# M.V. "ELIAS L."

## EX SYCAMORE

# TRIM AND STABILITY DIAGRAMS

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PIRAEUS MAY 1971

STABILITY INFORMATION

Name of Ship: M.V. "ELIAS L"

Name of Builders: Burntisland S.B. Co., Ltd. No. 330

The information contained in the stability manual dated May 1971 is considered to be in an acceptable form.

It has been verified on the basis of hydrostatic particulars and cross curves of stability attached thereto, under the terms of Chapter I - General, and Regulation 10 of Annex 1 of the 1966 Load Line Convention, for the following conditions:

Ballast Departure.
Ballast Arrival.
Loaded Departure.
Loaded Arrival.

The curves of righting levers shown therein meet the criteria recommended by I.M.C.O. in this respect.

The provision of adequate stability, at all times, remains the Owner's responsibility.

Signature ..... Date 3/9/71...

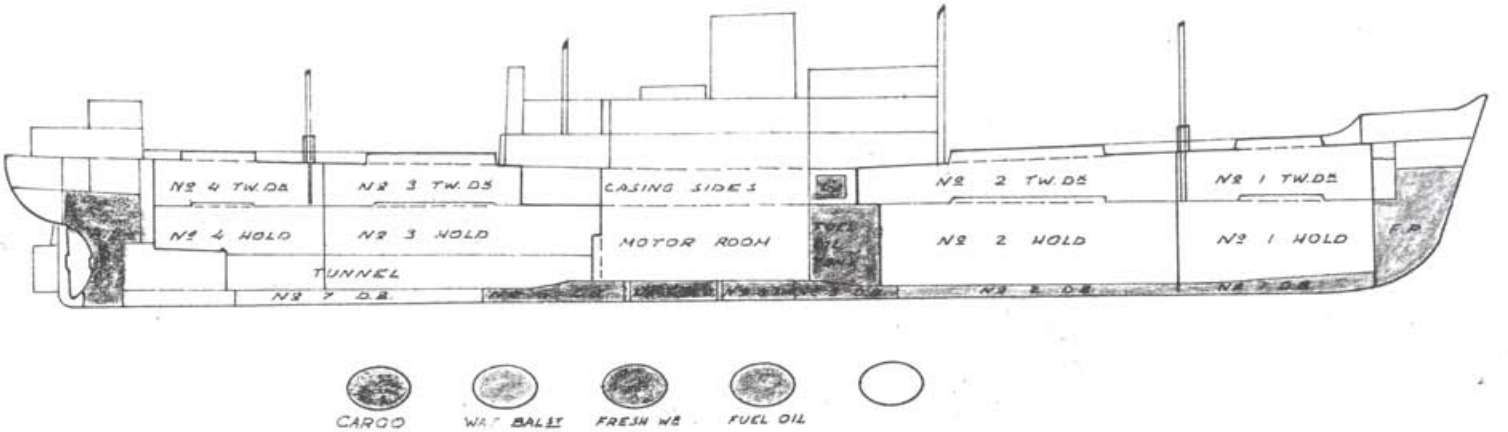
Surveyor to Lloyd's Register of Shipping

LLOYDS REGISTER OF SHIPPING
6 SEP 1971
LONDON

## ST. BILITY DATA

| ITEM | TONS | LCG | LONGL. MOMENT FWD | LONGL. MOMENT AFT | VCG | VERTIC. MOMENT |
|---|---|---|---|---|---|---|
| LIGHTSHIP | 2655 | 7.28' A | | 19328.4 | 22.74' | 60374.7 |
| FORE PEAK W.B. | 72 | 155.51' F | 11196.7 | | 18.84' | 1356.5 |
| Nº 1 D.B. W.B. | 66 | 123.09' F | 8123.9 | | 2.43' | 160.4 |
| Nº 2 D.B. W.B. | 208 | 65.07' F | 13534.5 | | 1.61' | 334.9 |
| Nº 3 D.B. B.O. | 95 | 19.77' F | 1878.1 | | 1.85' | 175.7 |
| Nº 4 D.B. F.O. | 71 | 2.96' A | | 210.1 | 2.14' | 151.9 |
| Nº 5 D.B. F.W. | 40 | 22.96' A | | 918.4 | 2.14' | 85.6 |
| Nº 6 D.B. F.O. | 112 | 48.39' A | | 5419.7 | 1.78' | 199.3 |
| AFTER PEAK F.W. | 117 | 156.36' A | | 18294.0 | 21.57' | 2523.7 |
| F.W. | 35 | 20.00' F | 700.0 | | 27.00' | 945.0 |
| F.O. BUNKER (P) | 125 | 22.07' F | 2758.7 | | 12.92' | 1615.0 |
| F.O. BUNKER (S) | 125 | 22.07' F | 2758.7 | | 12.92' | 1615.0 |
| F.O. BUNKER (Cℓ) | 198 | 22.12' F | 4379.7 | | 13.27' | 2627.5 |
| CREW STORE AND EFFECTS | 25 | 00.00 | | | 26.00 | 650.0 |
| | | | 45330.3 | 44170.6 | | |
| | 3944 | 0.29' F | 1159.4 | | 18.46' | 72815.2 |

# CONDITION 1. BALLAST DEPARTURE




## TRIM

| | |
|---|---|
| EVEN KEEL DRAUGHT AT 3944 | = 12.30' |
| LCB FROM ⊗ | = 7.00' F |
| LCG FROM ⊗ | = 0.29' F |
| LCF FROM ⊗ | = 5.50' F |
| MCT 1" | = 495 |
| LCB - LCG = y | = 6.71' |
| M = Δ·y ↺ | = 26464 |

$T = \frac{\text{TRIMMING MOMENT}}{MCT1''} = \frac{26464}{495} = 53.4''$ BY STERN

CHANGE OF TRIM

$FWD = \frac{L/2 - LCF}{L} T = \frac{349/2 - 5}{349} 53.4' = 25.90''$

$AFT = \frac{L/2 + LCF}{L} T = \frac{349/2 + 5}{349} 53.4 = 27.50'$

DRAUGHT AT FORE PERPENDICULAR = 10' - 9"

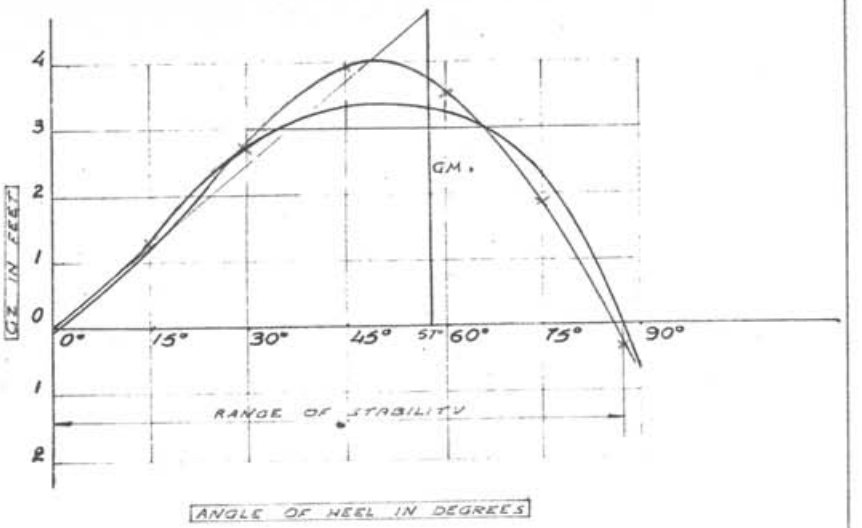
DRAUGHT AT AFT PERPENDICULAR = 15' - 2.5"

## STABILITY

| | |
|---|---|
| TRANSVERSE METACENTRE ABOVE BASE | = 23.20' |
| VERTICAL CENTRE OF GRAVITY | = 18.46 |
| METACENTRIC HEIGHT | = 4.74' |

# CONDITION 1
# BALLAST DEPARTURE

## CURVE OF STATICAL STABILITY



## FREE SURFACE CORRECTION

CORRECTION OF Nº 4 D.B. (F.O)

$$GG_1 = \frac{108730}{35 \cdot 3294} \cdot \frac{35}{39} = 0{,}84'$$

CORRECTION OF Nº 5 DB (F.W)

$$GG_2 = \frac{58525}{3294 \cdot 35} \cdot \frac{35}{36} = 0{,}49'$$

CORRECTION OF F.O. BUNKER (C.B)

$$GG_3 = \frac{17739.5}{3294 \cdot 35} \cdot \frac{35}{39} = 0{,}138$$

CORRECTION OF F.W. TANKS (P.S)

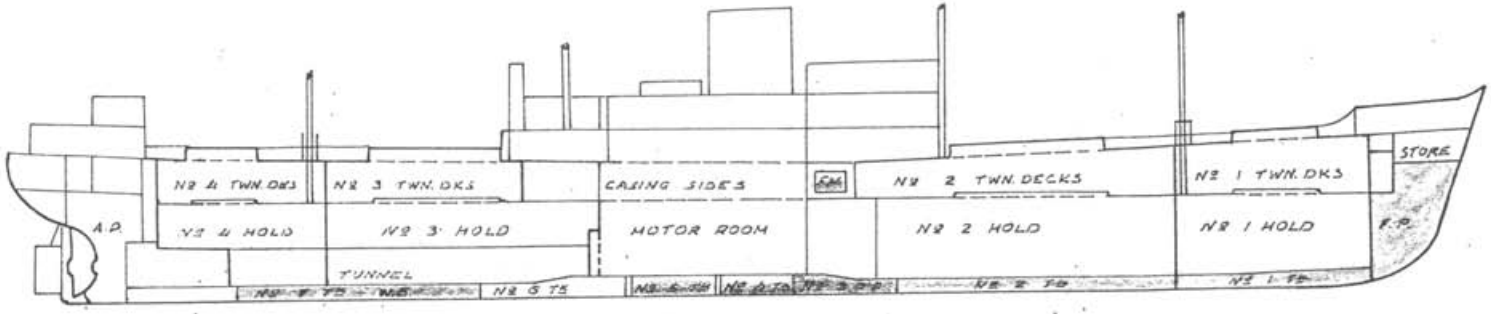
$$GG_4 = \frac{1458}{3294 \cdot 35} \cdot \frac{35}{36} = 0{,}012'$$

$$GG_T = 1.48'$$

## STABILITY DATA

| ITEM | TONS | LCG | LONGL MOMENT FWD | LONGL MOMENT AFT | VCG | VERTIC. MOMENT |
|---|---|---|---|---|---|---|
| LIGHTSHIP | 2655.0 | 7.28' A | | 19328.4 | 22.74' | 60374.4 |
| FORE PEAK | 72.0 | 155.51' F | 11196.7 | | 18.84' | 1356.5 |
| Nº 1 D.B. W.B. | 66.0 | 123.09' F | 8123.9 | | 2.43' | 160.4 |
| Nº 2 D.B. W.B. | 208.0 | 65.07' F | 13534.5 | | 1.61' | 334.9 |
| Nº 3 D.B. F.O. | 95.0 | 19.77' F | 1878.1 | | 1.85' | 175.7 |
| Nº 4 D.B. F.O. | 5.0 | 2.96' A | | 14.8 | 0.50' | 2.5 |
| Nº 5 D.B. F.W. | 12.0 | 22.96' A | | 275.5 | 1.50' | 18.0 |
| F.W. | 10.0 | 20.00' F | 200.0 | | 25.00' | 250.0 |
| F.O. BUNKER (P) | 37.5 | 22.07' F | 827.6 | | 8.00' | 300.0 |
| F.O. BUNKER (S) | 37.5 | 22.07' F | 827.6 | | 8.00' | 300.0 |
| CREW STORES & EFFECTS | 15.0 | 0.00' | | | 26.00' | 390.0 |
| Nº 7 D.B. W.B | 81.0 | 92.07' A | | 7457.6 | 1.75' | 141.7 |
| | | | 36588.4 | 27076.3 | | |
| | 3294.0 | 2.89' F | 9512.1 | | 19.37' | 63804.1 |

# CONDITION 2. BALLAST ARRIVAL




CARGO · WAT. BALLT · FRESH WT · FUEL OIL

## TRIM

| | |
|---|---|
| EVEN KEEL DRAUGHT AT 3294.0 | = 11.00' |
| LCB FROM ⊗ | = 7.40' F |
| LCG FROM ⊗ | = 2.89' F |
| LCF FROM ⊗ | = 6.00 F |
| MCT1" | = 470.7 |
| $y$ = LCB - LCG = 7.40' - 2.89' | = 4.51 |
| $M = \Delta \cdot y$ = 3.294 × 4.51 | = 14855,9 |

$T = \frac{\text{TRIMMING MOM.}}{MCT_1} = \frac{14855,9}{470,7} = 31,5''$ BY STERN

CHANGE OF TRIM:

$FWD = \frac{349\frac{1}{2} - 6}{349} 31,5 = 15,21''$

$AFT = \frac{349\frac{1}{2} + 6}{349} 31,5 = 16,29''$

DRAUGHT AT FORE PERPENDICULAR: 09' - 9"

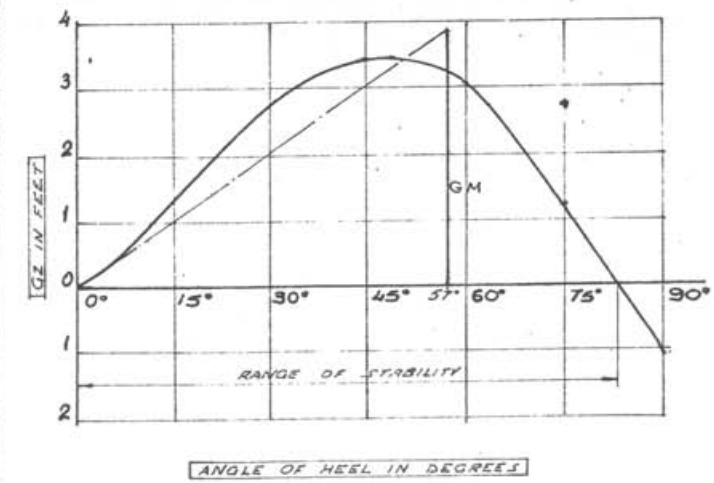
DRAUGHT AT AFT PERPENDICULAR: 12' - 4.5"

## STABILITY

| | |
|---|---|
| TRANSVERSE METACENTRE ABOVE BASE | = 24.80' |
| VERTICAL CENTRE OF GRAVITY | = 19.37' |
| UNCORRECTED METACENTRIC HEIGHT | = 5.43' |
| FREE SURFACE CORRECTION | = 1.59' |
| CORRECTED METACENTRIC HEIGHT | = 3.84' |

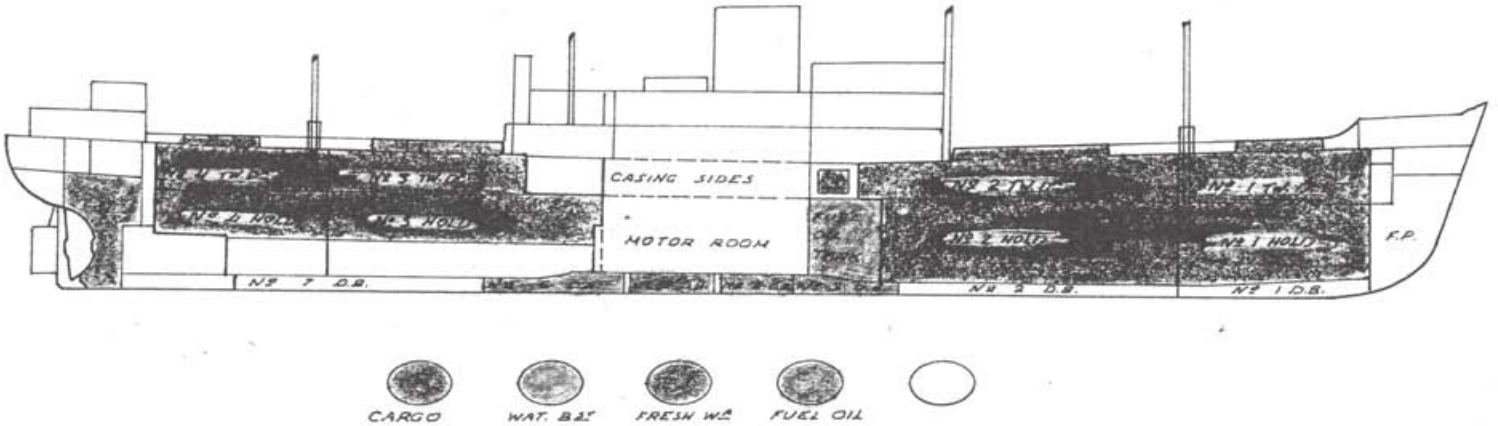
# CONDITION 2
# BALLAST ARRIVAL

## CURVE OF STATICAL STABILITY



| STABILITY DATA | | | | | | |
|---|---|---|---|---|---|---|
| ITEM | TONS | LCG | LONGL MOMENT | | VCG | VERTIC. MOMENT |
| | | | FWD | AFT | | |
| LIGHTSHIP | 2655 | 7.28' A | | 19328.4 | 22.74' | 60374.7 |
| Nº 3 D.B. B.O. | 95 | 19.77' F | 1878.1 | | 1.85' | 175.7 |
| Nº 4 D.B. F.O. | 71 | 2.96' A | | 210.1 | 2.14' | 151.9 |
| Nº 5 D.B. F.W. | 40 | 22.96' A | | 918.4 | 2.14' | 85.6 |
| Nº 6 D.B. F.O. | 112 | 48.39' A | | 5419.7 | 1.78' | 199.3 |
| F.W. | 35 | 20.00' F | 700.0 | | 27.00 | 945.0 |
| AFTER PEAK F.W. | 117 | 156.36' A | | 18294.0 | 21.57' | 2523.7 |
| F.O. BUNKER (P) | 128 | 22.07' F | 2758.7 | | 12.92' | 1615.0 |
| F.O. BUNKER (S) | 125 | 22.07' F | 2758.7 | | 12.92' | 1615.0 |
| F.O. BUNKER (C) | 198 | 22.12' F | 4379.7 | | 13.12' | 2627.5 |
| CREW, STORES & EFFECTS | 25 | 0.00 | | | 26.00' | 650.0 |
| | | | | | | |
| HOLD Nº 1 | 442 | 121.93' F | 53893.1 | | 14.22 | 6285.2 |
| HOLD Nº 2 | 1239 | 65.84' F | 81575.7 | | 13.43 | 16639.7 |
| HOLD Nº 3 | 1013 | 68.78' A | | 69674.0 | 14.09' | 14273.2 |
| HOLD Nº 4 | 302 | 121.20' A | | 36602.4 | 16.12' | 4868.2 |
| TWEEN DECK Nº 1 | 367 | 124.59' F | 45724.5 | | 29.77 | 10925.6 |
| TWEEN DECK Nº 2 | 748 | 62.87' F | 47026.7 | | 28.15 | 21056.2 |
| TWEEN DECK Nº 3 | 425 | 80.60' A | | 34255.0 | 28.06' | 11923.5 |
| TWEEN DECK Nº 4 | 318 | 123.45' A | | 39257.1 | 28.56' | 9082.1 |
| EX TONNAGE WELL | 39 | 144.25' A | | 5625.7 | 28.95' | 1129.0 |
| | | | 240693.2 | 229584.8 | | |
| | 8491 | 1.31' F | 11110.4 | | 19.685' | 167148.1 |

# CONDITION 3. LOADED DEPARTURE




## TRIM

| | |
|---|---|
| EVEN KEEL DRAUGHT AT B491 | =24'-6.531" |
| LCB FROM ⊗ | = 3' F |
| LCG FROM ⊗ | = 1.31' F |
| MCT,1" | = 750 |
| LCB - LCG = y | = 1.69' |
| M = Δ y = 8491 · 1.69 ↺ | = 14349.79 |
| LCF FROM ⊗ | = 6.5' A |

$T = \frac{\text{TRIMMING MOM.}}{MCT_1} = \frac{14349.79}{750} = 19.13''$ BY STERN

CHANGE OF TRIM

$FWD = \frac{349/2 + 6.5}{349} \, 19.13 = 9.92''$

$AFT = \frac{349/2 - 6.5}{349} \, 19.13 = 9.21''$

DRAUGHT AT FORE PERPENDICULAR: 23'-8.50"

DRAUGHT AT AFT PERPENDICULAR: 25'-3.75"

## STABILITY

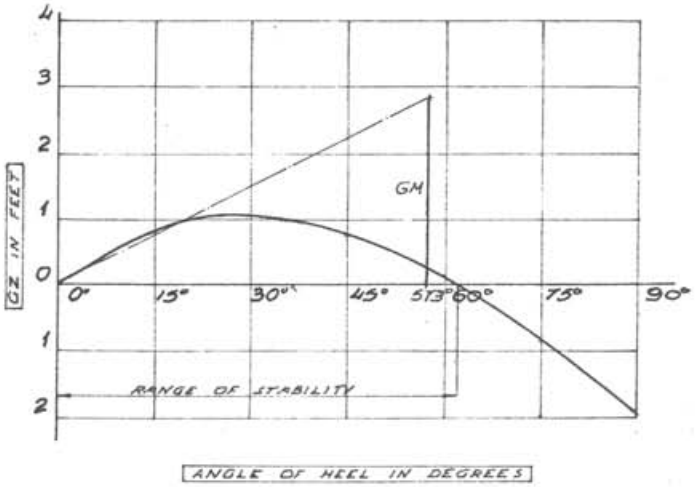
| | |
|---|---|
| TRANSVERSE METACENTRE ABOVE BASE | = 22.50' |
| VERTICAL CENTRE OF GRAVITY | = 19.68 |
| METACENTRIC HEIGHT | = 2.82' |

# CONDITION 3

# LOADED DEPARTURE

# 54,3 FT³/TN

## CURVE OF STATICAL STABILITY



## FREE SURFACE CORRECTION

CORRECTION OF Nº 4 D.B. (F.O.)

$GG_1 = \frac{10873}{7760 \times 35} \frac{35}{39} = 0{,}035$

CORRECTION OF Nº 5 D.B. (FW)

$GG_2 = \frac{58525}{7760 \times 35} \frac{35}{36} = 0{,}205$

CORRECTION OF F.O. BUNKER (C.S)

$GG_3 = \frac{17739}{7760 \times 35} \frac{35}{39} = 0{,}058$

CORRECTION OF FW TANKS (P.S)

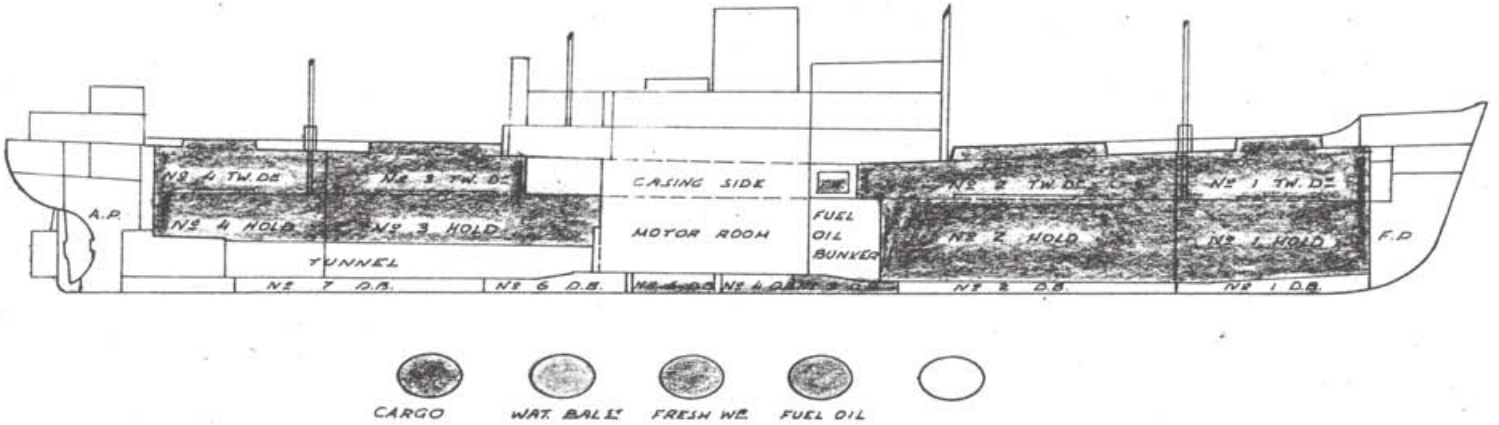
$GG_4 = \frac{1458}{7760 \times 35} \frac{35}{36} = 0{,}005$

$GG_T = 0{,}31'$

## STABILITY DATA

| ITEM | TONS | LCG | LONGL MOMENT FWD | LONGL MOMENT AFT | VCG | VER MO |
|---|---|---|---|---|---|---|
| LIGHTSHIP | 2655.0 | 7.28' A | | 19328.4 | 22.74' | 60 |
| Nº 3 D.B. F.O. | 95.0 | 19.77' F | 1878.1 | | 1.85' | |
| Nº 4 D.B. F.O. | 5.0 | 2.96' A | | 14.8 | 0.50' | |
| Nº 5 D.B. F.W. | 12.0 | 22.96' A | | 275.5 | 1.50' | |
| F.W. | 10.0 | 20.00' F | 200.0 | | 25.00' | |
| F.O. BUNKER P | 37.6 | 22.07' F | 827.6 | | 8.00' | |
| F.O. BUNKER S | 37.6 | 22.07' F | 827.6 | | 8.00' | |
| CREW STORES EFFECTS | 15.0 | 0.00 | | | 25.00' | |
| | | | | | | |
| HOLD Nº 1 | 442 | 121.93' F | 53893.1 | | 14.22' | 62 |
| —"— —"— 2 | 1239 | 65.84' F | 81575.7 | | 13.43' | 166 |
| —"— —"— 3 | 1013 | 68.78 A | | 69674.0 | 14.09' | 142 |
| —"— —"— 4 | 302 | 121.20' A | | 36602.4 | 16.12' | 4 |
| TWEEN DECK Nº 1 | 367 | 124.59' F | 45724.5 | | 29.77' | 10 |
| —"— —"— 2 | 748 | 62.87' F | 47026.7 | | 28.15' | 210 |
| —"— —"— 3 | 425 | 80.60' A | | 34255.0 | 28.06' | 119 |
| —"— —"— 4 | 318 | 123.45' A | | 39257.1 | 28.56' | 90 |
| EX TONNAGE WELL | 39 | 144.25' A | | 5625.7 | 28.95' | 11 |
| | | | 231953.3 | 205032.9 | | |
| | 7760 | 3.47' F | 26920.4 | | 20.35' | 157 |

# CONDITION 4. LOADED ARRIVAL




## TRIM

| | |
|---|---|
| EVEN KEEL DRAUGHT AT 7760.0 TONS | =22'-9½" |
| LCB FROM ⊗ | = 3.75' F |
| LCG FROM ⊗ | = 3.47' F |
| MCT1" | = 704 |
| LCF | = 5.0' A |
| LCB - LCG = y | = 0.25' |
| M = Δ · y = 7760 × 0.28' | = 2172.8 |
| $T = \frac{\text{TRIMMING MOM}}{MCT_{1"}} = \frac{2172.8}{704}$ | = 3.08" BY STERN |

CHANGE OF TRIM

$FWD = \frac{174.5 + 5}{349} 3.08 = 1.6''$

$AFT = \frac{174.5 - 5}{349} 3.08 = 1.5''$

| | |
|---|---|
| DRAUGHT AT FORE PERPENDICULAR | 22'-8" |
| DRAUGHT AT AFT PERPENDICULAR | 22'-11" |

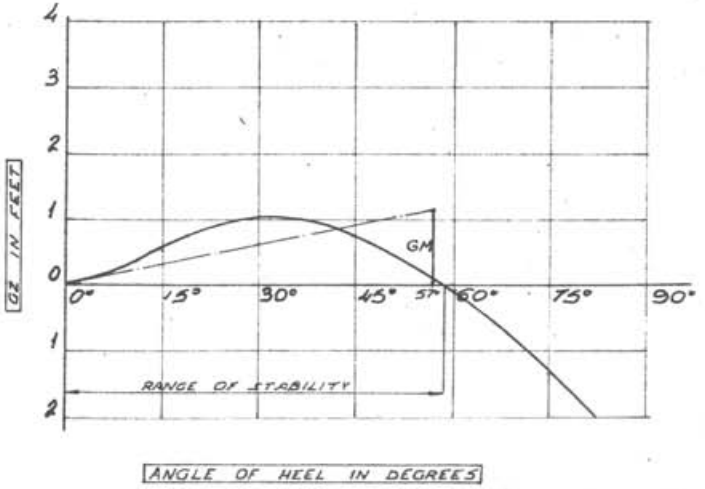
## STABILITY

| | |
|---|---|
| TRANSVERSE METACENTRE ABOVE BASE | = 21.80' |
| VERTICAL CENTRE OF GRAVITY | = 20.35 |
| UNCORRECTED METACENTRIC HEIGHT | = 1.45' |
| FREE SURFACE CORRECTION | = 0.31 |
| CORRECTED METACENTRIC HEIGHT | = 1.14' |

# CONDITION 4
# LOADED ARRIVAL

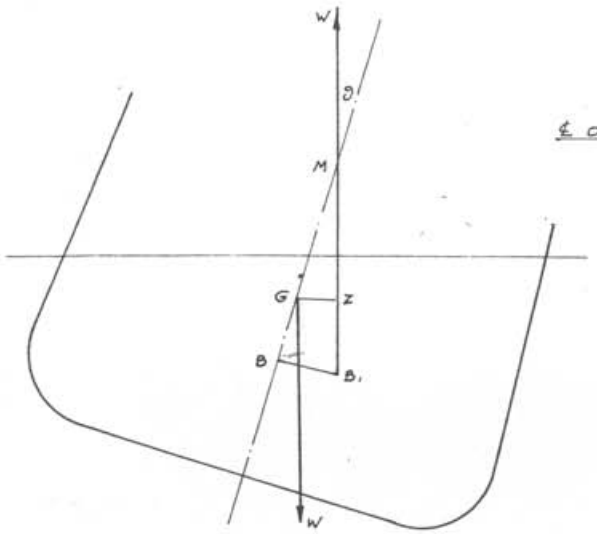
## 54,3 FT³/TN

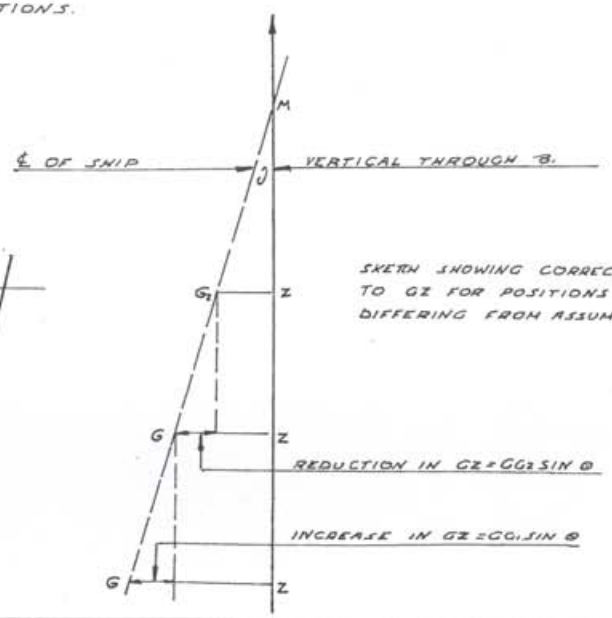
## CURVE OF STATICAL STABILITY



# STABILITY CURVES

HERE IS GIVEN A FULLY WORKED-OUT EXAMLE FOR CONDITION 3 AND IS TYPICAL FOR ALL OTHER CONDITIONS.



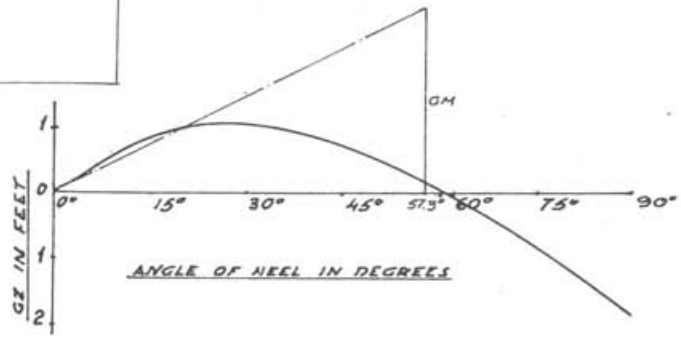




SKETCH SHOWING CORRECTION TO GZ FOR POSITIONS OF "G" DIFFERING FROM ASSUMED HEIGHT.

FOR VARIATION IN HEIGHT OF CENTRE OF GRAVITY (G RIGHTING LEVERS (GZ) AS SHOWN BY CROSS CURVES, BE CORRECTED, IF G IS LOWER THAN ASSUMED HE (20.0') THE VALUES OF GZ WILL BE INCREASED A THE VALUES OF GZ WILL BE REDUCED; THE METHO MAKING CORRECTION IS ILLUSTRATED BY DIAGRAM. THE FOLLOWING WORKED OUT EXAMPLE SHOWS CAL FOR HEIGHT OF G & METHOD OF OBTAINING VALU GZ FROM CROSS CURVES.

DISPLACEMENT : 8491 TONS.
VERTICAL MOMENTS : 167148 FT. TN.
KG : 19.68 FT.

| ANGLE OF HEEL | 15° | 30° | 45° | 60° | 75° | 90° |
|---|---|---|---|---|---|---|
| SIN θ | .259 | .500 | .707 | .866 | .966 | 1.00 |
| GZ FROM CROSS CURVES AT Δ=8491 TNS. | .72 | .90 | .55 | -.13 | -1.15 | -2.18 |
| $GG_1 = -.32 \times \sin\theta$ | +.08 | +.16 | +.23 | +.28 | +.31 | +.32 |
| CORRECTED GZ : ORDINATES FOR CURVE | +.80 | +1.06 | +.78 | +.16 | -.84 | -1.86 |



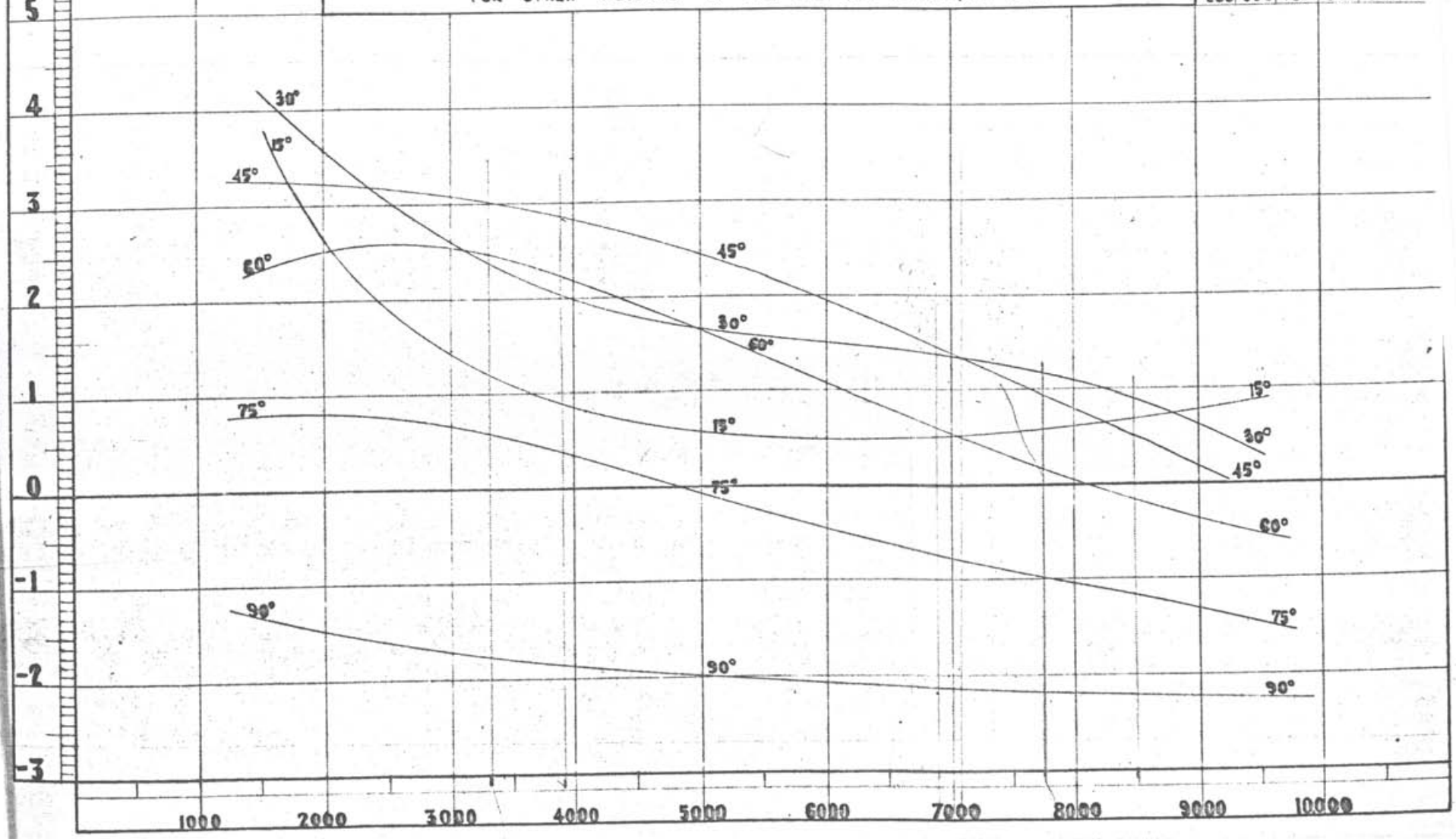

VALUE OF GM IS SET UP AT 57.3° AND LINE TO ORIGIN GIVES THE SLOPE OF CURVE AT START AND SHOULD LIE ALONG THIS LINE.

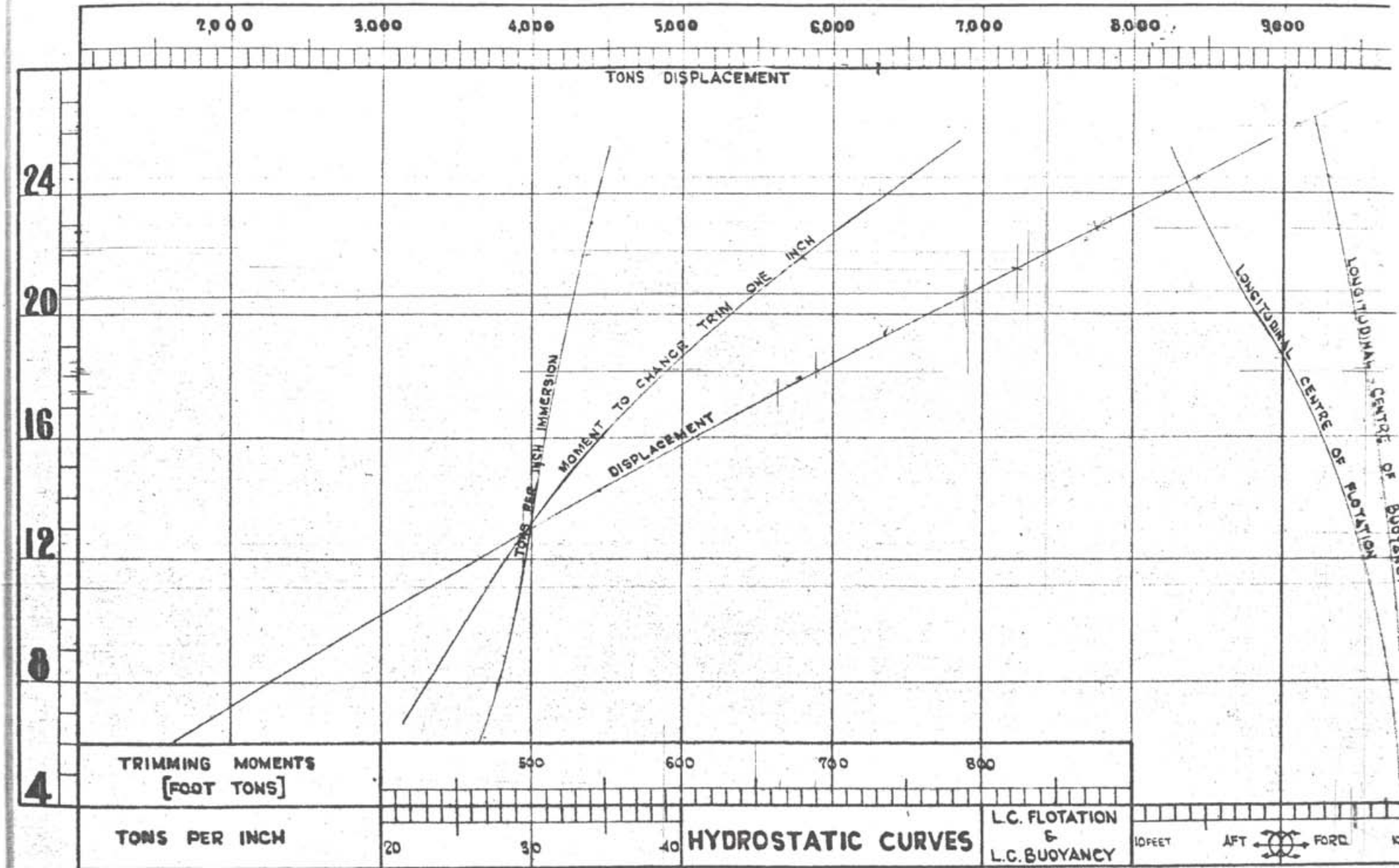
# STABILITY CROSS CURVES

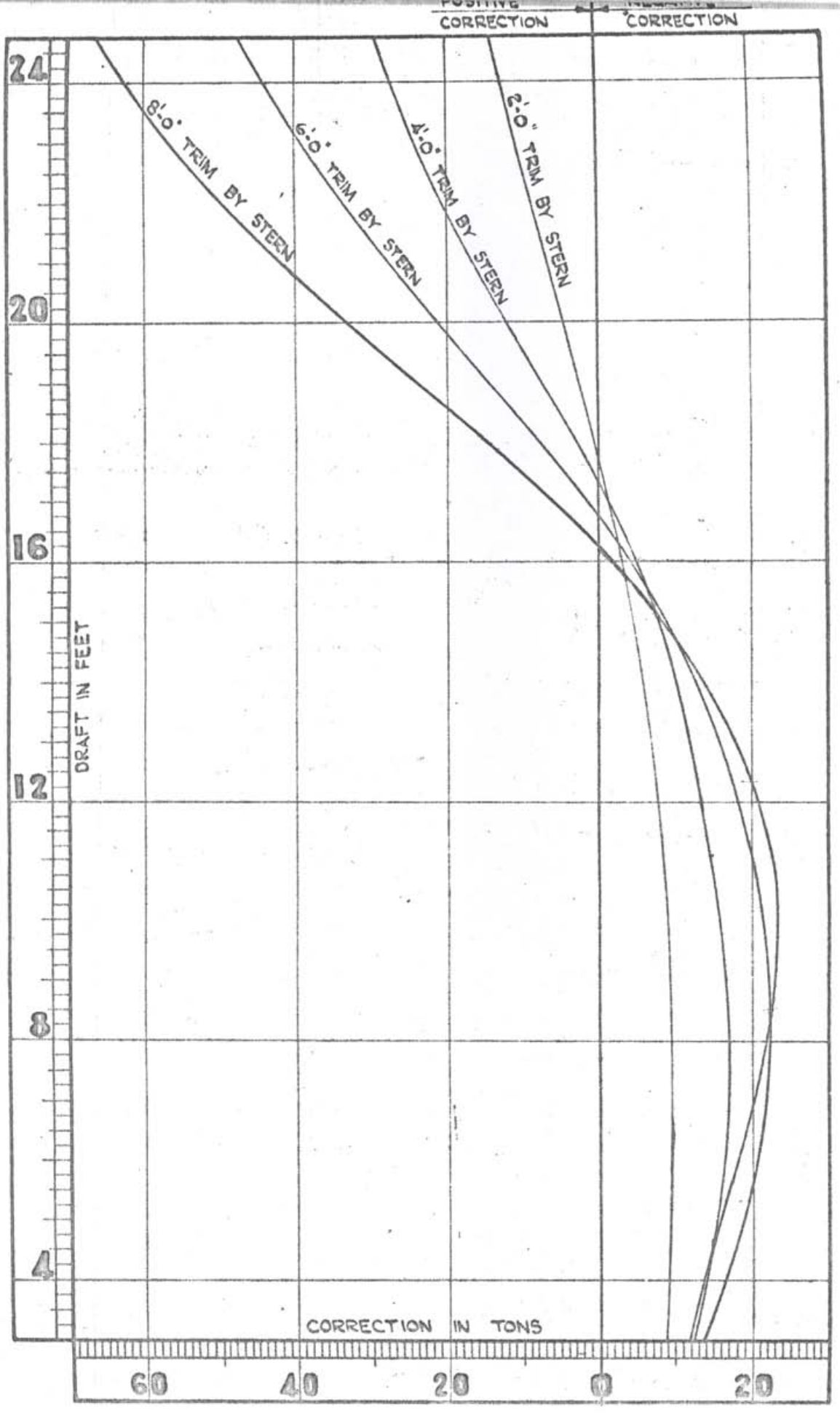
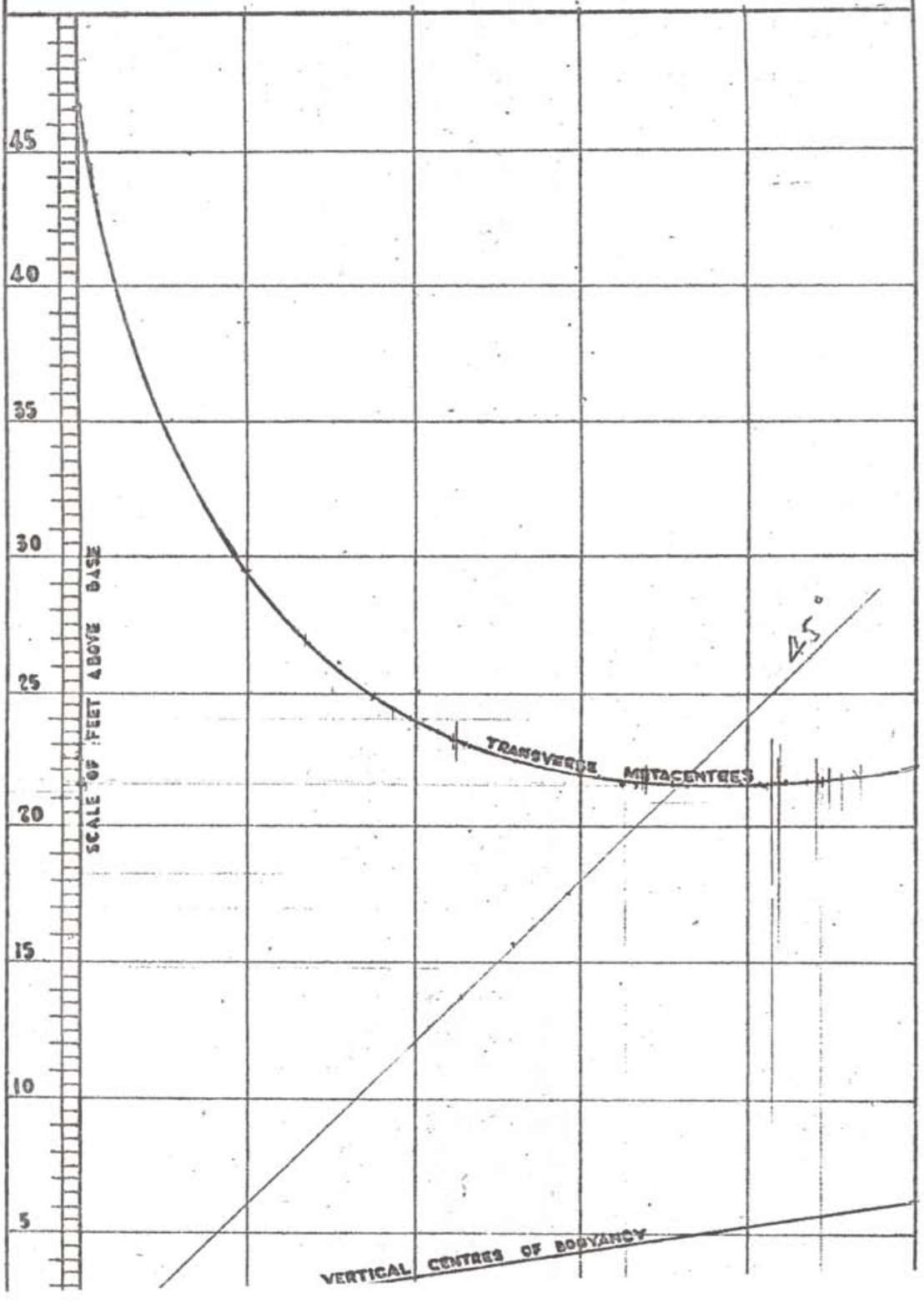
CENTRE OF GRAVITY ASSUMED 20 FEET ABOVE BASE
FOR OTHER HEIGHTS OF C.G. SEE GZ CORRECTION TABLE

CORRECTION TO GZ½[ft] FOR ON
FOOT DIFFERENCE IN HEIGHT OF C.

| 15° | 30° | 45° | 60° | 75° | 90 |
|---|---|---|---|---|---|
| ·259 | ·500 | ·707 | ·866 | ·966 | 1·0 |




2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
TONS DISPLACEMENT
24
20
16
12
8
4
TONS PER INCH IMMERSION
MOMENT TO CHANGE TRIM ONE INCH
DISPLACEMENT
LONGITUDINAL CENTRE OF FLOTATION
LONGITUDINAL CENTRE OF BUOYANCY
TRIMMING MOMENTS
[FOOT TONS]
500
600
700
800
TONS PER INCH
20
30
40
HYDROSTATIC CURVES
L.C. FLOTATION
&
L.C. BUOYANCY
10 FEET
AFT
FORD


POSITIVE CORRECTION
CORRECTION
8'-0" TRIM BY STERN
6'-0" TRIM BY STERN
4'-0" TRIM BY STERN
2'-0" TRIM BY STERN
DRAFT IN FEET
24
20
16
12
8
4
CORRECTION IN TONS
60
40
20
0
20

# METACENTRIC DIAGRAM