life At Sea, 1974*, and the Protocol of 1978 relating to the *International Convention for the Safety of Life At Sea, 1974*
MARPOL	*International Convention for the Prevention of Pollution from Ships*, 1973 as modified by the Protocol of 1978
Load Line Convention	*International Convention on Load Lines, 1966*

PART 1 — GENERAL

1.1 — DEFINITIONS

The following definitions apply in the Standard:

"amidships" is the midpoint of the length [L] of a ship where the forward terminal of that length coincides with the fore side of the stem. Length is defined in Section 1.2;

"breadth" is the maximum breadth of the ship, measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material (see Figure 1.1);

"camber" is the vertical distance measured on the centre line plane of the ship, from the underside of the deck plating to a line athwartships between the points where the underside of the deck plating meets the inner side of the ship's shell plating (see Figure 1.2);

"cargo spaces" are enclosed spaces included in the calculation of the net tonnage that are appropriated for the transport of cargo which is to be discharged from the ship, if the spaces have also been included in the calculation of the gross tonnage. These cargo spaces are identified by the readily visible permanent markings **CC** (cargo compartment). The total volume of cargo spaces as defined above is designated as V_C;

"enclosed spaces" are all those spaces that are bounded by the ship's hull, by fixed or portable partitions or bulkheads or by decks or coverings other than permanent or moveable awnings. No break in a deck, or any opening in the ship's hull, in a deck or in a covering of a space, or in the partitions or bulkheads of a space, nor the absence of a partition or bulkhead, precludes a space from being included in an enclosed space. The following are not enclosed spaces:
(a) spaces below the upper deck open to the sea (See Section 2.4.2 (e) for further elaboration);
(b) excluded spaces – see definition "excluded spaces";

Note: Spaces that fulfill any one of the three conditions set out in the definition "excluded spaces" are enclosed spaces.

"excluded spaces" The spaces referred to in clauses (A) to (E) are excluded spaces, and must not be included in the volume of enclosed spaces, unless the space fulfills any of the following three conditions:
(a) the space is fitted with shelves or other means for securing cargo or stores; (for example, stanchions, fences and railings to keep livestock in the corrals); or
(b) the openings are fitted with any means of closure; or
(c) the construction provides the possibility of the openings being closed.

In ships with rounded gunwales, the breadth (B) of the deck for use in this section is shown in Figure 1.12.

(A) (i) A space within an erection opposite an end opening extending from deck to deck, except for a curtain plate of a depth not exceeding by more than 25 millimetres the depth of the adjoining deck beams, if the opening has a breadth equal to or greater than 90% of the

breadth of the deck at the line of the opening of the space. This provision is to be applied, so as to exclude from the enclosed spaces, only the space between the actual end opening and a line drawn parallel to the line or face of the opening at a distance from the opening equal to one half of the width of the deck at the line of the opening (see Figure 1.3);

(A) (ii) If the width of the space, because of any arrangement except by convergence of the outside plating, becomes less than 90% of the breadth of the deck, only the space between the line of the opening and a parallel line drawn through the point where the athwartships width of the space becomes equal to, or less than, 90% of the breadth of the deck shall be excluded from the volume of enclosed spaces (see Figures 1.4, 1.5 and 1.6);

(A) (iii) If an interval that is completely open except for bulwarks or open rails separates any two 2spaces, the exclusion of one or both of which is permitted under subparagraphs (i) or (ii) or both, the exclusion does not apply if the separation between the two spaces is less than the least half breadth of the deck in way of the separation (see Figures 1.7 and 1.8);

(B) A space under an overhead deck covering open to the sea and weather, having no other connection on the exposed sides with the body of the ship than the stanchions necessary for its support. In such a space, open rails or a bulwark and curtain plate may be fitted or stanchions fitted at the ship's side, provided that the distance between the top of the rails or the bulwark and the curtain plate is not less than 0.75 metres or one third of the height of the space, whichever is the greater (see Figure 1.9);

(C) A space in a side-to-side erection that is directly in the way of the opposite side opening and is not less in height than 0.75 m or one third of the height of the erection, whichever is the greater. If the opening in such an erection is provided on one side only, the space to be excluded from the volume of enclosed spaces is limited inboard from the opening to a maximum of one-half of the breadth of the deck in the way of the opening (see Figure 1.10);

(D) A space in an erection immediately below an uncovered opening in the deck overhead, if the opening is exposed to the weather and the space excluded from enclosed spaces is limited to the area of the opening (see Figure 1.13);

(E) A recess in the boundary bulkhead of an erection that is exposed to the weather and the opening of which extends from deck to deck without means of closing, if the interior width is not greater than the width at the entrance and its extension into the erection is not greater than twice the width of its entrance (see Figure 1.11);

The space between the side longitudinal bulkhead of a deckhouse and the bulwark below a deck extending from side to side, supported by stanchions or vertical plates connected to the bulwarks, must be treated as an excluded space in accordance with paragraphs (B) and (C) (see Figure 1.14).

"gross tonnage"

(a) For ships of 24 metres in length or more, means the measure of the overall size of a ship as determined in accordance with Part 2; and

(b) For ships of less than 24 metres in length, means the measure of the overall size of a ship as determined in accordance with Part 3.

"moulded depth" (D) of a ship is determined by measuring the vertical distance amidships:

(a) if the ship has a metal shell, from the moulded line of the upper deck at the side to the point where the line of the hull intersects the side of the keel (see Figure 1.15);

(b) if the ship is a wood or composite ship, from the moulded line of the upper deck at the side to the point at the lower edge of the keel rabbet (see Figure 1.15);

(c) if the ship is one in which the form at the lower part of the midship section is of a hollow character or on which thick garboards are fitted, from the moulded line of the upper deck at the side to the point where the moulded line of shell when continued inwards intersects the side of the keel (see Figure 1.15);

(d) if the ship has rounded gunwales, from the point of intersection of the moulded lines of the upper deck and side shell plating, the lines extending as though the gunwales were of angular design, to the point referred to in paragraphs (a) to (c), as the case may be (see Figure 1.15);

(e) if the ship has a stepped upper deck the raised part of which extends over amidships, from the point at which a line of reference extending along the lower part of the upper deck parallel to the raised part of that deck intersects amidships to the point referred to in paragraphs (a) to (c) as the case may be (see Figure 1.17); and

(f) if the ship is an open ship, from the top of the gunwale to the point referred to in paragraphs (a) to (c), as the case may be.

"moulded draught" (d) The moulded draught referred to in the Net Tonnage formula in Section 2.2 shall be one of the following draughts:

(a) if the ship is a Load Line Convention ship, the draught corresponding to the summer load line assigned to the ship in accordance with that Convention. A timber load line must not be used to calculate moulded draught;

(b) if the ship is a passenger ship, the draught corresponding to the deepest subdivision load line assigned in accordance with SOLAS;

(c) if the ship is not a Load Line Convention ship, but has been assigned a load line in accordance with the laws of the state whose flag the ship is entitled to fly, the draught corresponding to the summer load line so assigned;

(d) if the ship is a ship to which no load line has been assigned and in respect to which the draught is restricted in accordance with the laws of the state whose flag the ship is entitled to fly, the maximum permitted draught; and

(e) in the case of any other ship, 75% of the moulded depth amidships determined in accordance with the definition "Moulded Depth".

"moulded line of hull"

(a) if the ship has a metal shell, the outer surface of the frame of the hull without the plating (moulded frame line); and

(b) if the ship has a shell of a material other than metal, the outer surface of the shell.

"net tonnage"

(a) For ships 24 metres in length or more, is the measure of the useful capacity of the ship determined in accordance with Part 2.

(b) For ships of less than 24 metres in length, is the measure of the useful capacity of the ship determined in accordance with Part 3.

"passenger" is as defined in Section 2 of the *CSA*.

"upper deck"

(a) the uppermost complete deck exposed to weather and sea that has permanent means of weathertight closing of all openings in the weather part thereof, and below which all openings in the sides of the ship are fitted with permanent means of watertight closing (see Figure 1.16); and

(b) in the case of a ship that has a stepped upper deck, the lowest line of the exposed deck and the continuation of that line parallel to the upper part of the deck is taken as the upper deck (see Figures 1.16 and 1.17).

A discontinuity in the upper deck that extends over the full breadth of the ship and is in excess of 1 metre in length is treated as a step (see Figure 1.18).

Steps situated outside the length (as defined in Section 1.2) are not to be considered.

A discontinuity in the upper deck that does not extend to the side of the ship is treated as a recess located below the upper deck level (see Figure 1.19).

In a ship that has openings in its side below the uppermost deck, if the openings are not closed but limited inboard by weathertight bulkheads and decks, the deck below the openings is considered the upper deck (see Figure 1.20).

"watertight", in respect of a means of closure, means that it is capable of preventing the passage of water through an opening in either direction, under the maximum head of water to which the opening may be exposed.

"weathertight", in respect of a means of closure, means capable of preventing the passage of water into a ship in any sea condition.

"tonnage length" means the horizontal distance between the extremes of the upper deck (see Figure 1.22a), or in the case of a stepped upper deck, the extremes of the projected line of upper deck (see Figure 1.22b).

1.2 — MEASUREMENT OF LENGTH (L)

LENGTH (L) must be determined using the explanation below to determine which Part of this Standard is applicable.

Length is determined by calculating the greater of:

(a) 96% of the total length measured on a waterline at 85% of the least moulded depth measured from the top of keel; and

(b) the length from the fore side of the stem to the axis of the rudder stock on the waterline referred to in (a) above.

In a ship designed with a rake of keel, the waterline on which this length is measured shall be parallel to the designed waterline.

The lengths (a) and (b) are depicted below, and in Figure 1.0.
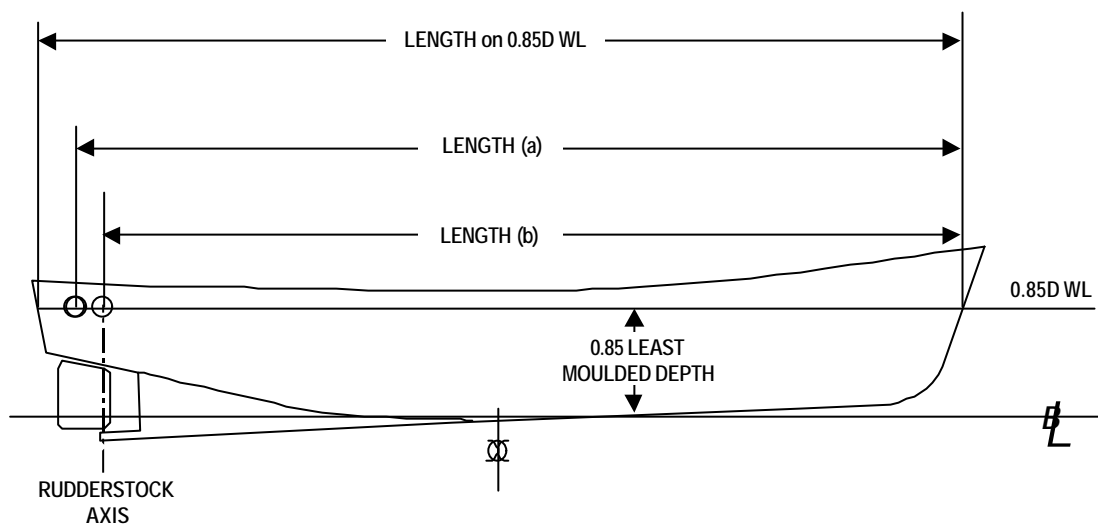
1.3 — UNITS OF MEASUREMENT AND DEGREE OF ACCURACY

<u>Measurements</u>

All measurements are to be taken in metres to the nearest centimetre. All lengths are to be measured in a fore and aft direction, breadths athwartships and heights or depths vertically. This order is to be followed on all tonnage calculations.

<u>Volume</u>

The volume in relation to any ship or space in a ship is to be in cubic metres.

<u>Degree of Accuracy</u>

Calculations are to be carried out with the following degrees of accuracy:

(i)	One-third round of beam	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(ii)	The common interval between the transverse ordinates	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(iii)	The common interval between the breadths in each transverse section	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(iv)	The common interval between the breadths in between deck space and in erections	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(v)	One-third of the common interval between the transverse ordinate	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(vi)	One-third of the common interval between the breadths in each transverse section	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(vii)	One-third of the common interval between the breadths in the between-deck space and in erections	To three decimal places, the third figure to be increased by one if the fourth is 5 or more
(viii)	The area of transverse sections	To two decimal places, the second figure to be increased by one if the third is 5 or more
(ix)	The mean height of the between-deck space	To two decimal places, the second figure to be increased by one if the third is 5 or more

PART 2 — TONNAGE MEASUREMENT OF CANADIAN SHIPS 24 METRES IN LENGTH OR MORE

2.1 — GROSS TONNAGE FORMULA

The gross tonnage (GT) of a ship is to be calculated using the following formula:

$$GT = K_1 V$$

where

V = total volume of all enclosed spaces of the ship in cubic metres; and

K_1 = $0.2 + 0.02 \log_{10} V$ (or as shown in the Table of Coefficients).

2.2 — NET TONNAGE FORMULA

The net tonnage (NT) of a ship is to be calculated using the following formula:

$$NT = K_2 \, V_c \, (4d/3D)^2 + K_3 \, (N_1 + N_2/10)$$

where:

V_C = total volume of cargo spaces in cubic metres;

K_2 = $0.2 + 0.02 \log_{10} V_c$ (or as shown in the Table of Coefficients);

K_3 = $1.25 \times (GT + 10,000)/10,000$;

D = the moulded depth amidships in metres;

d = the moulded draught amidships in metres;

N_1 = the number of passengers in cabins containing not more than eight berths;

N_2 = the number of other passengers;

$N_1 + N_2$ = the number of passengers as shown in the ship's passenger certificate;

GT = the gross tonnage of the ship as determined in accordance with Section 2.1.

NOTES:

.1 If the sum of N_1 and N_2 is less than 13, N_1 and N_2 are to be taken as zero.

.2 The factor $(4d/3D)^2$ is not to be taken as greater than unity.

.3 The term $K_2 V_c (4d/3D)^2$ is not to be taken as less than 0.25 GT.

.4 NT is not to be taken as less than 0.30 GT.

Table 1 — Coefficient K$_1$ And K$_2$ For Sections 2.1 And 2.2

V or V$_c$ = Volume in m^3

V or V$_c$	K$_1$ or K$_2$	V or V$_c$	K$_1$ or K$_2$	V or V$_c$	K$_1$ or K$_2$	V or V$_c$	K$_1$ or K$_2$
10	0.2200	45000	0.2931	330000	0.3104	670000	0.3165
20	0.2260	50000	0.2940	340000	0.3106	680000	0.3166
30	0.2295	55000	0.2948	350000	0.3109	690000	0.3168
40	0.2320	60000	0.2956	360000	0.3111	700000	0.3169
50	0.2340	65000	0.2963	370000	0.3114	710000	0.3170
60	0.2356	70000	0.2969	380000	0.3116	720000	0.3171
70	0.2369	75000	0.2975	390000	0.3118	730000	0.3173
80	0.2381	80000	0.2981	400000	0.3120	740000	0.3174
90	0.2391	85000	0.2986	410000	0.3123	750000	0.3175
100	0.2400	90000	0.2991	420000	0.3125	760000	0.3176
200	0.2460	95000	0.2996	430000	0.3127	770000	0.3177
300	0.2495	100000	0.3000	440000	0.3129	780000	0.3178
400	0.2520	110000	0.3008	450000	0.3131	790000	0.3180
500	0.2540	120000	0.3016	460000	0.3133	800000	0.3181
600	0.2556	130000	0.3023	470000	0.3134	810000	0.3182
700	0.2569	140000	0.3029	480000	0.3136	820000	0.3183
800	0.2581	150000	0.3035	490000	0.3138	830000	0.3184
900	0.2591	160000	0.3041	500000	0.3140	840000	0.3185
1000	0.2600	170000	0.3046	510000	0.3142	850000	0.3186
2000	0.2660	180000	0.3051	520000	0.3143	860000	0.3187
3000	0.2695	190000	0.3056	530000	0.3145	870000	0.3188
4000	0.2720	200000	0.3060	540000	0.3146	880000	0.3189
5000	0.2740	210000	0.3064	550000	0.3148	890000	0.3190
6000	0.2756	220000	0.3068	560000	0.3150	900000	0.3191
7000	0.2769	230000	0.3072	570000	0.3151	910000	0.3192
8000	0.2781	240000	0.3076	580000	0.3153	920000	0.3193
9000	0.2791	250000	0.3080	590000	0.3154	930000	0.3194
10000	0.2800	260000	0.3083	600000	0.3156	940000	0.3195
15000	0.2835	270000	0.3086	610000	0.3157	950000	0.3196
20000	0.2860	280000	0.3089	620000	0.3158	960000	0.3196
25000	0.2880	290000	0.3092	630000	0.3160	970000	0.3197
30000	0.2895	300000	0.3095	640000	0.3161	980000	0.3198
35000	0.2909	310000	0.3098	650000	0.3163	990000	0.3199
40000	0.2920	320000	0.3101	660000	0.3164	1000000	0.3200

Note: Coefficients K$_1$ or K$_2$ at intermediate values of V or V$_c$ shall be obtained by linear interpolation.

2.3 — CHANGE OF NET TONNAGE

A ship, to which Load Lines referred to in paragraphs (a) and (b) of the definition "moulded draught" are concurrently assigned, shall be given only one net tonnage as determined in accordance with Section 2.2, and that tonnage shall be the tonnage applicable to the appropriate assigned Load Line for the trade in which the ship is engaged.

2.4 — CALCULATION OF VOLUMES

Measurements to calculate the tonnage of a ship are to be taken from:
(a) the ship; and
(b) the scrieve boards, comprising the full or reduced size of the ship; or
(c) the lines plan and scale drawings of the ship; or
(d) computer graphics of the ship.

All volumes included in the calculation of gross tonnage and net tonnage are to be measured, irrespective of the fitting of insulation or the like, to the inner side of the shell or structural boundary plating in ships constructed of metal, and to the outer surface of the shell and to the inner side of structural boundary surfaces in ships constructed of any other material.

The volume components of gross tonnage are to consist of the sum of the following:
(a) the volume of the ship below the upper deck measured in cubic metres; and
(b) the volume of each enclosed space above the upper deck measured in cubic metres.

2.4.1 — TONNAGE VOLUMES BELOW UPPER DECK

The volumes to be measured include the following:
(a) the main body;
(b) overhangs beyond the upper deck length or breadth;
(c) bulbous or similar bows;
(d) skegs and keels;
(e) shaft bossings;
(f) sponsons added for improved buoyancy or stability; and
(g) all other permanent volumes except those not included.

2.4.2 — VOLUMES NOT TO BE INCLUDED IN THE TONNAGE CALCULATION

The following volumes are not to be included in the tonnage calculation:
(a) propellers;
(b) rudders;
(c) mechanical stabilizers;
(d) echo sounders, bilge keels and other non-essential appendages; and
(e) spaces within the boundaries of the main volume that open directly to the sea such as bow/stern thruster tubes, moonpools, hawsepipes, sea valve recesses, stern chutes in fishing vessels, dredging wells in dredges, anchor pockets and sea chests within the boundaries of the main hull volume.

Despite the above, any space with a volume less than 1 cubic metre shall not be taken into account either for inclusion or deduction.

Volumes within the hulls of ships, such as split-hull barges and dredgers, shall be retained in V and V_c despite the fact that the space within the hull is temporarily opened to the sea when discharging cargo (see Figure 2.1).

2.5 — CALCULATION OF ENCLOSED SPACES BELOW THE UPPER DECK

2.5.1 — MEASUREMENT

Measure the tonnage length in a straight line along the upper side of the upper deck from the moulded line of the hull at the stem to the moulded line of the hull at the stern (see Figure 1.22a).

In a ship having a stepped upper deck, such as a break forward, a break amidships or a break aft, the lowest line of exposed deck and the continuation of that line parallel to the upper part of the deck are to be measured as described in the preceding paragraph (see Figure 1.22b).

Note: It is found that the tonnage length taken on the surface or sheer line of the deck, in ships of standard sheer, is sufficiently accurate for the practical purpose of tonnage. In all cases of unusual sheer, such as trawlers, the length for calculation shall be taken by means of a tape or line stretched tightly from end to end of the deck.

2.5.2 — DIVISION OF TONNAGE LENGTH

Divide the tonnage length determined in Section 2.5.1 into the number of equal parts specified in the following table:

Table 2 — Division of Tonnage Length

Tonnage length less than 30 m	6 parts
Tonnage length 30 m or more but less than 45 m	8 parts
Tonnage length 45 m or more but less than 60 m	10 parts
Tonnage length 60 m or more but less than 75 m	12 parts
Tonnage length 75 m or more but less than 90 m	14 parts
Tonnage length 90 m or more but less than 105 m	16 parts
Tonnage length 105 m or more but less than 120 m	18 parts
Tonnage length 120 m and more	20 parts

Then subdivide the two foremost and two aftermost parts into two equal parts.

As an example, a ship with a tonnage length of 50 metres would be divided into 10 equal parts and the two foremost and aftermost parts would be further divided into two equal parts each making a total of 14 parts (15 sections) (see Figure 2.2).

2.5.3 —TRANSVERSE SECTIONS

Transverse sections are taken through the points of division determined in Section 2.5.2 and also through the extreme points of the tonnage length at right angles to the centre line, parallel to

the ship's main transverse bulkheads. These transverse sections are numbered from stem to stern, the terminal point at the fore end of the tonnage length being No. 1 (see Figure 2.2).

2.5.4 — DEPTH CORRECTION FOR CAMBER

The depth of each transverse section shall be corrected for camber as follows:

(a) by one third of the camber when the deck is rounded athwartships (parabolic curve) (see Figure 2.3);

(b) by one half of the camber when the deck rises in a straight line from the ship's sides to the centre line (see Figure 2.4); and

(c) if the deck athwartship rises in a straight line from the ship's sides and part of the deck is horizontal, the correction is to be calculated by the following formula (see Figure 2.5):

$$correction = \frac{x\,(B\text{-}b)}{2B}$$

where

      x = camber in metres;

      B = the uppermost breadth of the transverse section; and

      b = breadth of the horizontal part of the deck.

2.5.5 — DEPTH OF TRANSVERSE SECTION (DS)

Measure the depth of the transverse section as follows:

Determine the vertical distance on the centre line, from the moulded line of the upper deck less correction for camber as determined in Section 2.5.4.

Then:

(a) for ships built of metal, continue to the moulded line of the keel plate or if a bar keel or duct/box keel is fitted, to the point where the line of the hull intersects the side of the keel (see Figure 2.6);

(b) for wood or composite ships, continue to the lower edge of the keel rabbet (see Figure 2.6);

(c) if the form at the lower part of the hull is of a hollow character as in a ship built of glass reinforced plastic or if thick garboards are fitted, the distance is to be measured to the point where the line of the flat of the bottom continued inwards cuts the side of the keel (see Figure 2.6);

(d) in situations where a point of reference cannot be determined using paragraph (a), (b) or (c), the depth of the transverse section is to be measured to the moulded line of the hull at the centre line (see Figure 2.7).

If there is a break in the upper deck, the transverse section of the break is measured on the centre plane from the centre line used to take the vertical distance to the points of reference set out in paragraph (a), (b), (c) or (d) (see Figure 2.8).

For an open ship, measure from an athwartship line extending between the upper edges of the upper strakes to the points of reference set out in paragraph (a), (b), (c) or (d) (see Figure 2.9).

Note: For a ship with decks and tanks below the upper deck, the depth of the transverse section is taken at each level and the various deck and tank plate thicknesses are added.

2.5.6 — DIVISION OF DEPTH OF TRANSVERSE SECTION

The depth of each transverse section is to be divided into:
(a) five equal parts, where the depth at the middle of the tonnage length does not exceed 6 metres; or
(b) seven equal parts where the depth at the middle of the tonnage length exceeds 6 metres.

Then the lowest common interval is to be further divided into two equal parts (see Figure 2.10).

2.5.7 — BREADTHS OF TRANSVERSE SECTION

Breadths are to be measured through each point of division as determined in Section 2.5.6 and at the extreme points of the depth. The breadths will be numbered from above, the No. 1 breadth being taken at the upper point of the depth determined in Section 2.5.5 (see Figure 2.10).

In all ships, the bottom breadth will have a value equal to or greater than zero. It will never have a negative value.

2.5.8 — CALCULATION OF TRANSVERSE SECTION

If the area of a transverse section of the under deck can be calculated by a direct method, such as depth and breadth, without loss of accuracy, such a method may be used. Otherwise, the area is calculated using Simpson's First Rule, as follows:
(a) the uppermost breadth (Breadth No.1) is multiplied by 1;
(b) the three last breadths starting with the bottom breadth are multiplied respectively by 0.5, 2 and 1.5;
(c) the other even numbered breadths are multiplied by 4, and the odd numbered breadths by 2; and
(d) the sum of these products is then multiplied by one third of the common interval between breadths. The product obtained is the area of the transverse section.

2.5.9 — CALCULATION OF VOLUME BELOW UPPER DECK

Once the areas of the transverse sections have been ascertained, the volume below the upper deck is calculated using Simpson's First Rule, as follows:

The area of the foremost transverse section is multiplied by 0.5 and the following four (counted towards the stern) are multiplied respectively by 2,1, 2 and 1.5;

The areas of the five aftermost transverse ordinates starting at the aftermost section are multiplied respectively by 0.5, 2, 1, 2 and 1.5;
The even numbered transverse ordinates are multiplied by 4 and the odd numbered by 2;
The sum of these products is multiplied by one-third of the common interval between the transverse ordinates, and the product obtained is the volume of the space below the upper deck,

after the included and excluded spaces detailed in Section 2.4.1 and 2.4.2 are taken into account;

In a ship having a stepped upper deck such as breaks situated forward, aft, or amidships, the under deck volume is the sum of the volume below the upper deck and its line of continuation and the volume between the line of continuation and the deck above. For the method of calculating a break, refer to Section 2.6.3 (see Figure 2.11);

The main volume under the upper deck in ships with a bulbous bow or similar shape bow is to be calculated assuming there is no bulbous bow or similar bow volume; i.e. normal ship shape bow. Calculate the additional volume that is present due to the bulbous bow or similar shape bow and add as an appendage (see Figure 2.14 and Section 2.5.10 "Bulbous or similar bows").

2.5.10 — ADDITIONAL VOLUMES OF ENCLOSED SPACES BELOW THE UPPER DECK

The volume of any appendage is measured separately from the main volume below the upper deck as described below.

Overhangs beyond the Upper Deck Length
Overhangs are to be measured by Simpson's First Rule. The length is divided into two equal parts (three sections) and five ordinates are to be taken at each section (see Figure 2.12).

An equivalent method of measurement without loss of accuracy may be used.

Overhanging Deck
A closed in space beneath an overhanging deck supported by deck beams, brackets or by other means is measured by

mean length x mean breadth x mean depth

If the space beneath the overhanging deck is not enclosed because the bottom is open or the external side is open, it is to be ignored. If the space beneath the overhanging deck is not enclosed because the internal side is open, it is to be measured (see Figure 2.13).

Bulbous and Similar Bows
Such bows are measured by Simpson's First Rule. The length is divided into four equal parts (5 sections) and five ordinates are taken at each section (see Figure 2.14).

Skegs and Keels
Volume displacement type skegs and keels, whether separate from or open to the hull, are measured using Simpson's First Rule. The length of the space is divided into four equal parts (five sections) and three ordinates are taken at each section. An equivalent method of measurement, without loss of accuracy, may be used.

Note: Some of the measurements may have already been included in the measurement of the main volume below the upper deck (see Figure 2.15).

Shaft Bossings
Shaft Bossings are measured by Simpson's First Rule. The length is divided into four equal parts (five sections) and five ordinates are taken at each section (see Figure 2.16).

2.5.11 — EXCLUDED VOLUMES OF ENCLOSED SPACES BELOW THE UPPER DECK

Tunnel Thruster Tubes

The volume may be determined by use of the formula:

$V = 0.7854$ x diameter^2 x breadth (mean)

or

$V = \pi$ x radius^2 x breadth (mean)

An equivalent method of measurement without loss of accuracy may be used.

Anchor Pockets, Sea Chests and Similar Spaces

Any accurate method of measurement is acceptable.

2.6 — CALCULATIONS OF ENCLOSED SPACES ABOVE THE UPPER DECK

In accordance with Section 2.5.9, the volume of a "break" is to be included as part of the volume below the upper deck. However, for calculation purposes, "breaks" have been grouped in with enclosed spaces above the upper deck.

Spaces located within the boundaries of "permanent or movable awnings" are to be treated as excluded spaces.

The following are not included in the total volume of enclosed spaces, if they are completely inaccessible and above the upper deck and separated on all their sides from other enclosed spaces:
(a) masts, kingposts, cranes, crane and container support structures;
(b) air trunks having a cross-sectional area not exceeding 1 square metre;
(c) mobile cranes; and
(d hatchways with volumes less than 1 cubic metre.

The space between the side longitudinal bulkhead of a deckhouse and the bulwark below a deck extending from side to side supported by stanchions or vertical plates connected to the bulwarks is treated as an "excluded space".

In the case of a ro-ro ship, for example, if the space at the end of an erection is fitted with means for securing cargo, the space is included in volume (V) in accordance with the first condition contained in the definition "excluded spaces".

2.6.1 — APPLYING SIMPSON'S FIRST RULE TO ENCLOSED SPACES ABOVE THE UPPER DECK

Enclosed spaces above the upper deck, including breaks, are measured using Simpson's First Rule. However due to the shape and location of these spaces, variations in the application of Simpson's First Rule, as explained in   the following paragraphs, must be observed.

In applying this rule, the breadths taken are numbered consecutively starting   at the foremost point of the length. All lengths and breadths of enclosed spaces above the upper deck are measured, irrespective of the fitting of insulation or the like, to the inner side of the structural

boundary plating in ships constructed of metal and to the inner side of the structural boundary surfaces in ships constructed of any other material (see Figure 2.17).

All heights for enclosed spaces are to be measured from the top of the deck plate to the underside of the overhead deck plate.

Box-shaped enclosed spaces may be calculated by multiplying the three main dimensions together, i.e.,

mean length x mean breadth x mean height = V of enclosed space.

If spaces have an irregular shape and cannot be measured by the foregoing methods, they may be divided into parts, which may be calculated separately.

2.6.2 — BETWEEN DECK SPACE

Measure the mean length of the space at the middle of its height and divide this length into the same number of parts determined for the tonnage length of the space below the upper deck.

Breadths taken at half the height of the space are measured through each point of division and also through the extreme points of the length.

The area is calculated using Simpson's First Rule, as follows:

The breadth taken at the foremost point of the length is multiplied by 0.5. The following four breadths are multiplied respectively by 2, 1, 2 and 1.5. The breadths taken at the five aftermost points of division starting at the aftermost point of the length are multiplied respectively by 0.5, 2, 1, 2 and 1.5;

The breadths taken at the even numbered points of division are multiplied by 4 and at the odd numbered points of division by 2;

The sum of the products determined above is multiplied by one-third the common interval between breadths, and the result obtained is multiplied by the mean height of the space to determine the volume of this space.

2.6.3 — BREAK, FORECASTLE, POOP, DECK HOUSE, SIDE HOUSE, TRUNK, HATCHWAY

(a) Measure the mean length of the space at the middle of its height and divide the length into the following number of equal parts:
  (i) length less than 15 metres - 4 equal parts;
  (ii) length 15 metres and above - 6 equal parts;
  (iii) in spaces such as a Break Forward and a Forecastle, the two foremost parts determined in accordance with (a) or (b) are each divided into two equal parts (see Figure 2.18);
  (iv) in spaces such as a Break Aft and a Poop, the two aftermost parts determined in accordance with (a) or (b) are each divided into two equal parts (see Figure 2.19).

Division of parts determined in accordance with (i) or (ii) does not apply to spaces such as Break Amidships, Deckhouse, Side House, Trunk and Hatch.

(b) Breadths taken at half the height of the space are measured through each point of division

and also through the extreme points of the length.

The breadths are numbered consecutively starting with breadth No. 1 at the foremost point of the length.

> (i) In spaces such as a Break Forward and a Forecastle, the breadth taken at the foremost point of the length is multiplied by 0.5 and the following four breadths are multiplied respectively by 2, 1, 2 and 1.5.

The breadth taken at the aftermost point of the length is multiplied by 1.

The even numbered breadths are multiplied by 4 and the odd numbered breadths by 2.

> (ii) In spaces such as a "Break Aft" and a "Poop", the breadth taken at the foremost point of the length is multiplied by 1.

The breadths taken at the five aftermost points of division starting at the aftermost point of the length are multiplied respectively by 0.5, 2, 1, 2 and 1.5.

The even numbered breadths are multiplied by 4 and the odd numbered breadths by 2.

> (iii) In the case of a Break Amidships, a Deckhouse, a Sidehouse, a Trunk and a Hatch, the breadths at the foremost and aftermost points of the length are multiplied by 1.

The even numbered breadths are multiplied by 4 and the odd numbered breadths by 2.

The sum of the product determined in subparagraph (i), (ii) or (iii) must be multiplied by one-third of the common interval between breadths and the result obtained is multiplied by the mean height of the space to determine its volume.

2.7 — CALCULATION OF THE VOLUME OF CARGO SPACES

If any cargo space is of a shape that the volume may be calculated by a direct method without loss of accuracy, such a method may be used. Otherwise, it must be measured using Simpson's First Rule. Lengths, breadths, depths, and heights are to be measured irrespective of the fitting of insulation or the like, to the inner side of the boundary of the space.

For the purposes of measurement, "cargo space" can be taken as a longitudinal series of cargo holds or tanks, if they are not separated by machinery or accommodation spaces and do not have discontinuities.

2.7.1 — CARGO SPACES BELOW THE UPPER DECK

Division of the Length

The length of each cargo space [l] taken in a straight line at the uppermost point of the depth of the space is divided into the following number of equal parts:
(a) length of cargo space less than 20 metres - 4 parts;
(b) length of cargo space 20 metres or more but not more than 40 metres - 6 parts;
(c) length of cargo space more than 40 metres - 10 parts.

2.7.2 — VOLUME OF CARGO SPACE BELOW UPPER DECK (4 PARTS)

(a) A total of four (4) equally spaced parts [$l/4$] using five (5) transverse ordinates is taken

through the points of division specified in Section 2.7.1 which includes the two extreme enclosing bulkheads of the cargo space, in a similar manner as explained in Section 2.5.3. The transverse ordinates are numbered forward to aft with the terminal point at the forward bulkhead position being No. 1, and the aftermost bulkhead being No. 5.

In addition, the foremost and aftermost parts are further divided into two equal parts making a total of seven (7) ordinates (see Figure 2.2 for an example of 10 parts, 15 ordinates).

(b) The depth of each transverse section is divided as indicated in Section 2.5.6.

(c) The breadths are measured as indicated in Section 2.5.7.

(d) The area of the transverse sections is calculated in accordance with Section 2.5.8.

(e) Once the areas of the transverse ordinates have been ascertained, the volume below the upper deck is calculated using Simpson's First Rule, as follows:

The area of the foremost transverse section is multiplied by 0.5 and the following six sections (counted towards the stern) are multiplied respectively by 2, 1.5, 4, 1.5, 2 and 0.5.

(f) The sum of the products determined in (e) is multiplied by one-third of the common interval (*i.e.* 1/3 x *l* /4) between the transverse ordinates, and the product obtained is the volume of the cargo space below the upper deck.

2.7.3 — VOLUME OF CARGO SPACE BELOW UPPER DECK (6 OR 10 PARTS)

(a) A total of six [or ten] equally spaced parts (*l* /6 or *l* /10) using seven or eleven transverse ordinates is taken through the points of division specified in Section 2.7.1 which includes the two extreme enclosing bulkheads of the cargo space, in a similar manner as explained in Section 2.5.3. The transverse ordinates are numbered forward to aft with the terminal point at the forward bulkhead position being No. 1, and the aftermost bulkhead being No. 7 (or 11).

In addition, the two foremost and two aftermost parts are further divided into two equal parts making a total of:

(i) for a cargo space of 6 parts - 11 ordinates;
(ii) for a cargo space of 10 parts - 15 ordinates;

(See Figure 2.2 for an example of 10 parts, 15 ordinates).

(b) The depth of each transverse section is divided as indicated in Section 2.5.6.

(c) The breadths are measured as indicated in Section 2.5.7.

(d) The area of the transverse sections is calculated in accordance with Section 2.5.8.

(e) Once the areas of the transverse sections have been ascertained, the volume below the upper deck is calculated using Simpson's First Rule as follows:

The area of the foremost transverse section is multiplied by 0.5 and the following four sections (counted towards the stern) are multiplied respectively by 2, 1, 2, 1.5;

The areas of the five aftermost transverse sections are multiplied (starting at the aftermost section) respectively by 0.5, 2, 1, 2 and 1.5;

The even numbered transverse sections are multiplied by 4 and the odd numbered by 2.

(f) The sum of the products determined in clause (e) is multiplied by one third of the common interval [*i.e.*1/3 x *ι*/6 or *ι*/10] between the transverse ordinates, and the product obtained is the volume of the cargo space below the upper deck.

2.7.4 — CARGO SPACES ABOVE THE UPPER DECK

If any cargo space is of such a shape that the volume can be calculated by a direct method without loss of accuracy, that method may be used. Otherwise the cargo space must be measured using Simpson's First Rule.

2.7.5 — INTERPRETATIONS OF COMPARTMENT VOLUMES FOR CARGO SPACES

The following are interpretations of compartment volumes for cargo spaces:

The volumes of segregated ballast tanks are not to be included in cargo volume (V_C) provided they are not to be used for cargo;

The volumes of clean ballast tanks in oil tankers are included in V_C if the ship is fitted with a crude oil washing system which would permit dual purpose cargo/clean ballast tank use of these tanks;

The volumes of dedicated clean ballast tanks are not to be included in V_C provided that:
(a) the tanks are not used for cargo;
(b) the ship carries a single International Oil Pollution Prevention Certificate which indicates it is operating with dedicated clean ballast tanks in accordance with regulation 13A, Annex I, MARPOL.

Tanks, permanently located on the upper deck, provided with removeable pipe connections to the cargo system or the vent (de-airing) lines of the ship, are to be included in V_C;

The volume of weathertight steel pontoon covers on hatchway coamings are included in the calculations of the total volume (V) of the ship. If covers are open on the underside, their volume is also included in V_C;

Multipurpose ships that have the facility to trade with cargo hatches open or closed are always measured with the hatch covers considered to be closed;

The volumes of slop tanks for cargo residues are included in V_C;

In fishing vessels, the volumes of fish processing space for fishmeal, liver oil and canning, tanks for re-cooling fish, wet fish bunkers, stores for salt, spices, oil and tare are included in V_C. Fishing gear stores are not included in V_C;

The volume of refrigerating machinery used for refrigerating cargoes and situated within the boundaries of the cargo spaces is included in V_c;

The volumes of mail rooms, baggage compartments separate from passenger accommodation, and bonded stores for passengers are included in V_C. The volume of provision rooms for crew or passengers and bonded stores for crew are not included in V_C;

Dual purpose oil/ballast tanks on combination carriers that have been converted to ballast tanks are to be excluded from V_c if they are solely allocated to carry ballast, permanently disconnected

from the oil cargo system and connected to an independent ballast system and not used for the carriage of cargo;

When determining the volumes of cargo spaces, no account shall be taken of insulation, sparring or ceiling that is fitted within the boundaries of the space concerned. For ships that have permanent independent cargo tanks constructed within the ship, e.g. gas tankers, the volume to be included in V_C is calculated to the structural boundary of such tanks, irrespective of insulation which may be fitted on the inside or outside of the tank boundary;

The volumes of dual-purpose spaces such as those used for both ballast and cargo are included in V_C;

Spaces allocated to passenger automobiles are included in V_C.

PART 3 — TONNAGE MEASUREMENT OF SHIPS LESS THAN 24 METRES IN LENGTH

3.1 — OPTIONS FOR MEASUREMENT

(a) Subject to paragraph (b), the gross tonnage and net tonnage of a ship that is less than 24 metres in length shall be determined in accordance with the Tonnage Block Coefficient Method detailed in Sections 3.2 to 3.7.

(b) The gross tonnage and net tonnage of a ship may be determined in accordance with the Tabular Method detailed in Section 3.8 provided that the ship meets all conditions given in that Section.

Note: Under Section 21 of the *CSA*, the Registrar may require a declaration to be made as to the ship's tonnage before the ship is registered under that Part. In the case of a pleasure craft, the owner may make this declaration; in the case of any other ship, the owner or the owner's authorized representative may make the declaration.

3.2 — TONNAGE BLOCK COEFFICIENT METHOD

The following definitions are to be applied in determining tonnages in accordance with this method:

"tonnage block coefficient" means the coefficient provided by the owner, authorized representative or Tonnage Measurer and determined in accordance with the formula

$$\frac{\nabla}{\mathbf{TML} \times \mathbf{TMB} \times \mathbf{TMD}}$$

where **"$\tilde{\mathbf{N}}$"** equals the volume of displacement in cubic metres of the moulded form up to the depth of the ship;

"tonnage measurement length" (TML) means the length of a ship measured in metres on the upper deck in the case of a decked ship or at the upper edge of the topmost strake in the case of an open ship from the moulded line of shell at the stem to the moulded line of the transom or the shell at the stern (see Figure 3.1);

"tonnage measurement breadth" (TMB) means the breadth of a ship measured in metres taken to the moulded line of the shell at one-half (mid-point) of the length (TML) (see Figures 3.1 and 3.2);

"tonnage measurement depth" (TMD) means
　　　(i) in the case of a decked ship, the depth of the ship measured in metres at the middle of the length (TML) from the moulded line of the upper deck to the moulded line of the shell at the centreline; (see Figure 3.3) and
　　　(ii) in the case of an open ship, the depth of the ship measured in metres from an athwartship line extending from the upper edge to the upper edge of the topmost strake at the middle of the length (TML) to the moulded line of the shell at the centreline (see Figure 2.9).

"upper deck" has the same meaning as in Section 1.1 of this Standard;

A ship that does not meet the requirements for an upper deck as defined in Section 1.1 shall be measured as an open ship.

3.3 — GROSS TONNAGE FORMULA (GT)

The gross tonnage of a ship shall be determined by the formula

$$GT = (V_1 \times C_1) + (V_2 \times 0.353)$$

where

V_1 = TML x TMB x TMD as defined in Section 3.2;

V_2 = the volume of spaces above the upper deck in cubic metres as determined in accordance with Section 3.5, 3.6 and 3.7;

C_1 = the coefficient set out in Columns II, III, IV, V and VI of an item of the table to this section, for the type of ship described in the heading thereof, and for the tonnage block coefficient set out in Column I of that item.

As an example, in the case of a decked fishing vessel having a tonnage block coefficient of 0.55, Item 2 of Column I and Column V of the following table would apply and the coefficient (C_1) would be 0.16.

Table 3 — Gross Tonnage Coefficients

	Column I	Column II	Column III	Column IV	Column V	Column VI
		Coefficient (C_1)				
Item	Tonnage Block Coefficient	Passenger ships and open boats	Tugs 12 m or less in length *(TML)	Tugs more than 12 m in length *(TML)	Other ships	Small passenger ships 10m or less in length *(TML)
1.	<0.50	0.11	0.10	0.15	0.15	0.09
2.	0.50 - 0.65	0.14	0.12	0.16	0.16	0.10
3.	>0.65 - 0.75	0.17	0.17	0.17	0.17	0.11
4.	> 0.75	0.20	0.20	0.20	0.20	0.12

*where TML is defined in Section 3.2

3.4 — THE NET TONNAGE FORMULA (NT)

The net tonnage of a ship shall be determined by the formula

$$NT = GT \times C_2$$

Where

GT = gross tonnage of the ship as determined in accordance with Section 3.3;

C_2 = the coefficient set out in Column II of an item of the following table of coefficients for the type of ship set out in Column 1 of that item.

Table 4 — Net Tonnage Coefficients

	Column I	Column ll
Item	Type of Ship	Coefficient (C_2)
1	Sailing Ship*	0.95
2.	Power-driven ship	0.75
3.	Non-propelled ship	1.00

*A sailing ship with an auxiliary propulsion engine is considered under Item 1.

3.5 — INCLUDED SPACES ABOVE THE UPPER DECK (V_2)

(a) Each individual, above deck compartment shall be measured by multiplying the inside mean length, breadth and height in metres of each space. The length and breadth shall be taken at one half the height of the space (see Figure 3.4).

(b) If a space has an irregular shape and cannot be measured accurately by the method described in (a), the space shall be divided into parts that can be calculated separately.

(c) For a decked ship containing a break, the break shall be calculated separately and included in V_2 (see Figure 3.1(B) and 3.4).

3.6 — MEASUREMENT OF SPACES

The measurement of all spaces whether situated above or below the upper deck shall be taken, irrespective of the fitting of ceilings, insulation or the like, to the inner side of the shell of the hull and to the inner side of structural boundary surfaces in spaces above the upper deck (see Figure 2.17).

3.7 — EXCLUDED SPACES ABOVE THE UPPER DECK

Option: An owner or authorized representative may elect to have the following spaces excluded from the gross tonnage provided the spaces are properly constructed and reasonable in extent (size) for their purpose or function.

(a) Those **excluded spaces** as set out in Section 1.1.

(b) Propelling Machinery Spaces
Spaces forming part of the propelling machinery space or serving for the admission of light and air thereto.

(c) Machinery Spaces
Spaces containing machinery such as anchor gear, steering gear, pumps, refrigerating machinery (not for cargo), etc. However, spaces containing machinery used in the handling of cargo, dredging operations and the such, shall be included in the gross tonnage.

(d) Wheelhouse

(e) Chain Locker

(f) Companions

Companionways and access hatches which protect stairways and ladderways leading to compartments situated below, also openings over such stairways and ladderways and elevator shafts and related machinery.

(g) Galley

Only that part of the galley permanently fitted with ovens or other cooking appliances is to be excluded. Spaces such as sculleries, washing-up rooms, preparation rooms and confectionery rooms although contained within the confines of the galley shall be included in the gross tonnage.

(h) Washrooms

Washrooms, shower spaces, toilets and urinals.

Changing rooms provided with washbasins and/or showers are to be considered as washrooms. However, laundries are not considered as washrooms.

(i) Shelter Space

Shelter space on small passenger vessels 10 metres in length (TML) or less providing weather protection only, for use free of charge in ships is not to be included in the gross tonnage, provided that;

    (i)   the space is used solely for the shelter of the unberthed passengers;
    (ii) no form of service of meals or refreshments is provided in the space;
    (iii) seating for deck passengers is not in the form of upholstered armchairs or settees;
    (iv) tables are not normally permitted. The occasional table may be provided; and
    (v) no carpets are to be provided.

3.8 — TABULAR METHOD

(a) The following definitions are to be applied in determining tonnages in accordance with this method:

"breadth" is the maximum breadth of the ship measured in metres at any point on the length of the ship;

"length overall" **[LOA]** is the length of a ship measured in metres from the fore part of the uppermost end of the stem to the aft side of the aftermost permanent structure of the ship, not including guards or rubbing strakes, spars, platforms, outboard motors, Z-drives, jet drives, or transom-hung rudders, but is to include any additional enclosed hull volume that is to be added to the hull in the form of detachable or fixed volumes such as blisters, sponsons, bolted stern appendages, etc. (see Figure 3.5);

(b) This method does not require a Tonnage Measurer and is applicable to a ship that

    (i) is 12 metres in length (LOA) or less,
    (ii) is of monohull form,
    (iii) has a maximum breadth not greater than 4.8 metres,

(iv) has a single tier of deckhouse/superstructure having a length not exceeding 70% of LOA,

(v) is not a houseboat, or

(vi) is not a barge hull form.

(c) This method is designed to be used by the owner in the case of a pleasure craft, or by the owner or the authorized representative in the case of any other ship. First, the LOA of the ship is ascertained. Then the appropriate row of Table 5 is selected and from this row the Gross and Net Tonnages are recorded.
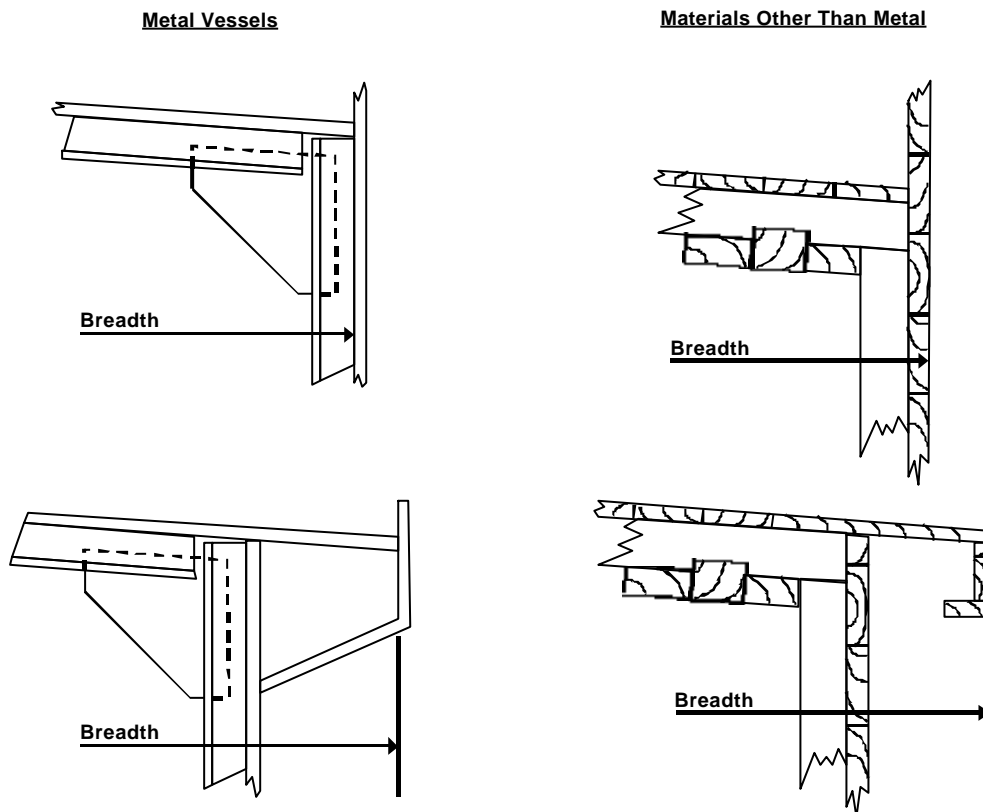
Table 5 — LOA vs. Tabular Gross and Net Tonnages

Column 1	Column 2	Column 3
Length Overall (LOA)	Tabular Gross Tonnage	Tabular Net Tonnage
Less than 8 m	4.60	2.30
8 m or more but less than 8.5 m	5.00	2.53
8.5 m or more but less than 9 m	6.00	3.01
9 m or more but less than 9.5 m	7.00	3.56
9.5 m or more but less than 10 m	8.00	4.17
10 m or more but less than 10.5 m	9.50	4.85
10.5 m or more but less than 11 m	11.00	5.59
11 m or more but less than 11.5 m	12.50	6.41
11.5 m or more but less than 12 m	14.50	7.30
Equal to 12 m	15.00	7.78

PART 4 – FIGURES
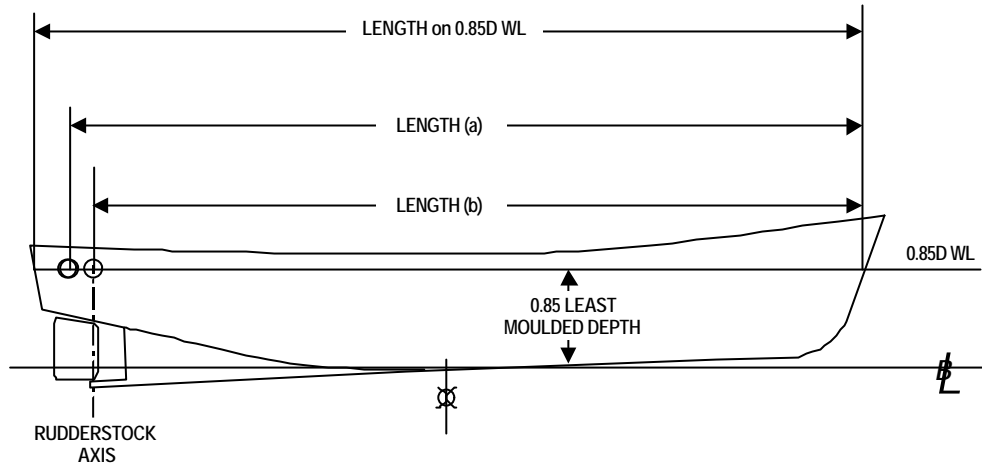
Figure 1.0 — Length (Section 1.2)

Figure 1.1 — Breadth *(Section 1.1)*

Parabolic Curved Camber   **Straight Line Camber**

Straight Line Camber
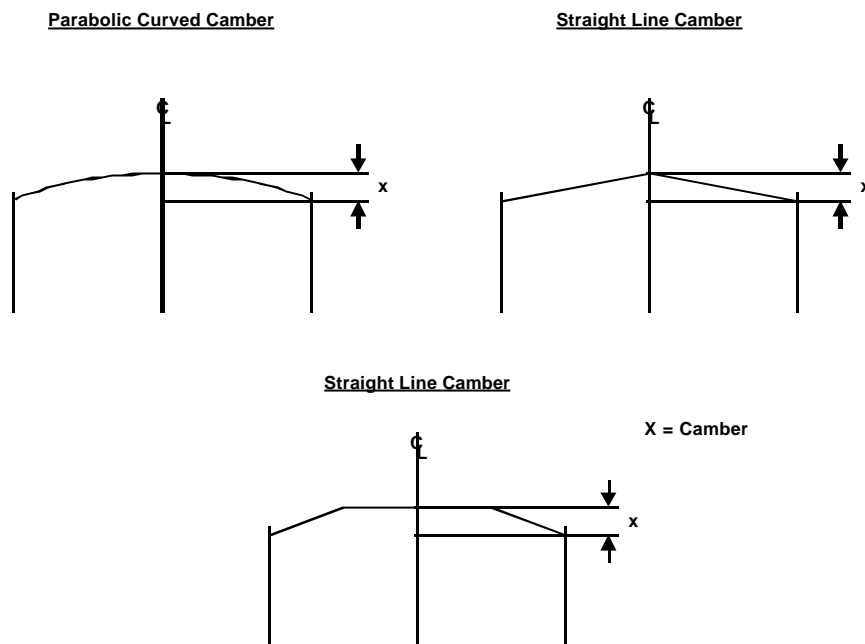
X = Camber

Figure 1.2 — Camber *(Section 1.1)*

O = Excluded Space

C = Enclosed Space

B = Breadth of Deck in Way of Opening
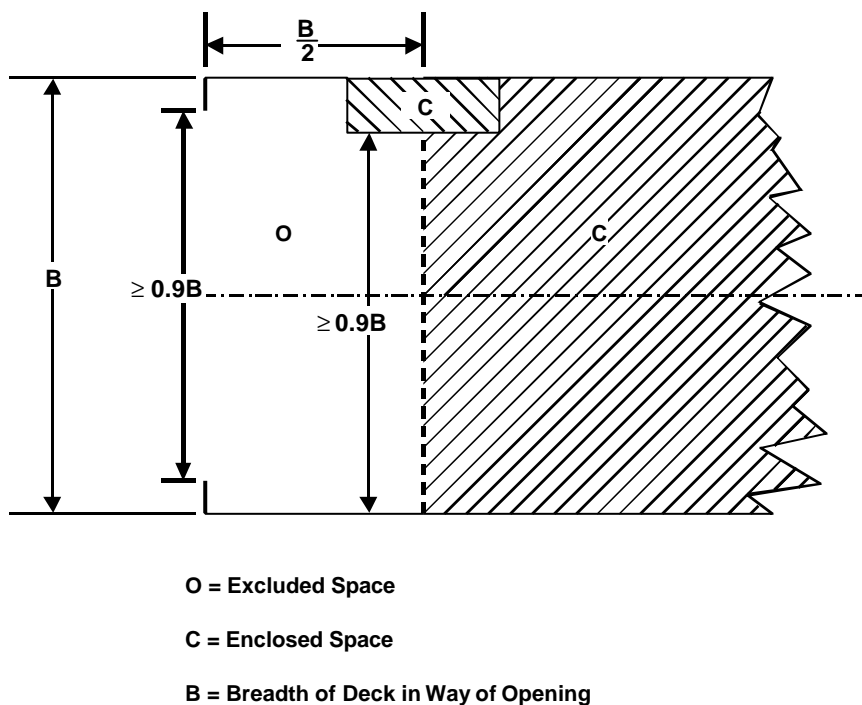
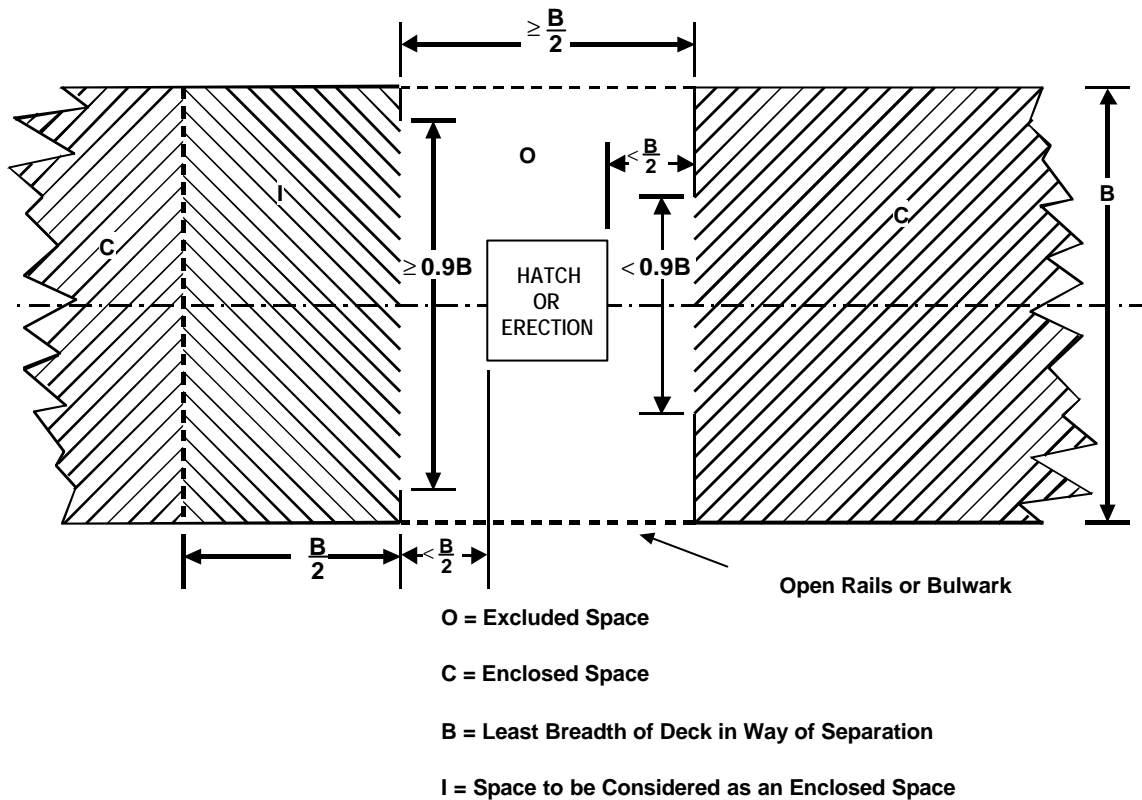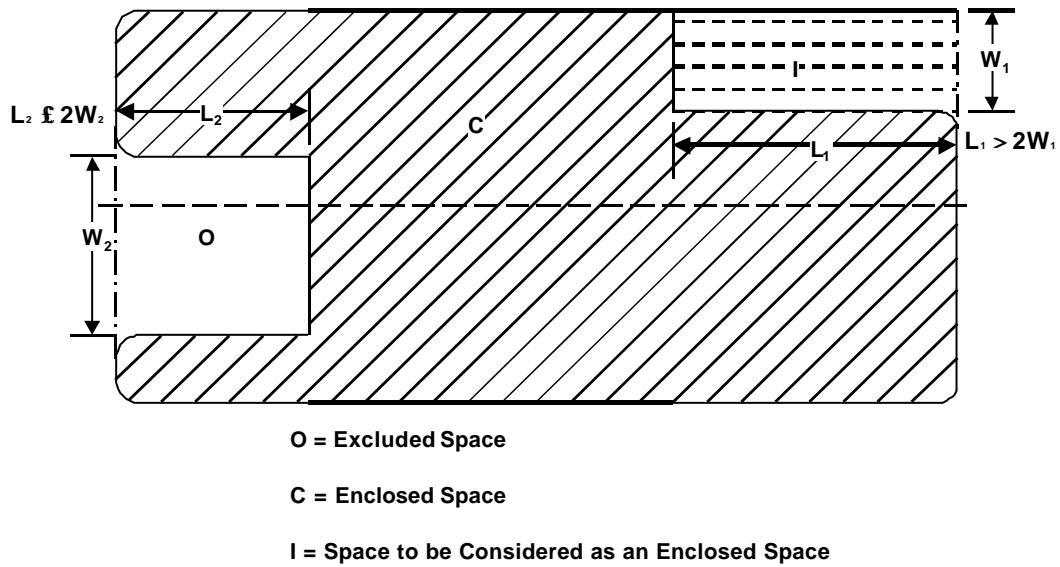**Figure 1.3 — Enclosed & Excluded Spaces** *(Paragraph 1.1(A)(i))*
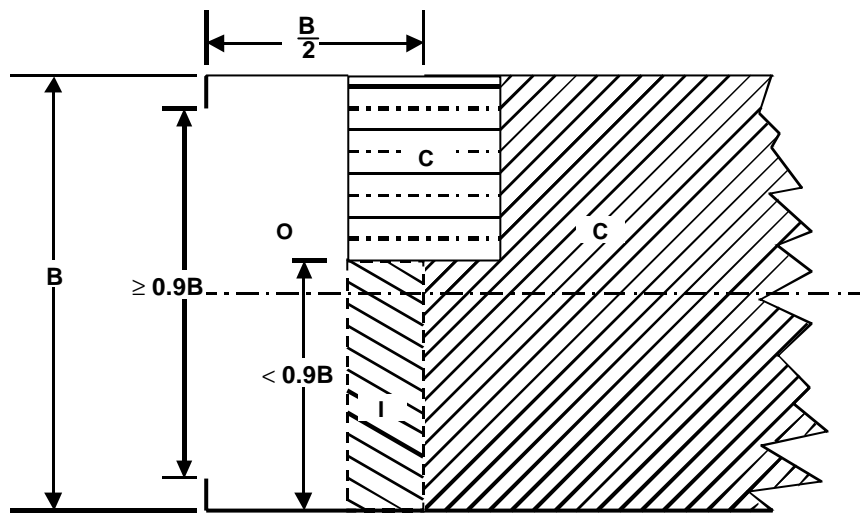
O = Excluded Space

C = Enclosed Space

B = Breadth of Deck in Way of Opening

I = Space to be Considered as an Enclosed Space

Figure 1.4 — Enclosed & Excluded Spaces *(Paragraph 1.1(A)(ii))*
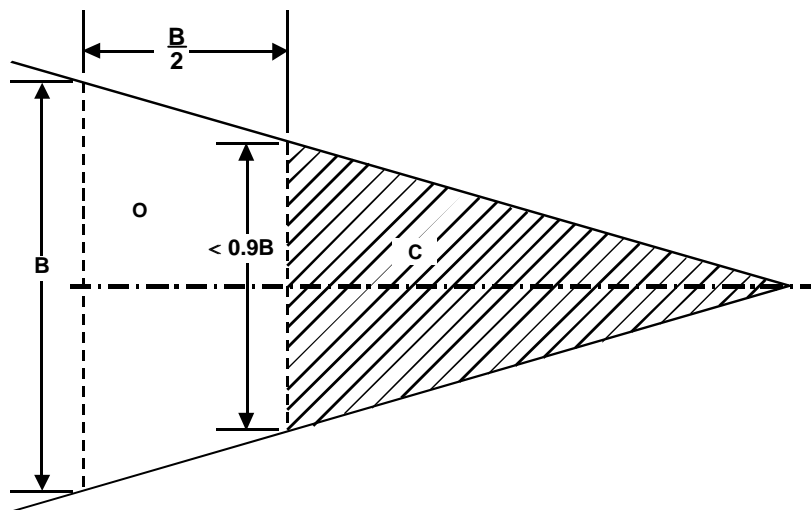
O = Excluded Space

C = Enclosed Space

B = Breadth of Deck in Way of Opening

Figure 1.5 — Enclosed & Excluded Spaces *(Paragraph 1.1(A)(ii))*

O = Excluded Space

C = Enclosed Space

B = Breadth of Deck in Way of Opening

I = Space to be Considered as an Enclosed Space
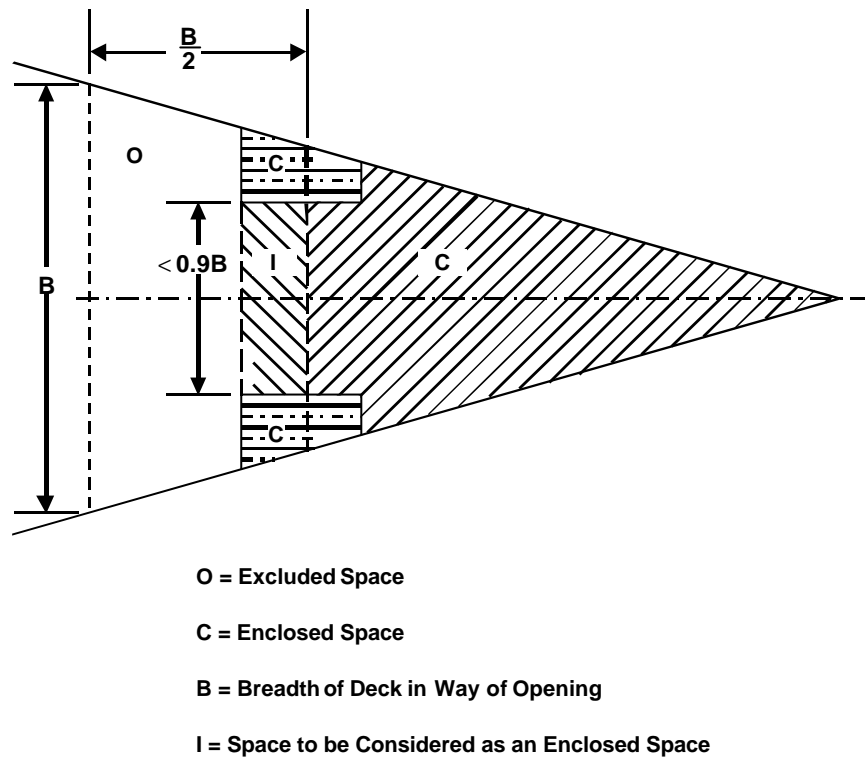
Figure 1.6 — Enclosed & Excluded Spaces *(Paragraph 1.1(A)(ii))*

O = Excluded Space

C = Enclosed Space

B = Least Breadth of Deck in Way of Separation
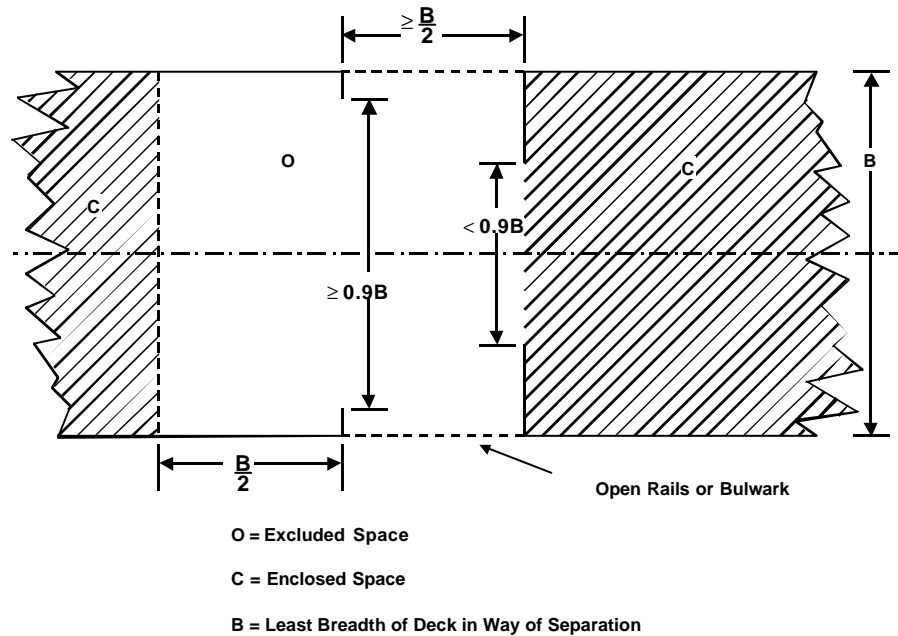
Figure 1.7 — Enclosed & Excluded Spaces *(Paragraph 1.1(A)(iii))*

O = Excluded Space

C = Enclosed Space

B = Least Breadth of Deck in Way of Separation

I = Space to be Considered as an Enclosed Space

Figure 1.8 — Enclosed & Excluded Spaces *(Paragraph 1.1(A)(iii))*

$$h = \text{At Least } \frac{H}{3} \text{ or } 0.75\,m$$
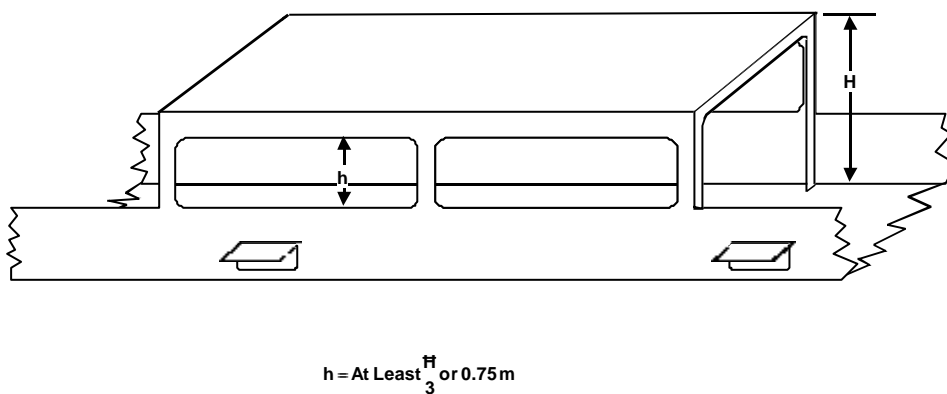
Figure 1.9 — Enclosed & Excluded Spaces *(Subsection 1.1(B))*

Length of Excluded Space

$$h = \text{At Least} \frac{H}{3} \text{ or } 0.75m$$

whichever is the greater

Opposite Side Openings   **Opening on One Side Only**

O = Excluded Space

B & B₁ = Breadth of Deck in Way of Opening
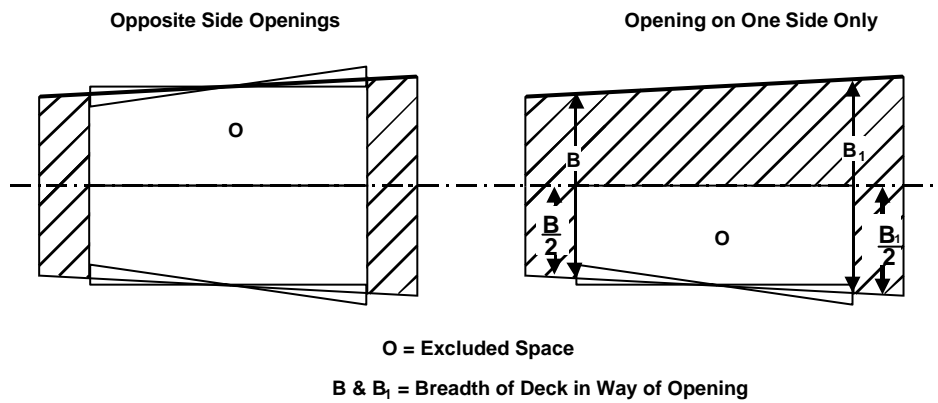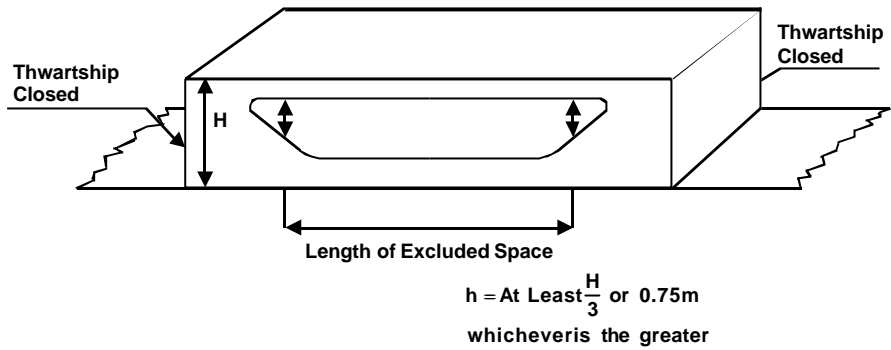
Figure 1.10 — Enclosed & Excluded Spaces *(Subsection 1.1(C))*

O = Excluded Space

C = Enclosed Space

I = Space to be Considered as an Enclosed Space

Figure 1.11 — Enclosed & Excluded Spaces *(Subsection 1.1(E))*
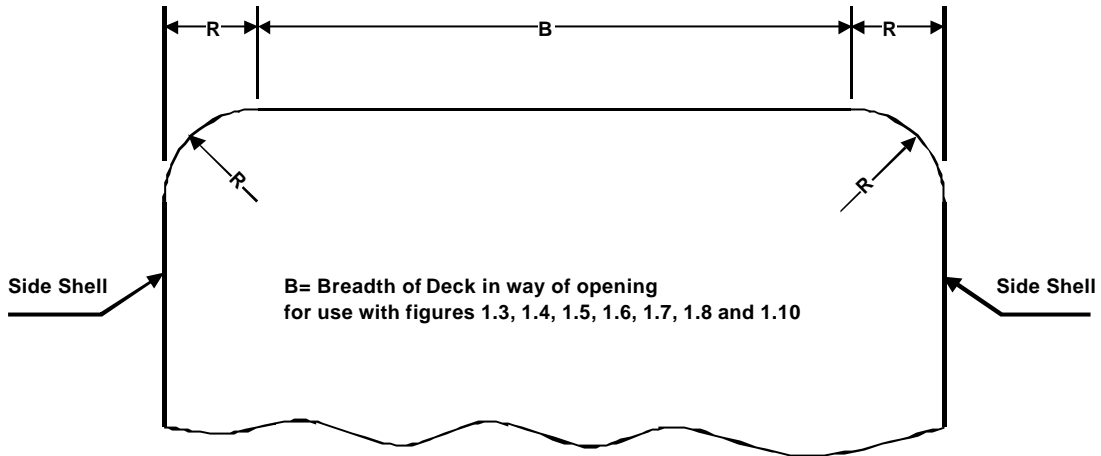
Figure 1.12 — Ships with Rounded Gunwales *(Section 1.1)*
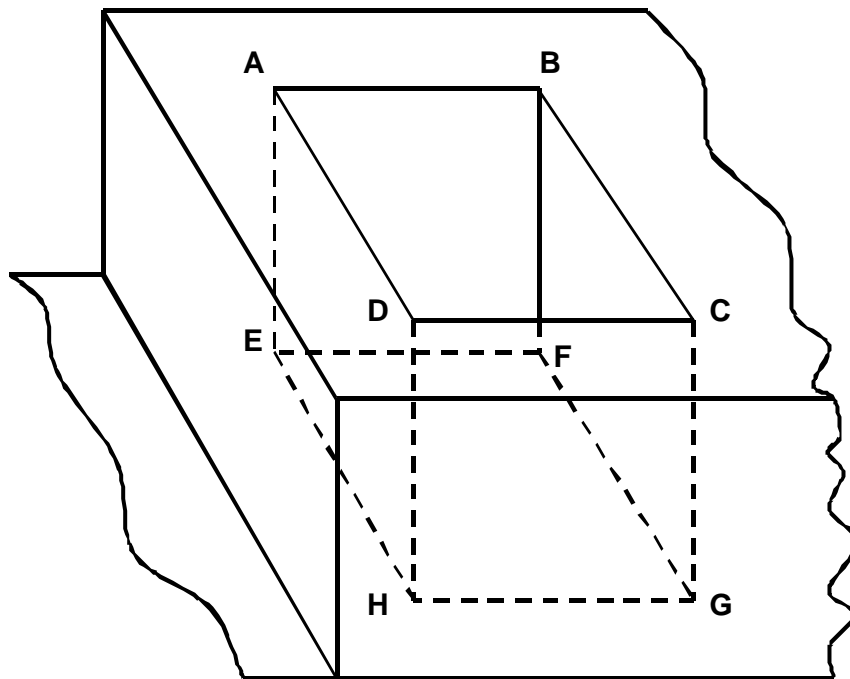
ABCD=Opening in the Deck

**Space ABCDEFGH shall be
excluded from enclosed space**

Figure 1.13 — Enclosed & Excluded Spaces *(Subsection 1.1(D))*
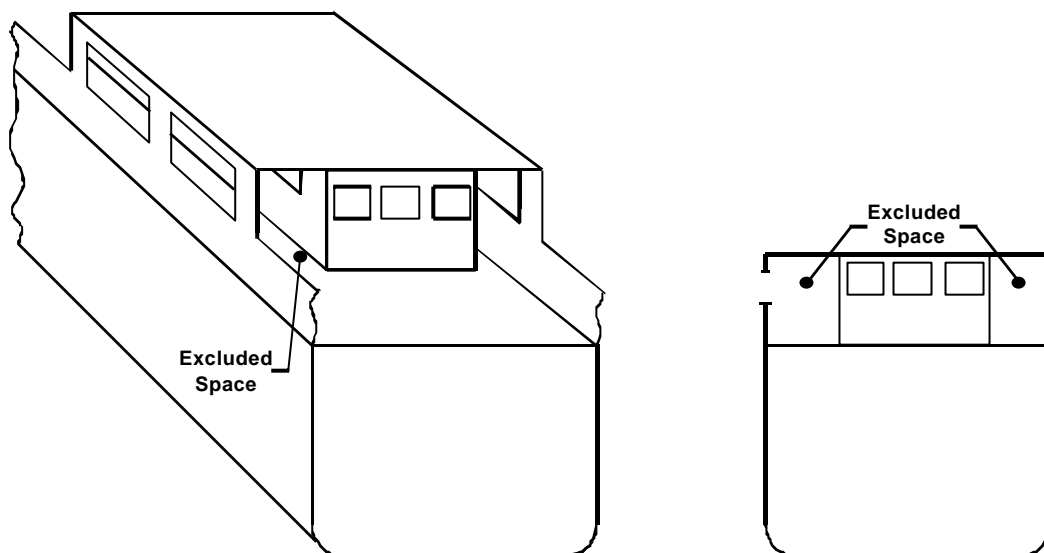
Figure 1.14 — Enclosed & Excluded Spaces *(Section 1.1)*

Ships Other Than Metal   **Metal Ships**

Moulded Depth
(D)

D

D

Wood Keel   **Plate Keel**
With Thick Garboards

D

GRP   **Bar Keel**
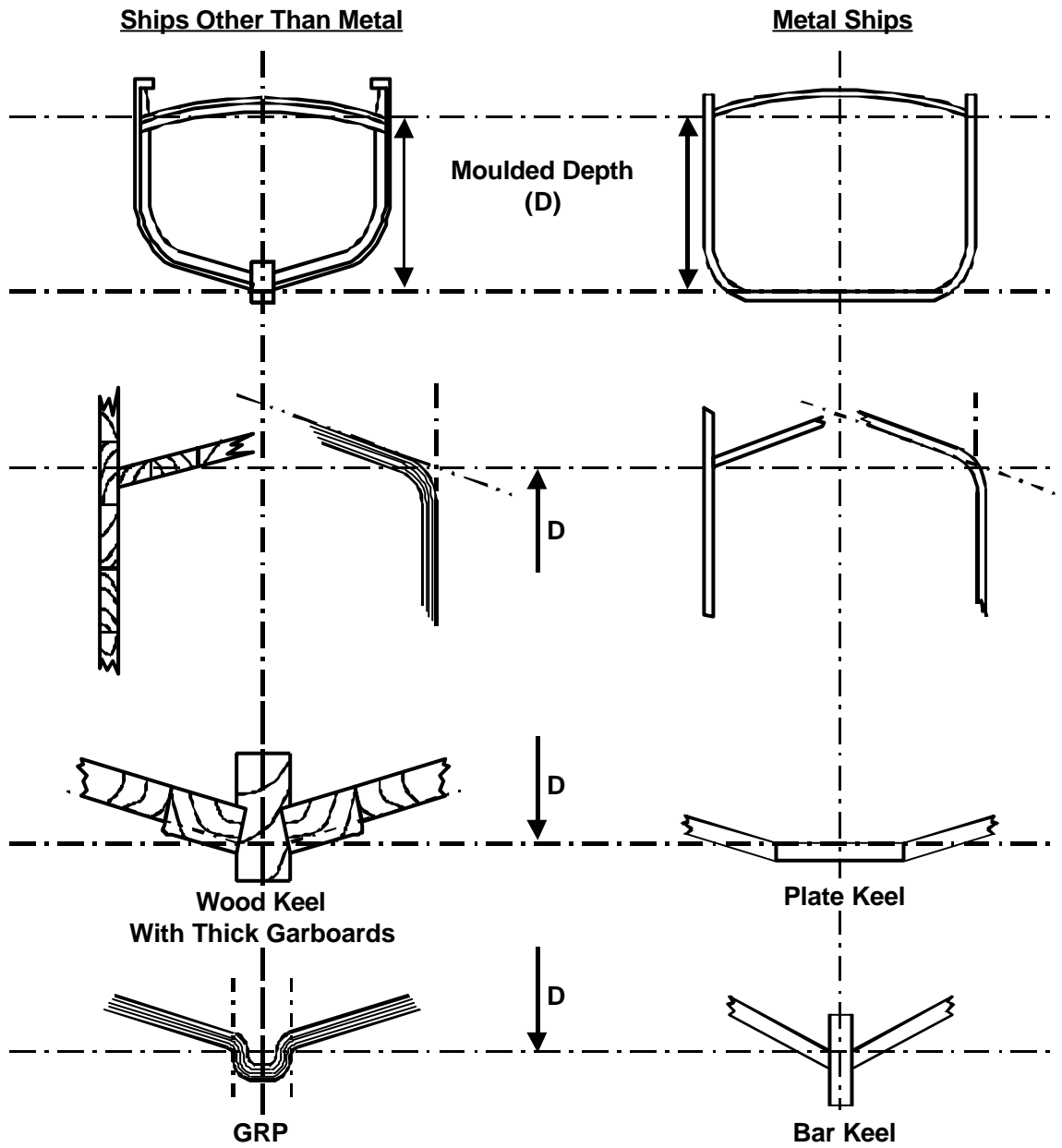
Figure 1.15 — Moulded Depth *(Section 1.1)*

Single Deck

Two Decks

Three Decks
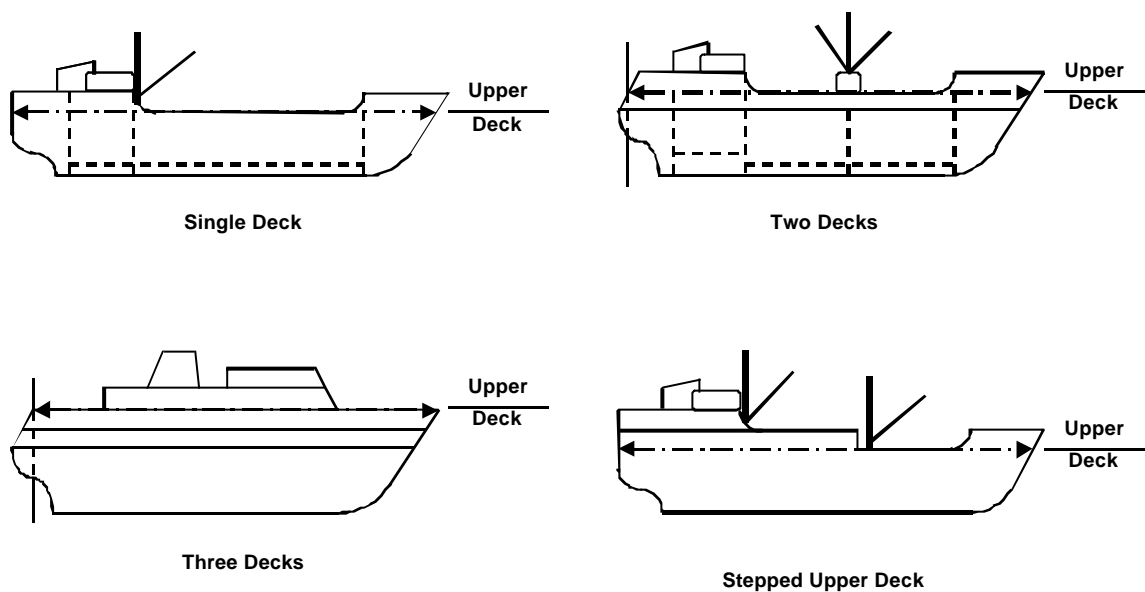
Stepped Upper Deck

Figure 1.16 — Upper Deck *(Section 1.1)*

Stepped Upper Deck

Upper Deck

Line of Upper Deck
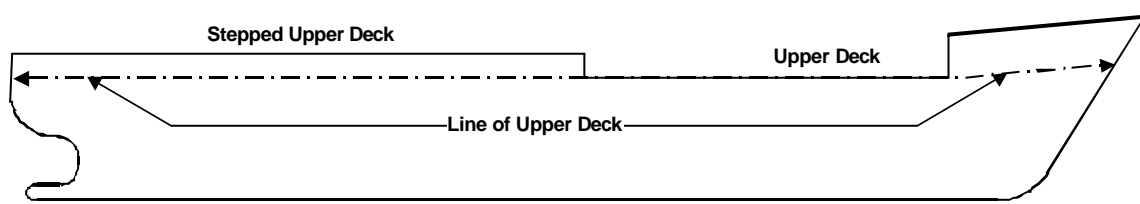
Figure 1.17 — Stepped Upper Deck *(Section 1.1)*

>1.0 m   Line parallel to exposed deck

Moulded Depth (D)
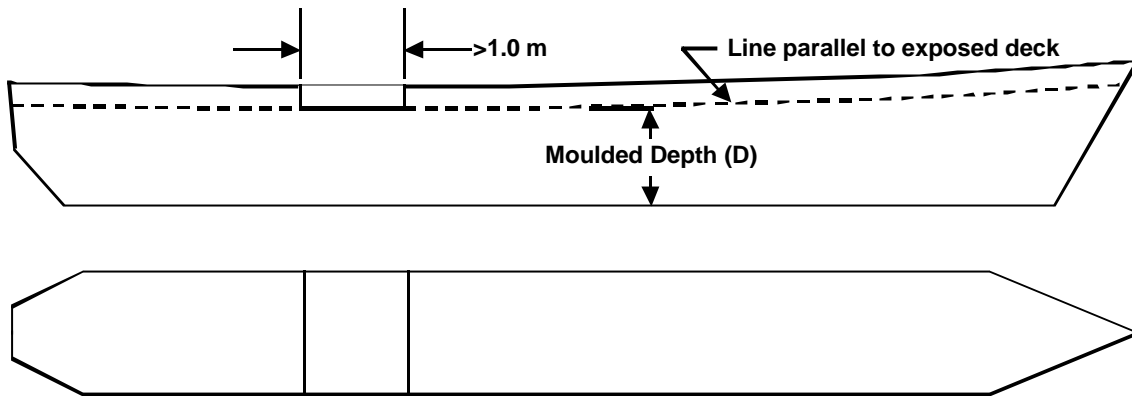
Figure 1.18 — Stepped Upper Deck *(Section 1.1)*

d_1

Moulded Depth (D)

l

b
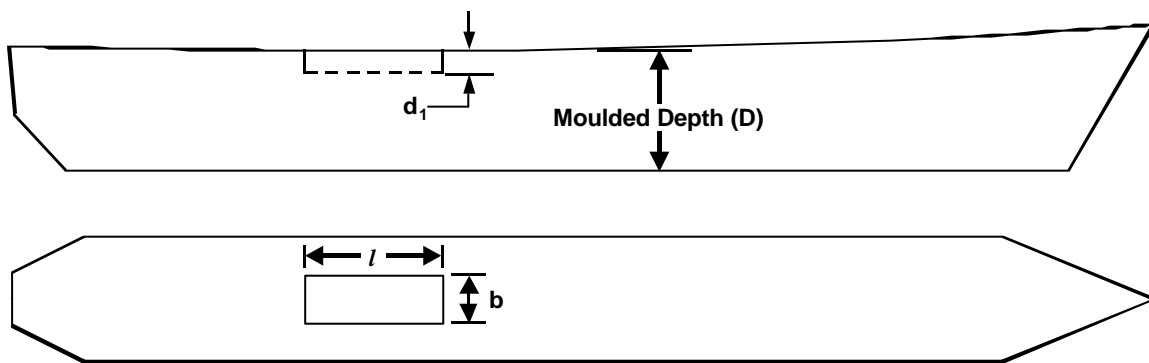
Figure 1.19 — Recessed Upper Deck *(Section 1.1)*

A

Upper Deck

A
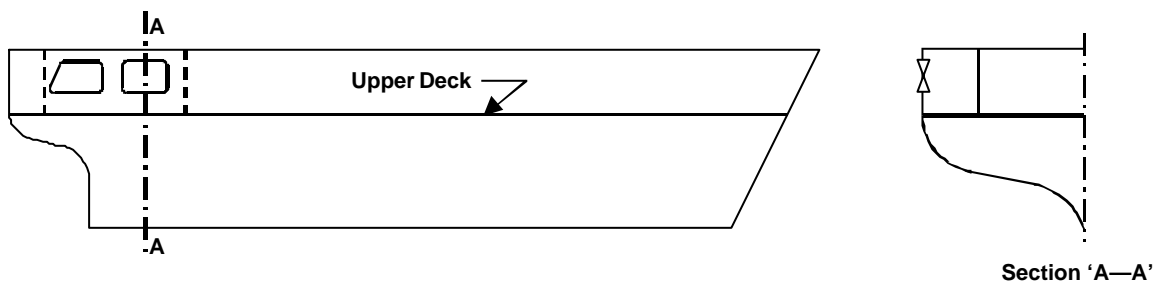
Section 'A—A'

Figure 1.20 —Upper Deck *(Section 1.1)*
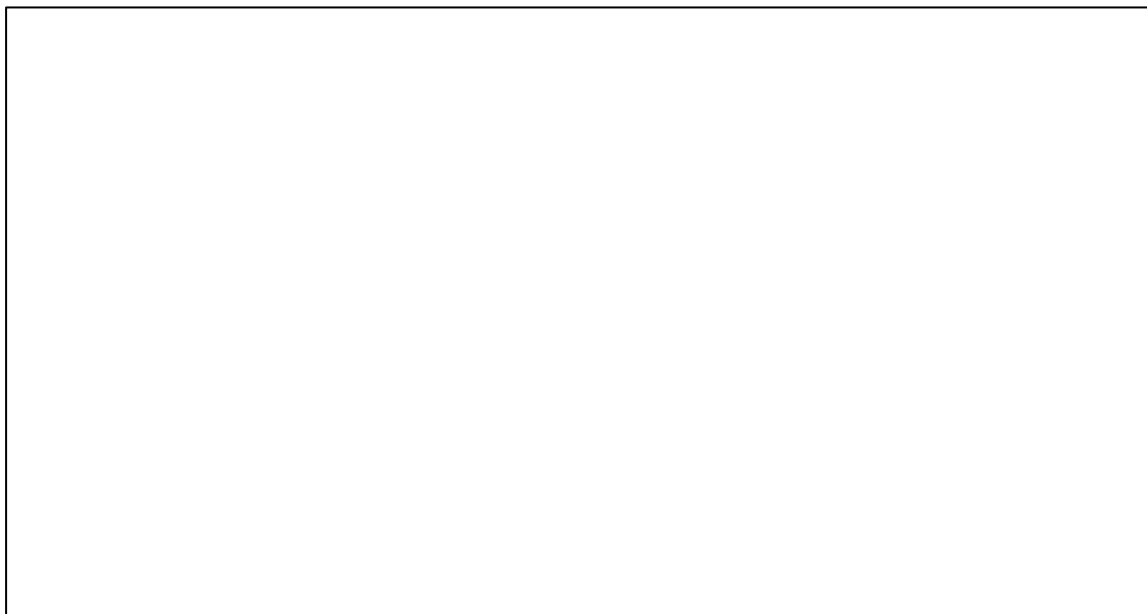
Figure 1.21 — *(RESERVED)*
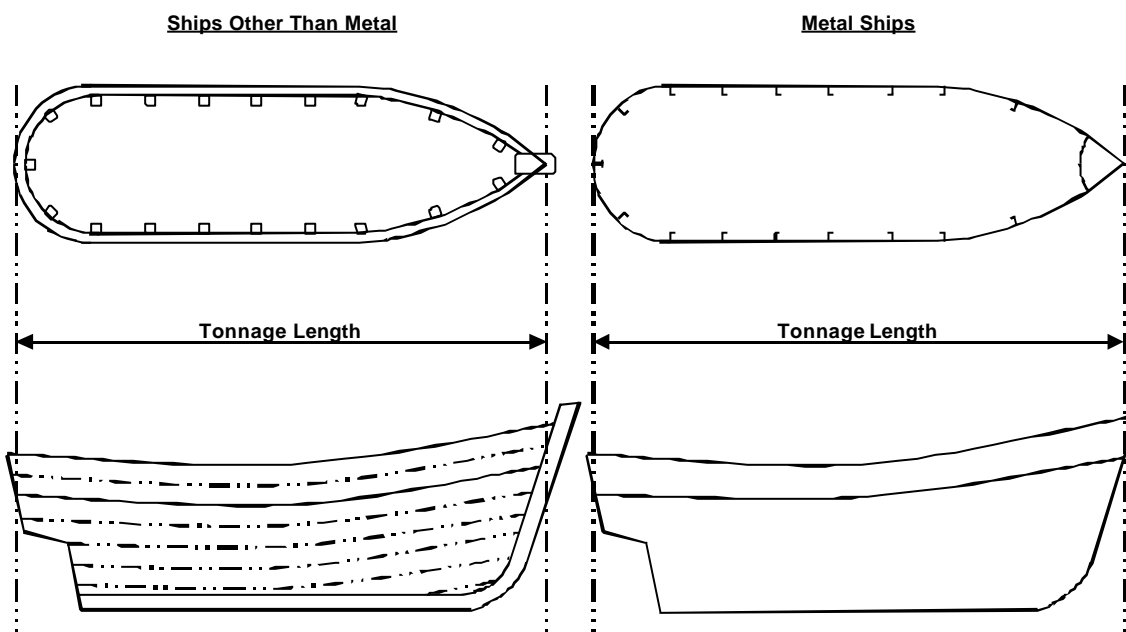
Figure 1.22a —Tonnage Length *(Section 1.1)*

Stepped Deck

Upper Deck

Main Hull Volume

Moulded
Line of Hull
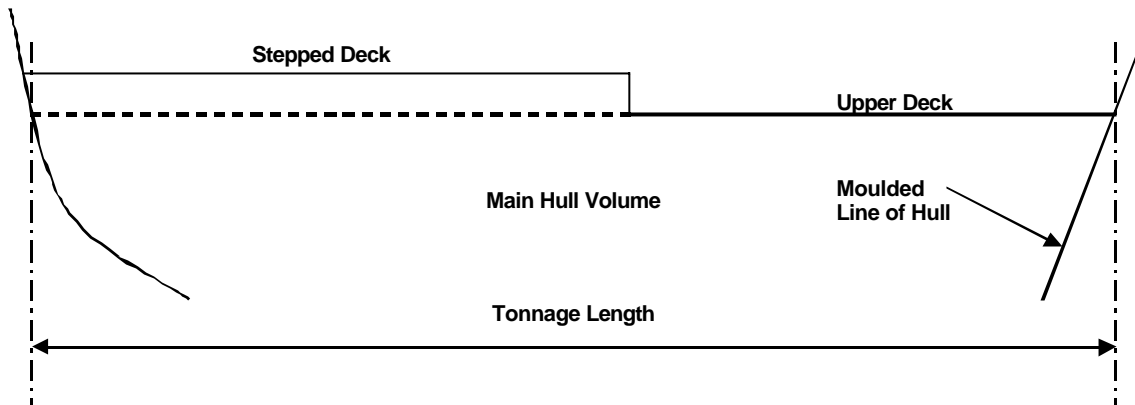
Tonnage Length

Figure 1.22b —Tonnage Length *(Section 1.1)*

Non-Watertight
Bottom Hatch
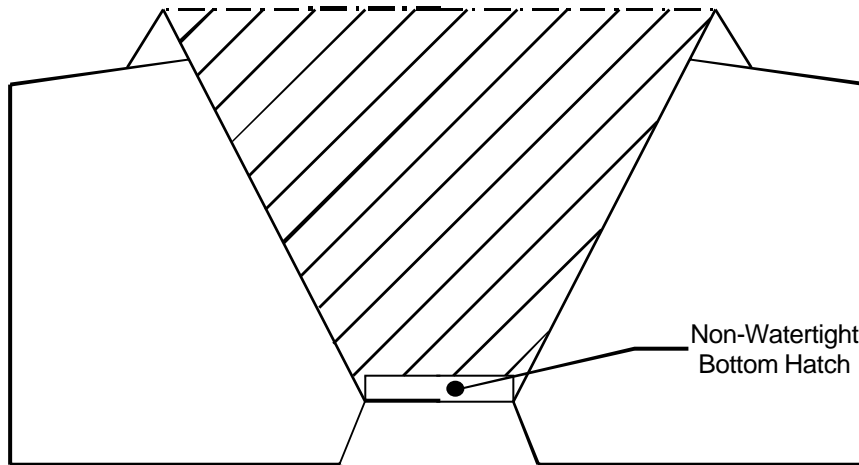
Shaded volumes include in V and V_c
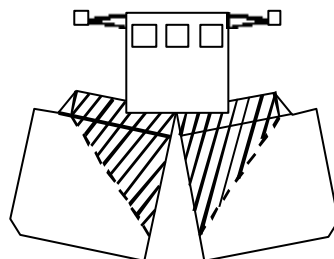
Figure 2.1 — Split Hull Barges and Dredges *(Section 2.4.1)*

Tonnage Length = 50 m

(Common Interval Between Sections = 50/10 = 5 m

Upper Deck

c.i./2   c.i./2   c.i.   c.i./2   c.i./2

$10\frac{1}{2}$ $9\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$

**Section
No 11**   **10**   **9**   **8**   **7**   **6**   **5**   **4**   **3**   **2**   **Section
No 1**
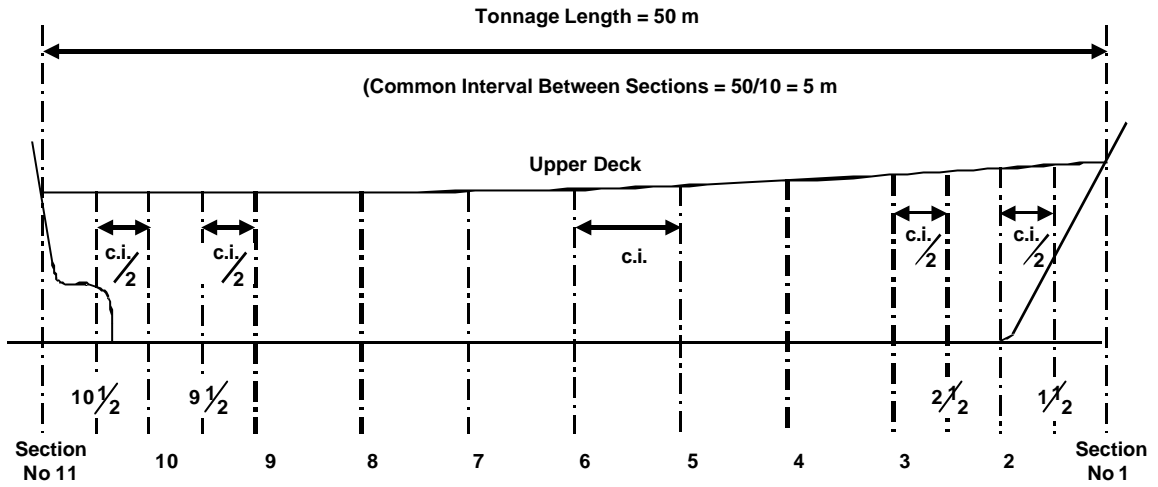
Figure 2.2 — Division of Tonnage Length *(Section 2.5.2)*

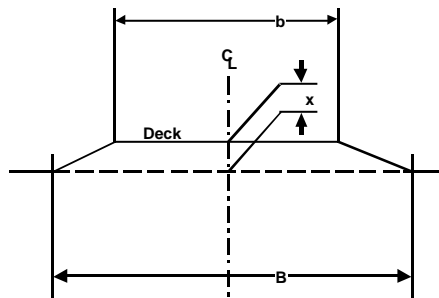Ç L   Ç L

x   x

Deck   **Deck**

B   B
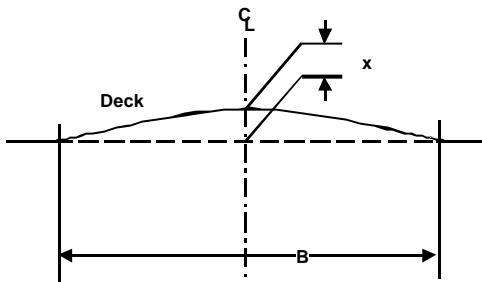
x = Camber in meters   x = Camber in meters

$\frac{x}{3}$ = Correction for Camber $\frac{x}{2}$ = Correction for Camber

**Figure 2.3 — Parabolic Curved
Camber** *(Subsection 2.5.4(a))*
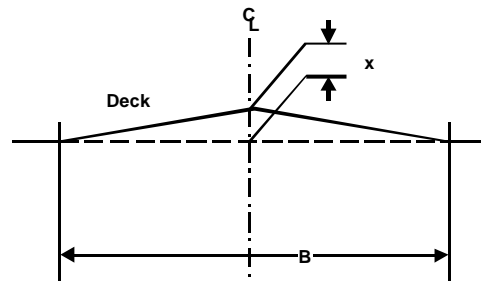
Figure 2.4 — Straight Line Camber
(Subsection 2.5.4(b))

b

Ç L

x

Deck

B

x = Camber in meters

$x\left(\frac{B-b}{2B}\right)$ = Correction for Camber

**Figure 2.5 — Straight Line Camber
*(Subsection 2.5.4(c))***

39

Ships Other Than Metal

Metal Ships

**Lower Edge of
Keel Rabbet**

**Wood Keel
With Thick Garboards**

Duct/Box Keel

GRP

Bar Keel

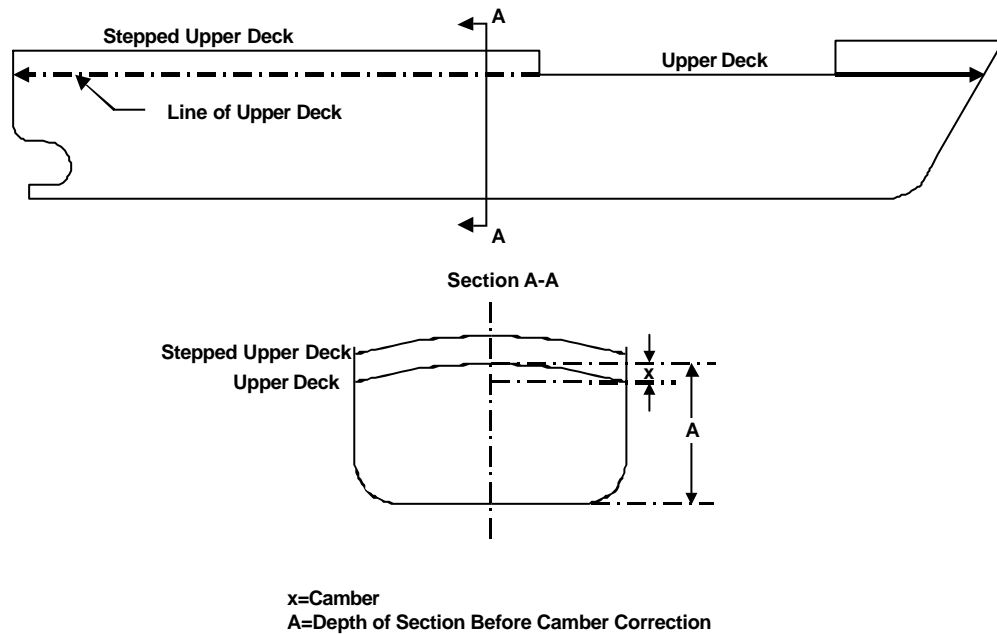**x=Camber
A=Depth of Section Before Camber Correction**
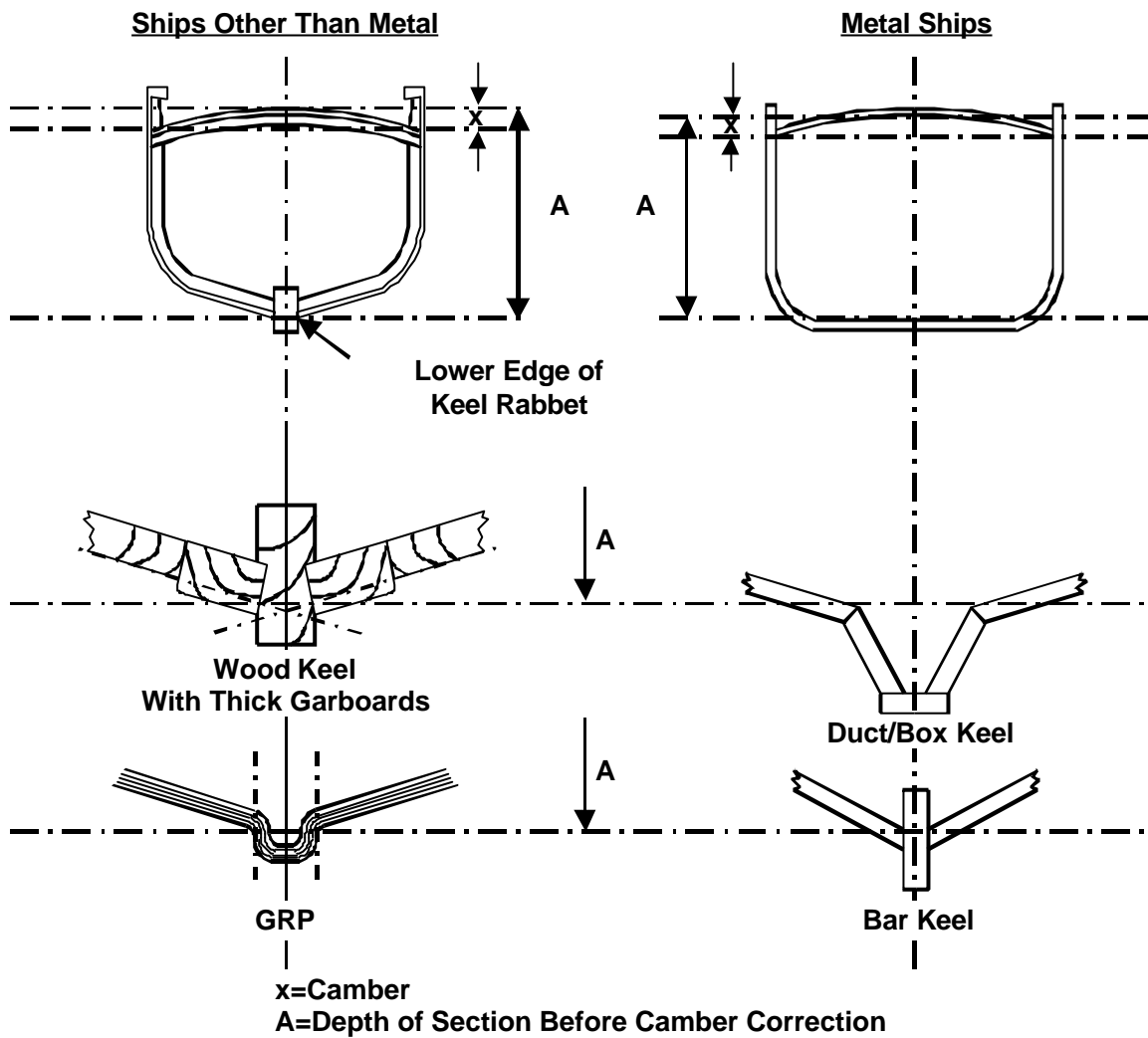
Depth of Transverse Section (DS) = A - Correction for Camber

**Figure 2.6 — Depth of Transverse Section
*(Subsections 2.5.5(a), (b) and (c))***

Section ' B-B '   Section ' A-A '

x=Camber
A=Depth of Section Before Camber Correction
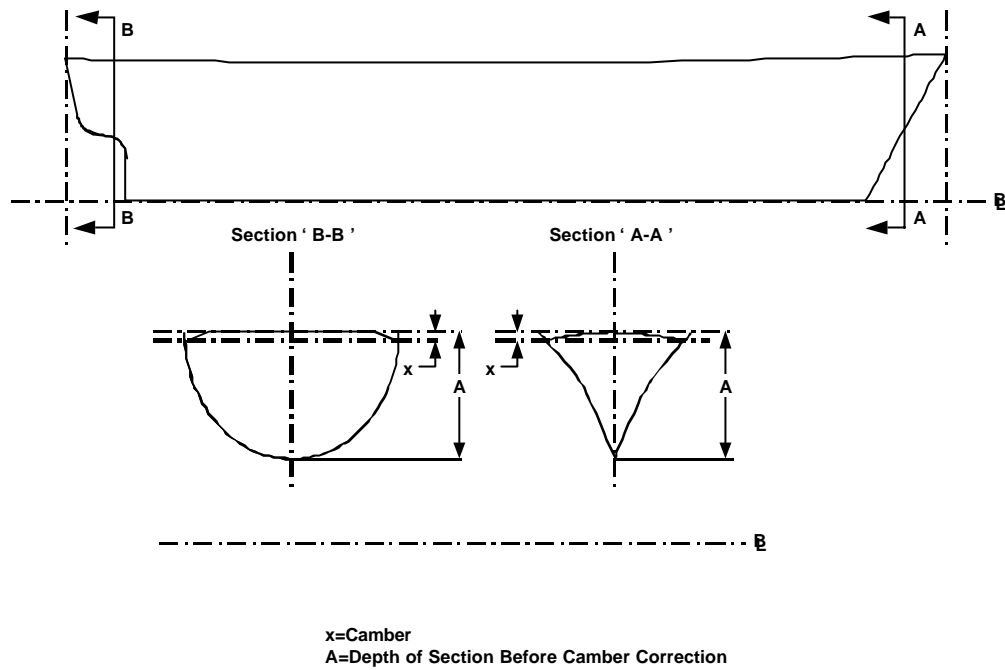
Depth of Transverse Section (DS)=A-Correction For Camber

Figure 2.7 — Depth of Transverse Section *(Subsection 2.5.5(d))*

Stepped Upper Deck   Upper Deck

Line of Upper Deck

Section A-A

Stepped Upper Deck
Upper Deck

x=Camber
A=Depth of Section Before Camber Correction

Depth of Transverse Section (DS)=A-Correction For Camber

Figure 2.8 — Depth of Transverse Section *(Section 2.5.5)*

Ships Other Than Metal   **Metal Ships**
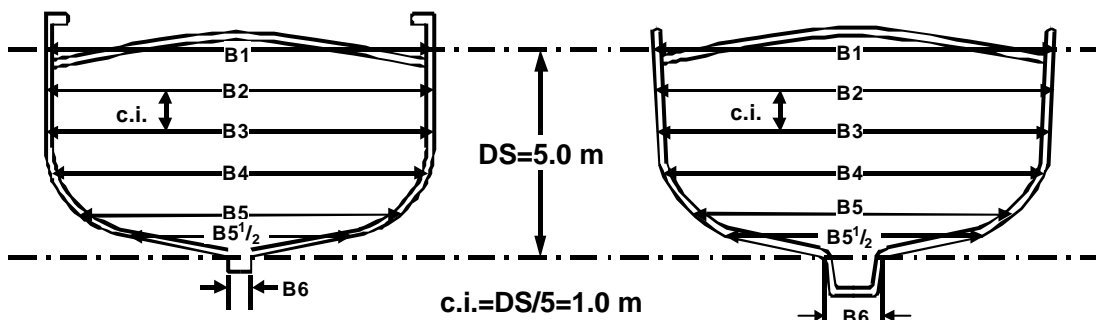

Depth of Transverse
Section (DS)
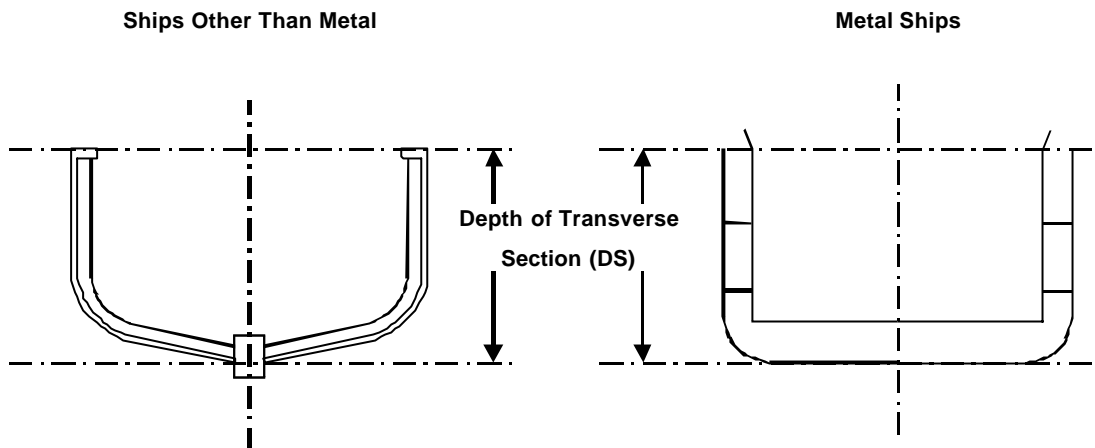
Figure 2.9 — Depth of Transverse Section *(Section 2.5.5)*

Vessels Other Than Metal

Where Depth of Transverse Section (DS) ≤ 6.0 m

DS=5.0 m

c.i.=DS/5=1.0 m

Metal Vessels

Where Depth of Transverse Section (DS) >6.0 m

DS=14.0 m

Flat
Keel

Bar
Keel

c.i.=DS/7=2.0 m
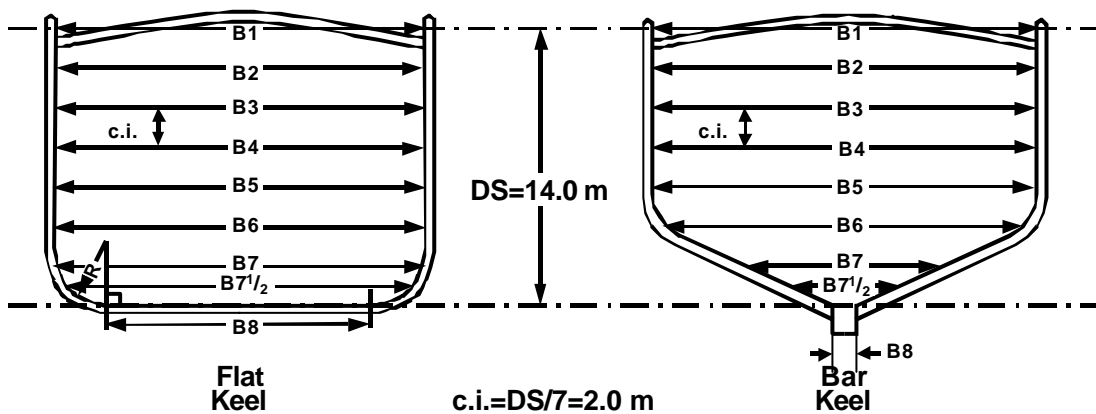
Figure 2.10 — Division of Depth of Transverse Section
(Sections 2.5.6 and 2.5.7)

Under Deck Volume= V_{UD}+ V_{SUD}
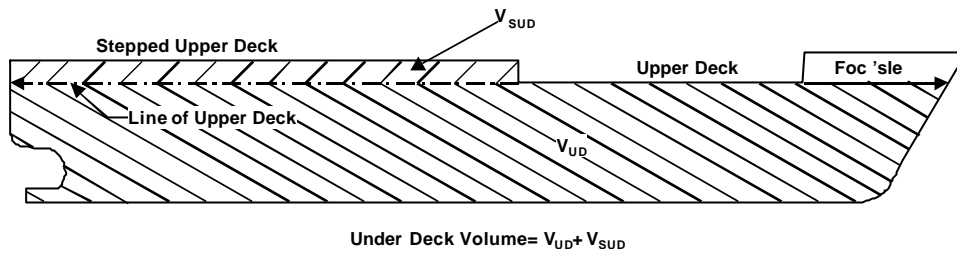
Figure 2.11 — Calculation of Volume with Stepped Upper Deck *(Section 2.5.9)*

DS = Depth of Transverse Section
c.i. = DS/4
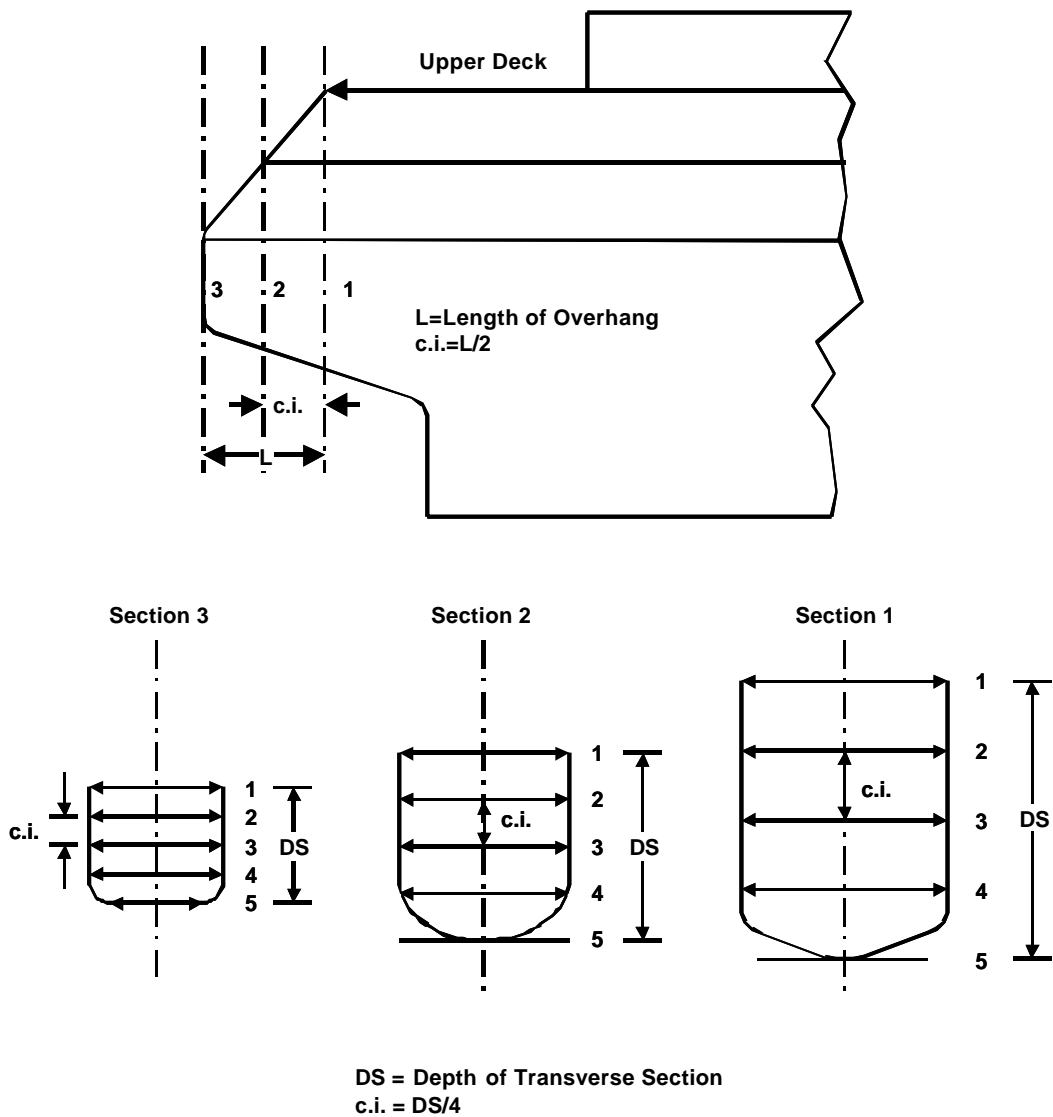
Figure 2.12 — Overhang Beyond the Upper Deck *(Section 2.5.10)*

Metal Ships   **Ships Other Than Metal**

Overhang Closed   **Overhang Open**
To Underdeck   **To Underdeck**

Volumes A and B are measured separately
and added to main volume
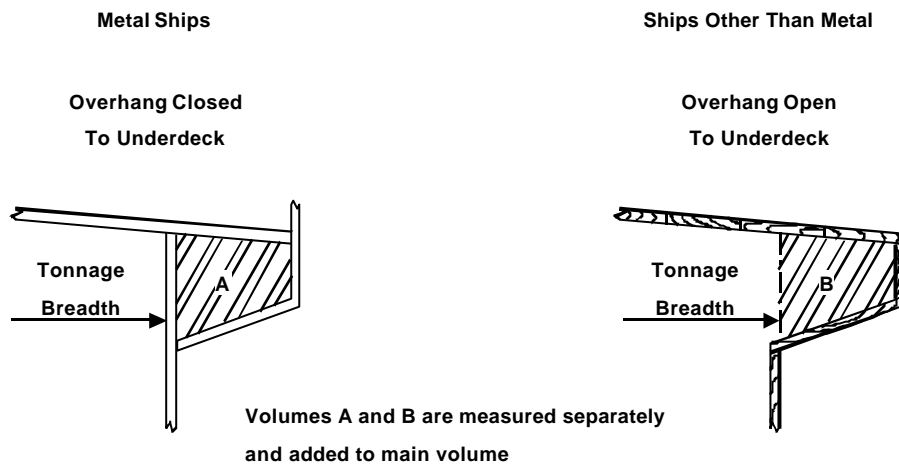
Figure 2.13 — Overhang Deck *(Section 2.5.10)*

L=Length of Bulbous Bow

c.i.=L/4

Section 1

Zero
Bulb
Area

Section 2

Main Hull
Volume

1
2
3
4
5

DS

c.i.

Area to be deducted from
the bulb section area

Section 5

Main Hull
Volume

$\left(\begin{array}{c}\textbf{Zero}\\\textbf{Bulb}\\\textbf{Area}\end{array}\right)$

Section 4

Main Hull
Volume

c.i.

1
2
3
4
5

DS

Section 3

Main Hull
Volume

c.i.

1
2
3
4
5

DS

DS=Depth of Transverse Section
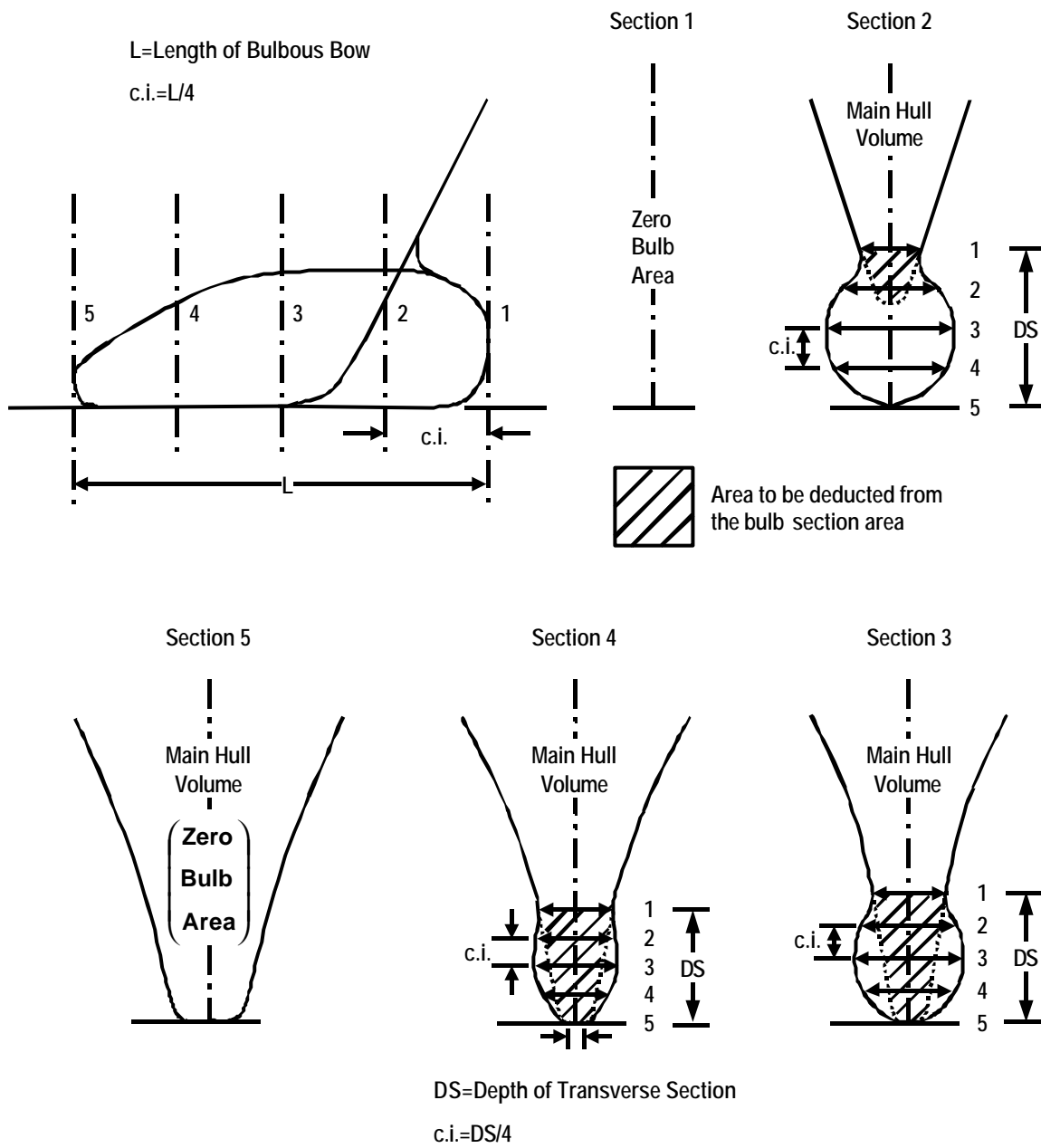
c.i.=DS/4

Figure 2.14 — Bulbous and Similar Bows *(Section 2.5.10)*

45
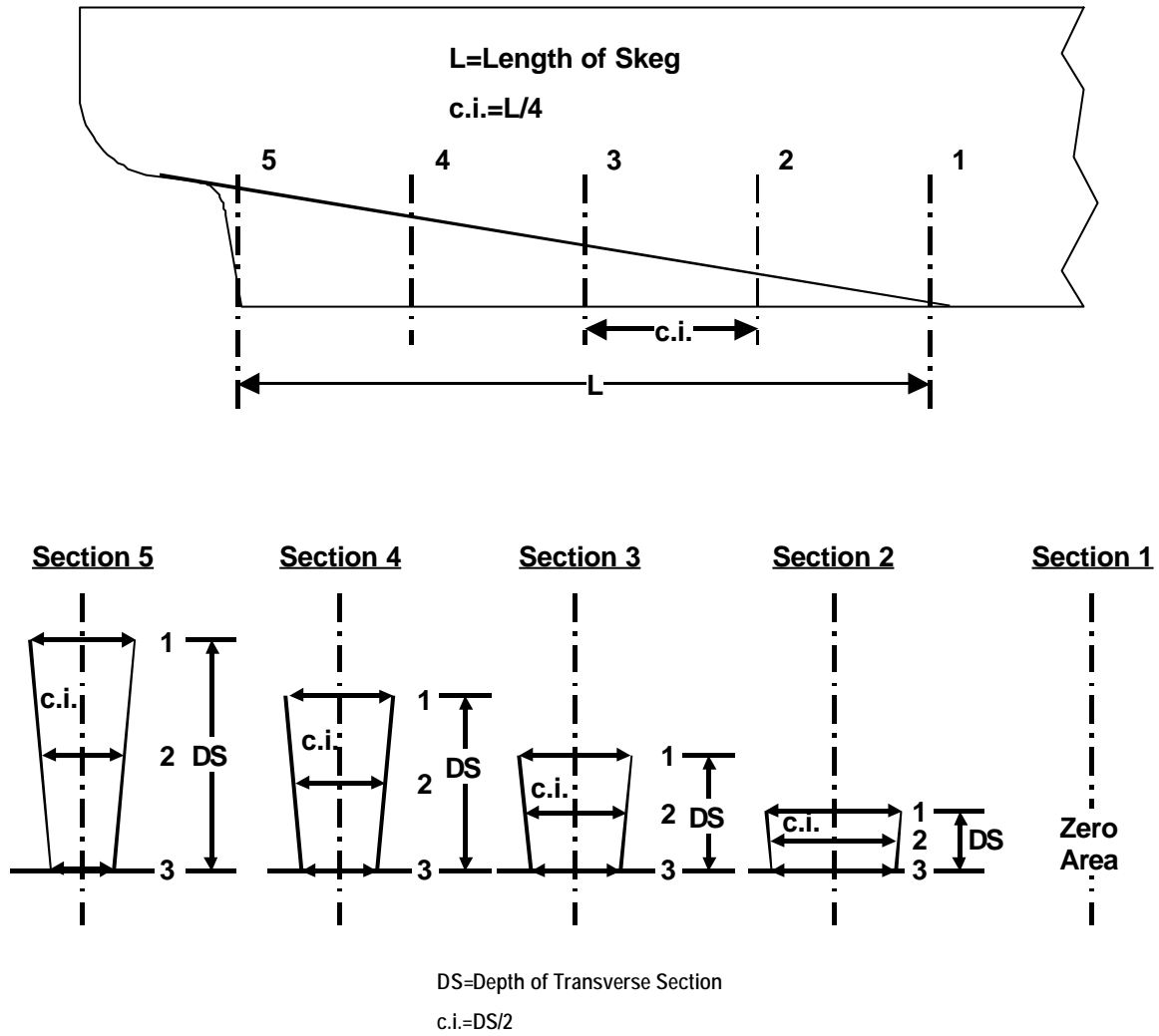
Figure 2.15 — Skegs and Keels *(Section 2.5.10)*

L=Length of Shaft Bossing
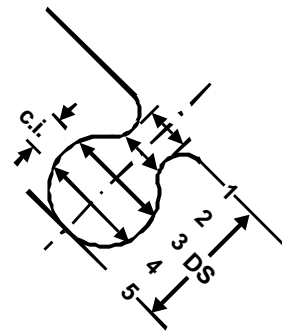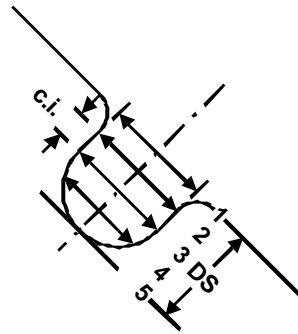
c.i.=L/4
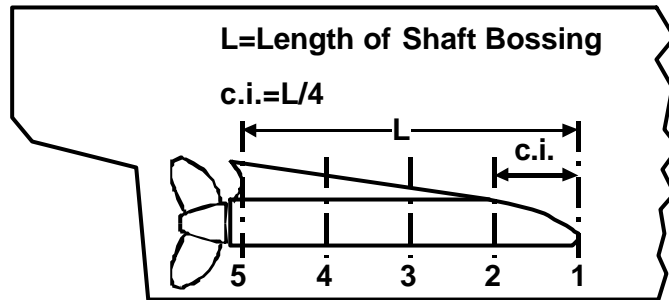
Section 1   **Section 2**   **Section 3**

Zero Area

DS=Depth of Transverse Section
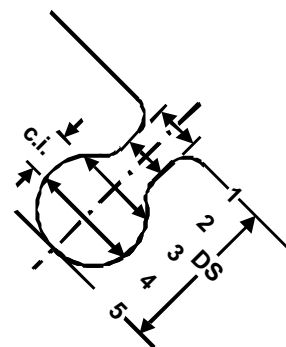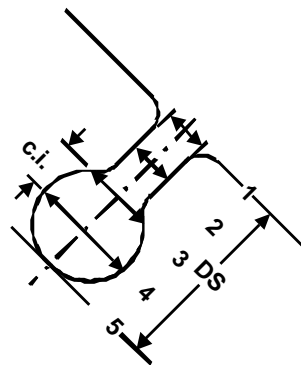
c.i.=DS/4

Section 5   **Section 4**
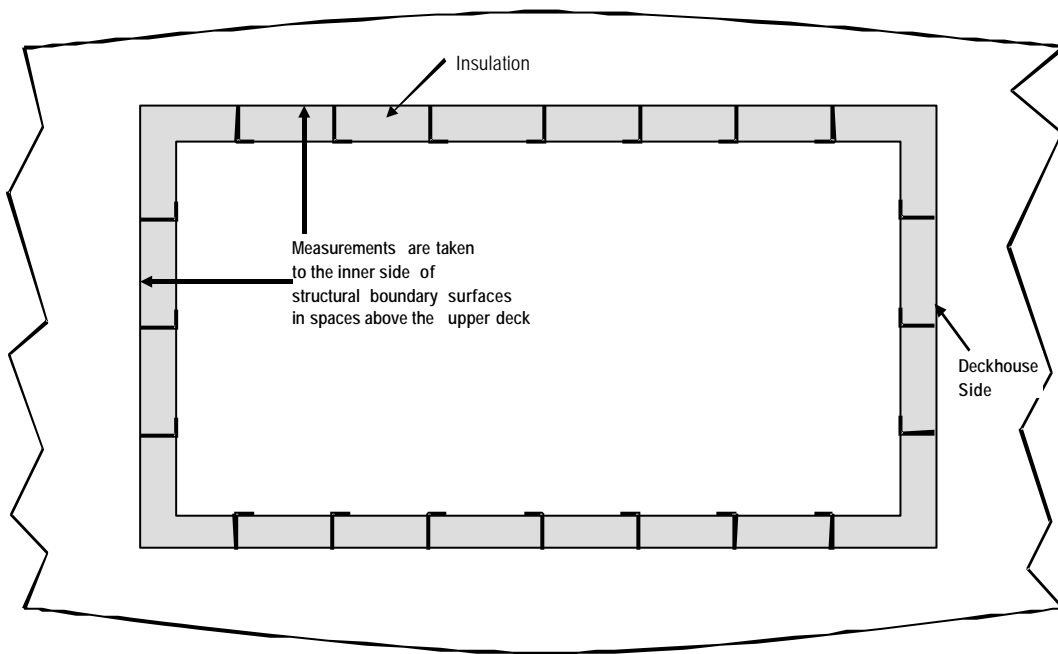
Figure 2.16 — Shaft Bossing *(Section 2.5.10)*

Insulation

Measurements are taken
to the inner side of
structural boundary surfaces
in spaces above the   upper deck

Deckhouse
Side

Figure 2.17 — Termination of Measurements (Section 2.6.1)

L = Mean Length of Space
H = Height of Space
h = H/2
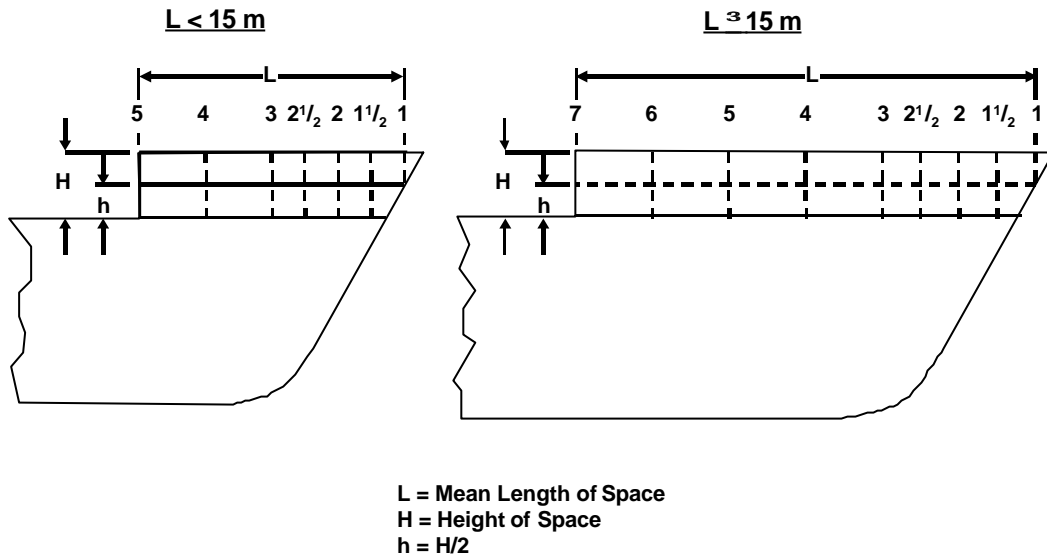
Figure 2.18 — Breaks Forward and Foc'sles *(Section 2.6.3)*

L = Mean Length of Space
H = Height of Space
h = H/2
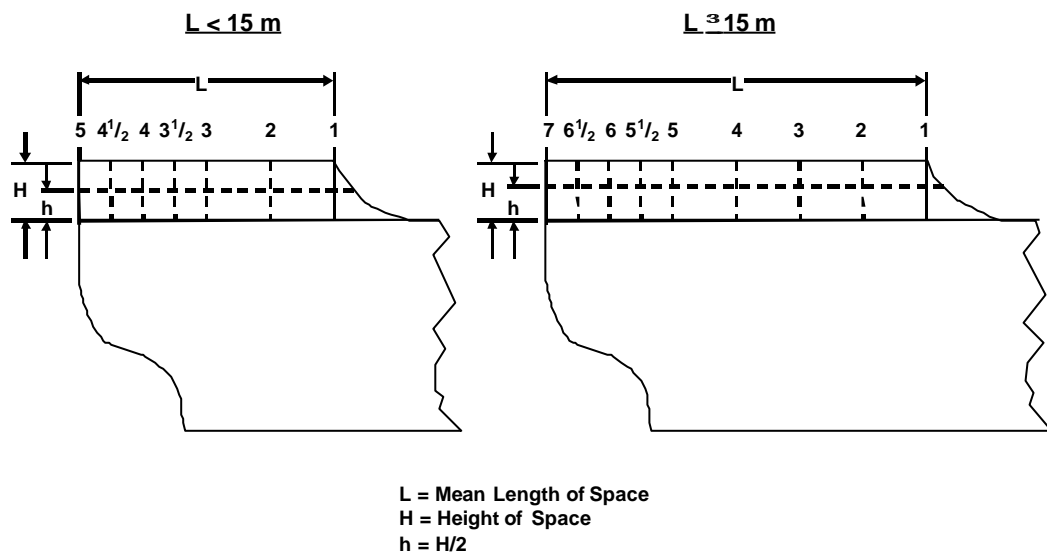
Figure 2.19 — Breaks Aft and Poops *(Section 2.6.3)*

**(A) OPEN VESSEL
(NO RULE AREA FREEING PORTS FITTED)**

TONNAGE BLOCK COEFF. $= \dfrac{\nabla}{TML \times TMD \times TMB}$

$\overline{V}$ (m³) INCLUDES CROSS HATCHED VOLUME

W 'HOUSE

TRUNK

DECK

TOP OF GUNWALE

TOP OF BULWARK

COCKPIT DECK

TML

ROK

$\dfrac{TML}{2}$ $\dfrac{TML}{2}$

TMB

W 'HOUSE

COCKPIT DECK

**(B) DECKED VESSEL
(RULE AREA FREEING PORTS FITTED)**

TONNAGE BLOCK COEFF. $= \dfrac{\nabla}{TML \times TMD \times TMB}$

W 'HOUSE

LINE OF BREAK PARALLEL TO LINE OF DECK
(BREAK VOL. INCLUDED IN V_2)

STEP IN DECK

TOP OF BULWARK

TRUNK

DECK

BREAK

DECK

RABBET

$\overline{V}$ (m³) INCLUDES CROSS HATCHED VOLUME

FREEING PORT P&S

TML

ROK

$\dfrac{TML}{2}$ $\dfrac{TML}{2}$

TMB

W 'HOUSE
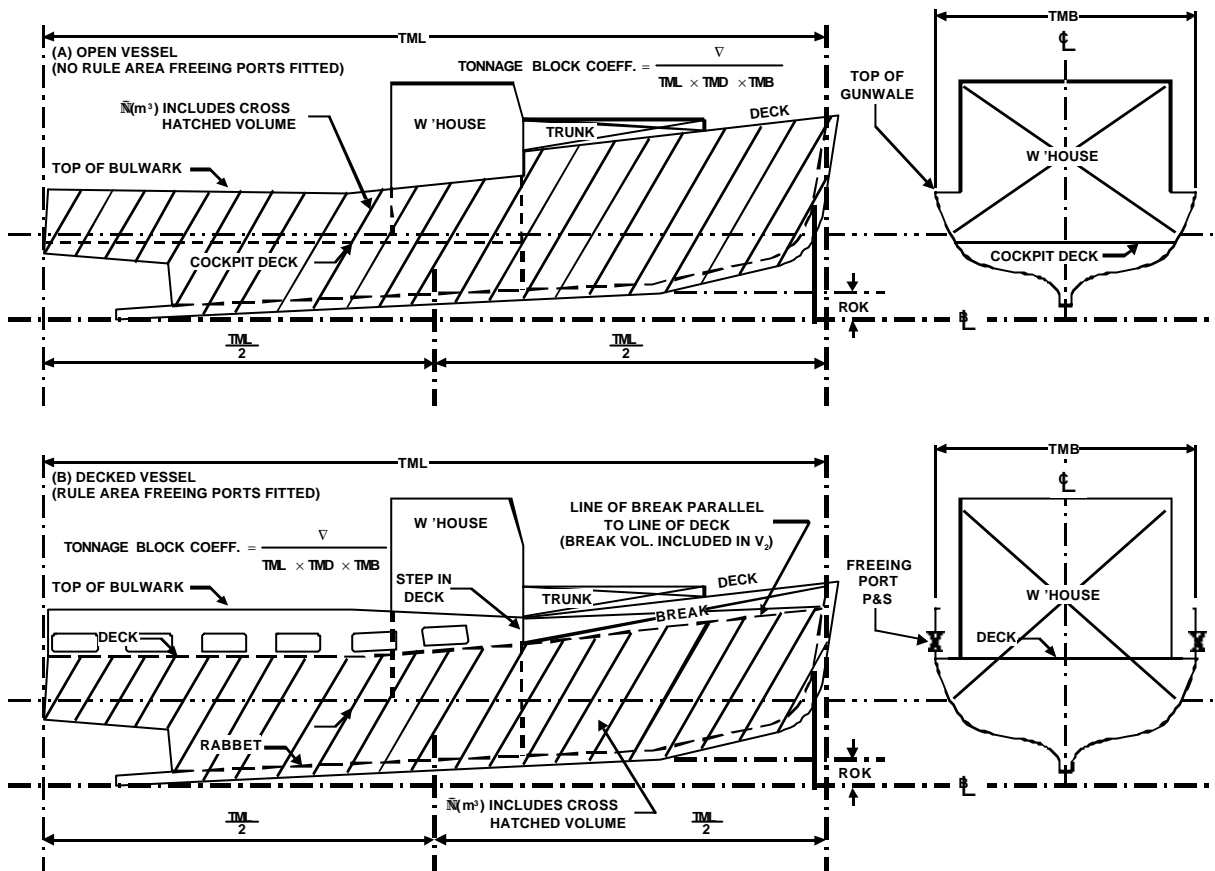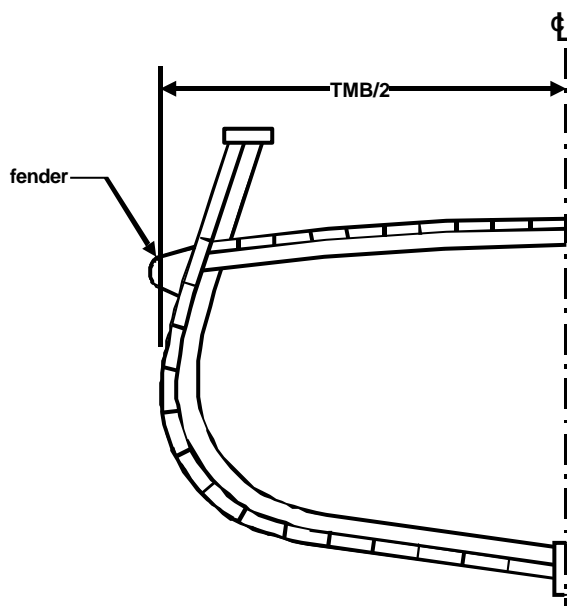
DECK

Figure 3.1 — Tonnage Measurement Dimensions TML, TMB *(Section 3.2)*

TMB/2

fender

In the case of tumblehome, TMB is measured to the extreme moulded line at the middle of length TML.

Fenders and sponsons are not included in TMB.

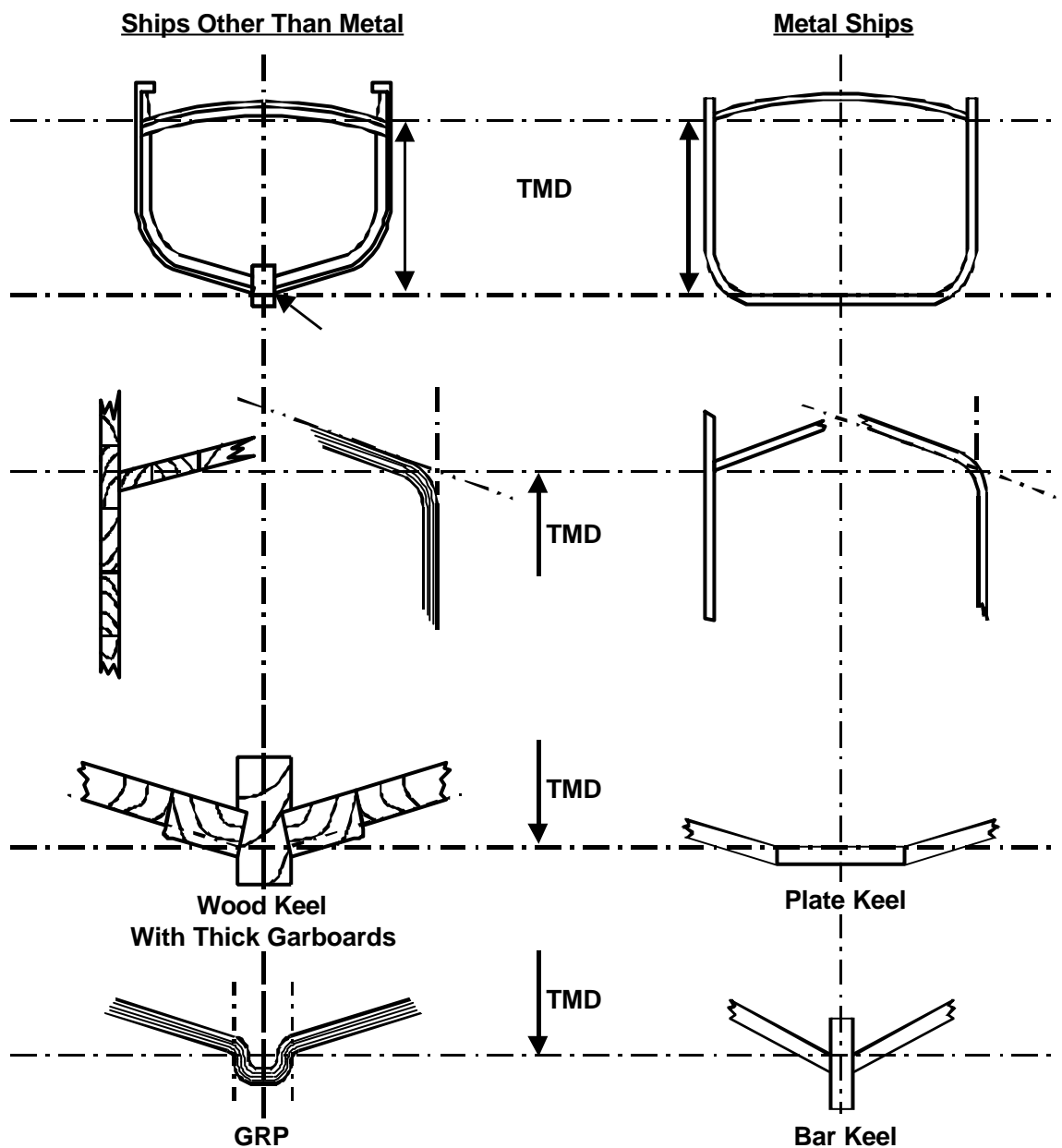**Figure 3.2 — Breadth Measurement with Tumblehome** *(Section 3.2)*

Ships Other Than Metal

Metal Ships

TMD

TMD

TMD

TMD

TMD

TMD

**Wood Keel
With Thick Garboards**

Plate Keel

GRP

Bar Keel

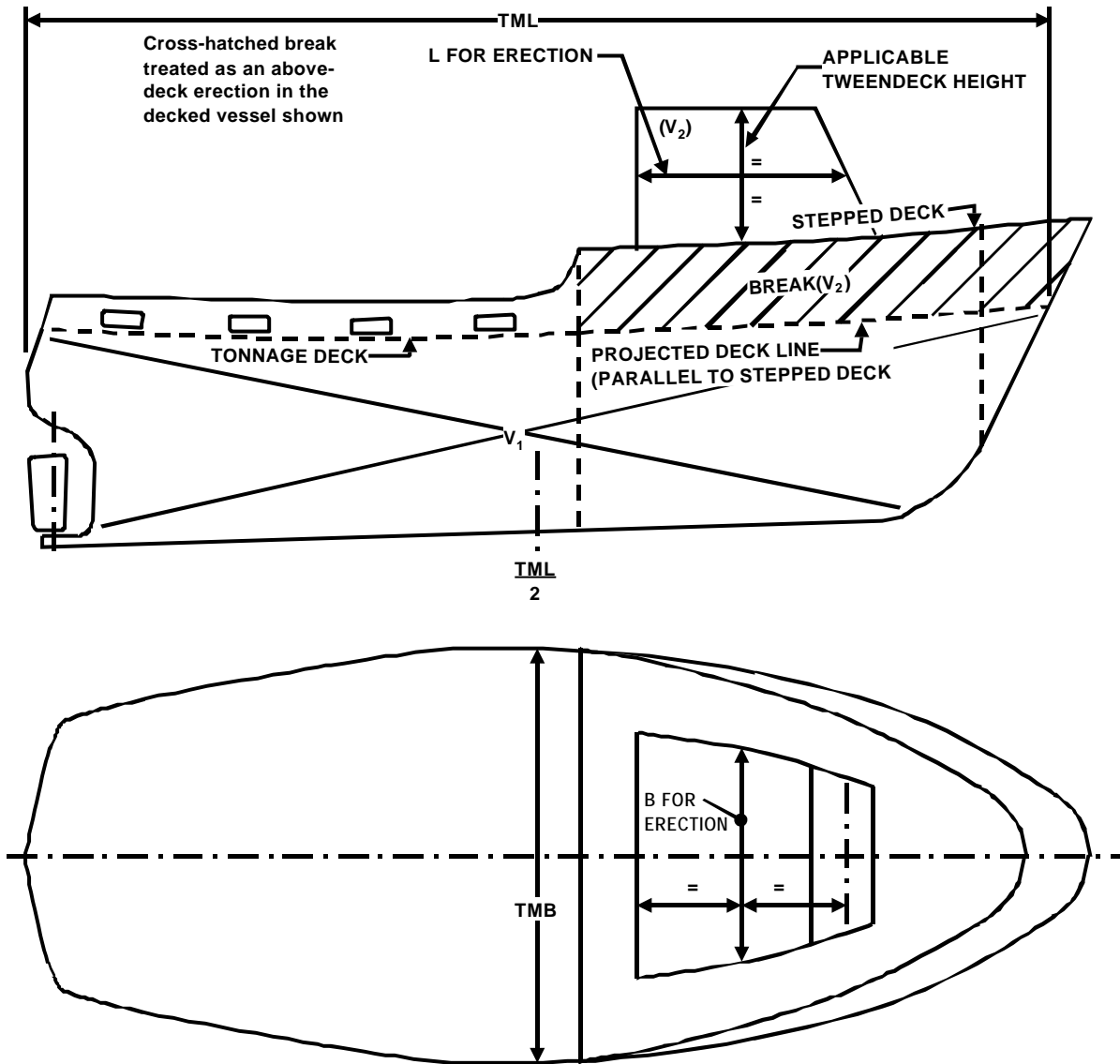**Figure 3.3 — Tonnage Measurement Depth (TMD)** *(Section 3.2)*

Figure 3.4 — Measurement of Included Space above the Tonnage Deck (V$_2$)
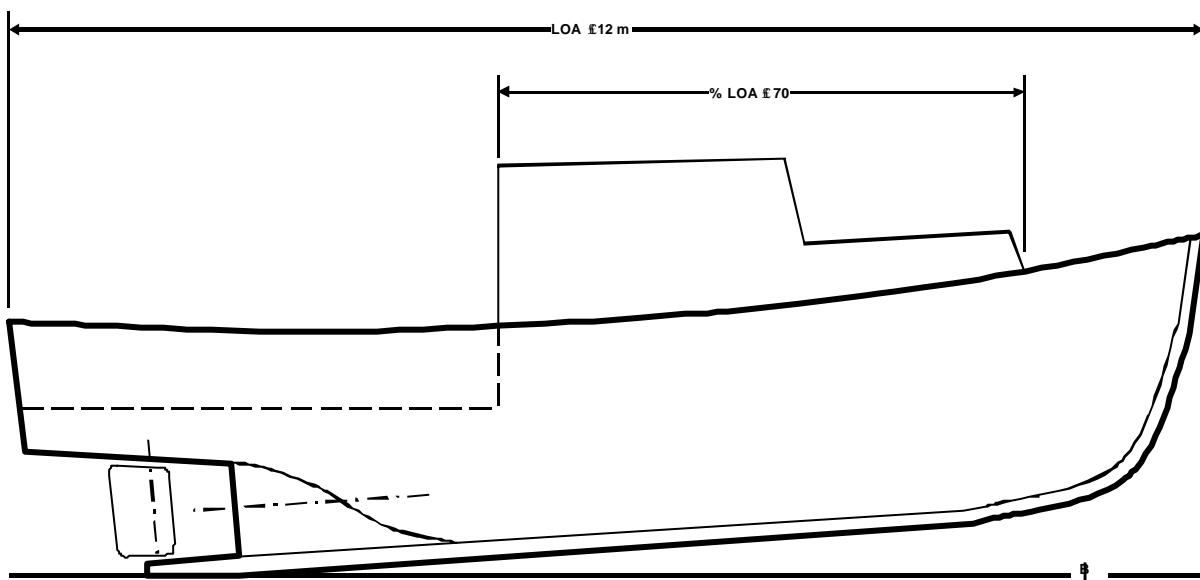*(Section 3.5)*

Figure 3.5 — Length Overall (LOA) for Tabular Method *(Section 3.8)*