NATIONAL CARGO BUREAU, INC.

ADDENDUM # 1 TO THE GRAIN STABILITY CALCULATION FORM

TO BE COMPLETED WHEN A TABLE OF MAXIMUM ALLOWABLE HEELING MOMENTS IS NOT PROVIDED IN THE VESSEL'S APPROVED GRAIN LOADING BOOKLET. IN SUCH A CASE, COMPLIANCE WITH PERTINENT GRAIN REGULATIONS MUST BE DETERMINED FROM A PLOT OF THE STABILITY CURVE. PREPARE ONE ADDENDUM FOR EACH STAGE OF THE VOYAGE AND USE THE RESULTS TO COMPLETE THE **SUMMARY PART** OF THE GRAIN STABILITY CALCULATION FORM.

CHECK ONE:

VESSEL: _____

☐ DEPARTURE FROM: _____

☐ INTERMEDIATE

PORT: _____ DATE: _____

☐ ARRIVAL AT: _____

INDENTIFICATION OF CROSS CURVES OF STABILITY: _____ (SEE NOTE 1)

BASIC DATA:

DISPLACEMENT (FROM PART II) .... _____

KG_V (FROM PART II) .... _____

GM (FROM PART II) .... _____

GRAIN HEELING MOMENT (FROM PART III).. _____

ANGLE OF FLOODING (SEE NOTE 2) .... _____

λ_0 HEELING ARM AT ANGLE 0° (GRAIN HEELING MOMENT ÷ DISPLACEMENT)._____

λ_{40} HEELING ARM AT ANGLE 40° (0.8 x HEELING ARM AT 0°).................... _____

ASSUMED KG OF THE CROSS CURVES .... _____

GZ CORRECTION FACTOR (ASSUMED KG – KG_V)................................... _____
(MAY BE "**+**" OR "**-**", RETAIN SIGN)

TABLE OF RIGHTING ARMS (GZ): INCLUDE DATA FROM 0° TO 60° (MINIMUM)

ANGLE OF INCLINATION θ						
SINE θ						
GZ (FROM CROSS CURVES)						
SINE θ x CORRECTION FACTOR (OBSERVE SIGN)						
CORRECTED GZ						

NOTES:

1. THIS INFORMATION IS REQUIRED ONLY IF CROSS CURVES OF STABILITY (OR TABULAR DATA) ARE **NOT** FURNISHED IN THE VESSEL'S APPROVED GRAIN LOADING BOOKLET.

2. THE ANGLE OF FLOODING MEANS AN ANGLE OF HEEL AT WHICH OPENINGS IN THE HULL, SUPERSTRUCTURES OR DECK HOUSES, THAT CANNOT BE CLOSED WEATHER-TIGHT, IMMERSE. SMALL OPENINGS THROUGH WHICH PROGRESSIVE FLOODING CANNOT TAKE PLACE NEED NOT BE CONSIDERED.

3. THIS METHOD APPLIES IN THE USUAL CASE WHERE THREE POINTS DESCRIBE THE RIGHTING ARM CURVE BETWEEN THE ANGLE OF HEEL AND THE LIMITING ANGLE; IF NOT, APPLY SIMPSON'S RULE USING FIVE STATIONS INSTEAD OF THREE AS SHOWN.

4. METER DEGREES DIVIDED BY 57.3 = METER RADIANS; FOOT DEGREES DIVIDED BY 188 = METER RADIANS.

PLOT OF STABILITY CURVE:

RIGHTING
ARM
GZ

HEELING
ARM

0°   10°   20°   30°   40°   50°   60°

PLOT HEELING ARM
AT 0°

PLOT HEELING ARM
AT 40°

PLOT GM AT 57.3°
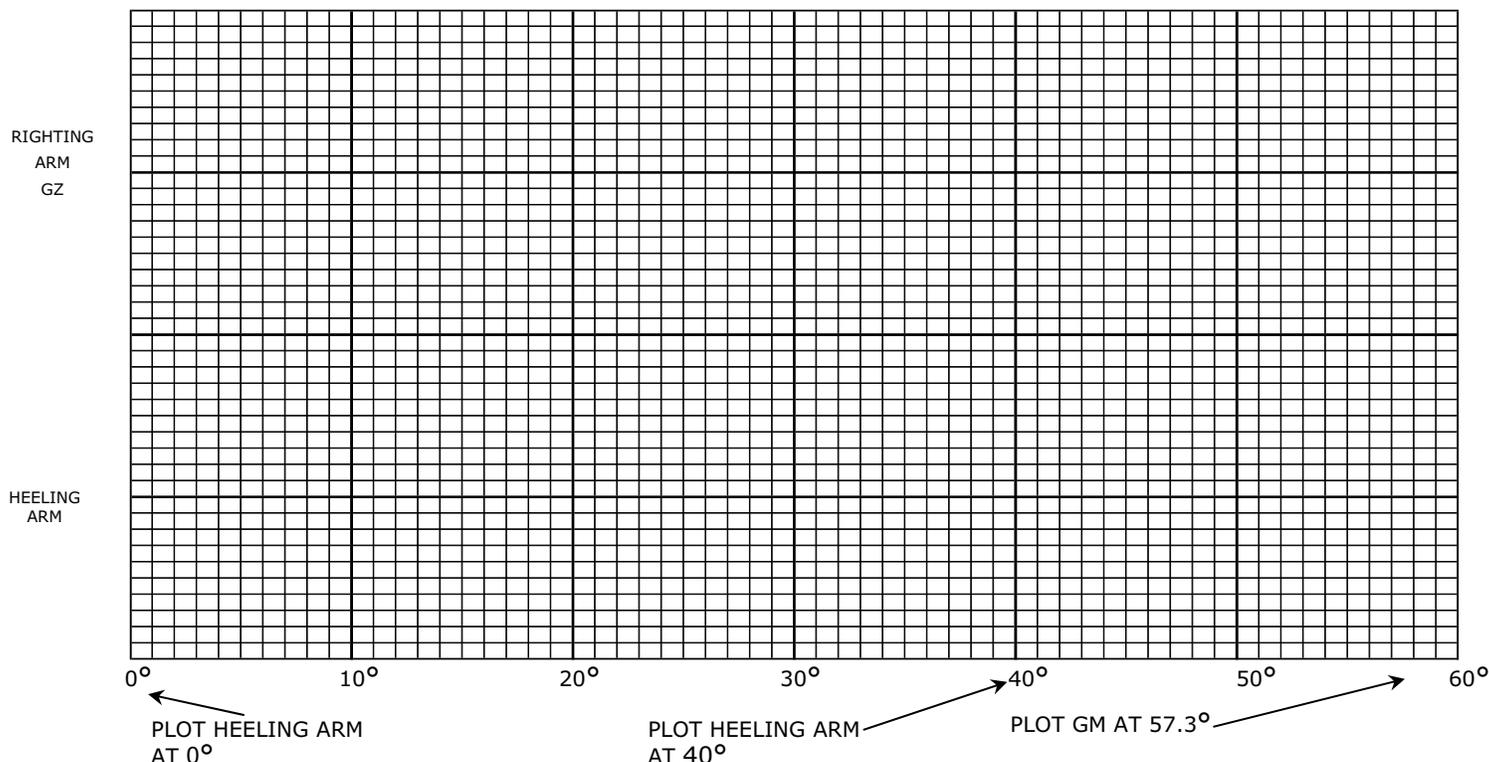
DETERMINE FROM THE ABOVE PLOT: **ANGLE OF HEEL** (THE FIRST INTERSECTION OF THE RIGHTING ARM CURVE WITH THE HEELING ARM CURVE)

= _____ **DEGREES**

LIMITING ANGLE   (40 DEGREES, OR
                        THE ANGLE OF FLOODING, OR   } WHICHEVER IS
                        THE ANGLE AT WHICH THERE IS MAXIMUM DIFFERENCE   **LEAST**
                        BETWEEN THE RIGHTING ARM CURVE AND THE HEELING ARM CURVE)

= _____ **DEGREES**

RESIDUAL AREA CALCULATION: STATION SPACING (**S**) = $\frac{\text{(LIMITING ANGLE} - \text{ANGLE OF HEEL)}}{2} = \frac{\_\_\_^\circ - \_\_\_^\circ}{2} = \_\_\_^\circ$ (SEE NOTE 3)

ANGLE OF INCLINATION		RIGHTING ARM	HEELING ARM	DIFFERENCE		PRODUCT
ANGLE OF HEEL				**0**	**1**	**0**
ANGLE OF HEEL + S°					**4**	
ANGLE OF HEEL + 2S° (LIMITING ANGLE)					**1**	
					SUM	

$\frac{\textbf{SUM x S}}{\textbf{3}}$ = **RESIDUAL AREA** = $\frac{_____}{\textbf{3}}$ = **m°** =   **mr**
                                                                            Ft°   (SEE NOTE 4)

_____   EXAMINED: _____
                MASTER   **N.C.B. SURVEYOR**