

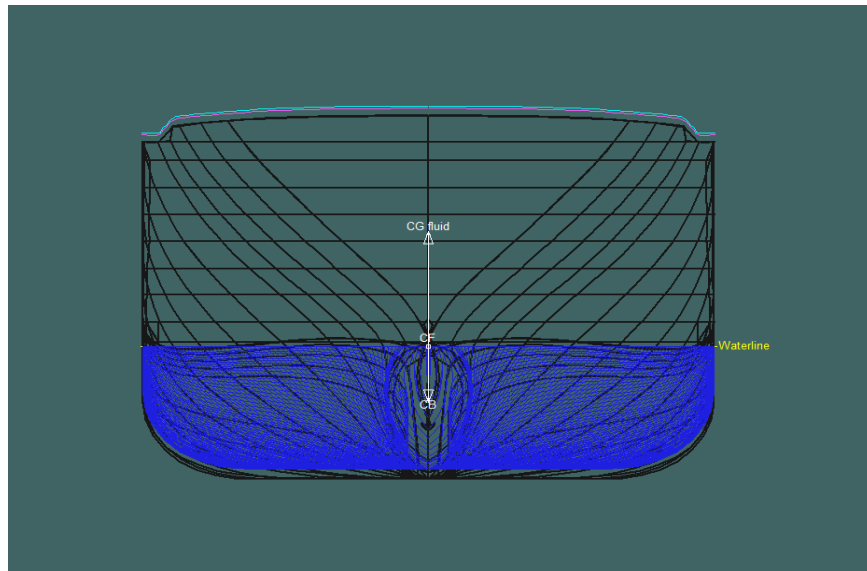


ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΑΤΤΙΚΗΣ
ΣΧΟΛΗ ΜΗΧΑΝΙΚΩΝ
ΤΜΗΜΑ ΝΑΥΠΗΓΩΝ

ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ

*«Σύγκριση Ντετερμινιστικής και Πιθανοτικής μεθόδου για
ευστάθεια πλοίου τύπου ROPAX μετά από βλάβη»*

*“Comparison of Deterministic and Probabilistic method of the damaged stability of a
ROPAX”*



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«Σύγκριση Ντετερμινιστικής και Πιθανοτικής μεθόδου για ευστάθεια πλοίου τύπου ROPAX μετά από βλάβη»

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Ο κάτωθι υπογεγραμμένος **ΑΣΠΙΩΤΗΣ ΙΣΙΔΩΡΟΣ** του **Ιωάννη** και της **Άννας**, με αριθμό μητρώου **51113056**, φοιτητής του Πανεπιστημίου Δυτικής Αττικής, της Σχολής **Ναυπηγών Μηχανικών**, δηλώνω υπεύθυνα ότι:

«Είμαι συγγραφέας της παρούσας διπλωματικής εργασίας και ότι κάθε βοήθεια την οποία είχα για την προετοιμασία της είναι αναγνωρισμένη και αναφέρεται στην εργασία. Επίσης, οι όποιες πηγές από τις οποίες έκανα χρήση δεδομένων, ιδεών ή λέξεων, είτε ακριβώς είτε παραφρασμένες, αναφέρονται στο σύνολό τους, με πλήρη αναφορά στους συγγραφείς, τον εκδοτικό οίκο ή το περιοδικό, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο. Επίσης, βεβαιώνω ότι αυτή η εργασία έχει συγγραφεί από μένα αποκλειστικά και αποτελεί προϊόν πνευματικής ιδιοκτησίας τόσο δικής μου, όσο και του Ιδρύματος.

Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του διπλώματός μου».

Ο Δηλών
ΑΣΠΙΩΤΗΣ ΙΣΙΔΩΡΟΣ

ΕΥΧΑΡΙΣΤΙΕΣ

Για την εκπόνηση της παρούσας διπλωματικής εργασίας, θα ήθελα να ευχαριστήσω τον καθηγητή, κ. Ιωάννη Τίγκα, για την καθοδήγησή του καθ' όλη τη διάρκεια συγγραφής της εργασίας και την επίλυση των ερωτημάτων που πρόκυπταν.

Επίσης, θα ήθελα να ευχαριστήσω την φίλη και συμφοιτήτριά μου Φλεριανού Ανθία, η συμβολή της οποίας ήταν καθοριστική για την περάτωση του ελέγχου ευστάθειας μέσω του προγράμματος *Max Surf*.

Τέλος, θέλω να ευχαριστήσω τον φίλο και Ναυπηγό Μηχ., Στάικο Ι. και το τεχνικό γραφείο όπου εργάζεται, για την παροχή των σχεδίων και οδηγιών σχετικά με την μελέτη.

ΠΕΡΙΛΗΨΗ

Πρωταρχικό ρόλο στην παγκόσμια ναυτιλία αποτελεί η διασφάλιση της ανθρώπινης ζωής στη θάλασσα. Για τον λόγο αυτό, και ιδιαίτερα για επιβατηγά πλοία, έχει δημιουργηθεί ο Παγκόσμιος Οργανισμός Ναυτιλίας (*I.M.O.*). Στα μέσα του 19ου αιώνα, στη Γένοβα, δημιουργήθηκε ο οργανισμός αυτός όπου πρωταρχικός του στόχος ήταν η δημιουργία μιας ανανεωμένης έκδοσης της *SOLAS*. (*International Convention for the Safety of Life at Sea*). Ο οργανισμός συνεχίζει να αναπτύσσεται μέχρι σήμερα και είναι πλέον υπεύθυνος για περισσότερες από 50 διεθνή συμβάσεις.¹

Από τις συμβάσεις του *IMO*, φυσικά δεν θα μπορούσε να παραληφθεί ο έλεγχος ευστάθειας των πλοίων. Η ευστάθεια έχει καθοριστικό ρόλο στη ναυπήγηση ενός πλοίου. Ως ευστάθεια ορίζουμε την ικανότητα ενός πλοίου να ανθίσταται σε οποιαδήποτε κλίση, εγκάρσια ή διαμήκη, καθώς και η τάση επαναφοράς του στην αρχική θέση (κατακόρυφη).²

Στην παρούσα εργασία, σχεδιάστηκε η γάστρα στο λογισμικό *Rhino3D*, έγινε έλεγχος της άθικτης ευστάθειας του πλοίου, όπως και της ευστάθειας μετά από βλάβη με την βοήθεια του προγράμματος *Max Surf*. Υπάρχουν δύο μέθοδοι ελέγχου της ευστάθειας: η μέθοδος της χαμένης άντωσης, η οποία είναι η πιο ευρέως χρησιμοποιούμενη, και η μέθοδος του πρόσθετου βάρους, οι οποίες αναλύονται στο κεφάλαιο 2.3.

Σε συνέχεια των ανωτέρω, ο σκοπός της εργασίας είναι η μελέτη της κατάκλυσης ενός επιβατηγού πλοίου και έλεγχος της ευστάθειάς του. Για την υλοποίηση της υπολογιστικής διαδικασίας, δημιουργήθηκε ένα τρισδιάστατο μοντέλο πλοίου στο κατάλληλο σχεδιαστικό πρόγραμμα, *Rhino3D*. Ύστερα, έγινε έλεγχος ευστάθειας με τη χρήση του λογισμικού προγράμματος *Max Surf*. Επιπλέον, έγινε έλεγχος με την ντετερμινιστική αλλά και με την πιθανοτική μέθοδο, οι οποίες αναλύονται στο κεφάλαιο 2,5.

¹ www.imo.org

²

https://el.wikipedia.org/wiki/%CE%95%CF%85%CF%83%CF%84%CE%AC%CE%B8%CE%B5%CE%B9%CE%B1_%CF%80%CE%BB%CE%BF%CE%AF%CE%BF%CF%85

ABSTRACT

The primary role of global shipping is to safeguard human life at sea. For this reason, and especially for passenger ships, the World Maritime Organization (I.M.O.). In the mid-19th century, in Genoa, this organization was created where its primary goal was to create a renewed edition of SOLAS. (International Convention for the Safety of Life at Sea). The organization continues to grow to this day and is now responsible for more than 50 international conventions.

From the Imo conventions, of course, ship stability control could not be omitted. Stability plays a crucial role in the construction of a ship. Stability is defined as the ability of a ship to withstand any inclination, transverse or longitudinal, as well as the tendency to return to the original position (vertical).

In this paper, the hull was designed in Rhino3D software, the intact stability of the ship was checked, as well as the stability after failure with the help of the Max Surf Program. There are two methods of stability control: the lost lift method, which is the most widely used, and the additional weight method, which are discussed in Chapter 2.3.

Following the above, the purpose of the work is to study the flooding of a passenger ship and check its stability. To implement the computational process, a three-dimensional model of a ship was created in the appropriate design program, Rhino3D. Then, stability was checked using the Max Surf software. In addition, the deterministic and probabilistic methods were tested, which are discussed in Chapter 2.5.

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ΚΕΦΑΛΑΙΟ 1^ο: ΕΙΣΑΓΩΓΗ

1.1 ΓΕΝΙΚΑ

Με την ανάπτυξη της τεχνολογίας τις τελευταίες δεκαετίες, οι ανάγκες για θαλάσσιες μεταφορές έχουν αυξηθεί. Ολοένα και περισσότερα πλοία, ιδίως μεγάλης χωρητικότητας, κατασκευάζονται για την κάλυψη των αναγκών αυτών. Με τα τόσα πολλά πλέον πλοία να κινούνται στους ωκεανούς και στις θάλασσες κάθε λεπτό, τα ατυχήματα είναι αναπόφευκτα. Επειδή δυστυχώς, σε πολλά από αυτά, χάνονται και ανθρώπινες ζωές, ο *IMO* δημιούργησε την *SOLAS (Safety of Life at Sea)*, μία σύμβαση που ασχολείται αποκλειστικά με την ανθρώπινη ζωή στην θάλασσα. Η πρώτη έκδοση της έγινε το 1914 και αφορμή για την δημιουργία της στάθηκε το ναυάγιο του Τιτανικού.³

Σε ένα πλοίο, οι δύο κυριότερες περιπτώσεις που προκαλούν εισροή υδάτων, είναι λόγω προσάραξης είτε λόγω σύγκρουσης. Για να εξασφαλιστεί η ασφάλεια των επιβατών, θα πρέπει το πλοίο να είναι σε θέση να διατηρήσει την ευστάθεια του καθ' όλη τη διάρκεια της κατάκλισης (*Vassalos and Guarin 2009*).

Η διατήρηση της ευστάθειας ύστερα από προσάραξη ή σύγκρουση αποτελεί πολυσύνθετο πρόβλημα, καθώς το πλοίο διαθέτει πολλά εσωτερικά ανοίγματα, όπως ανθρωποθυρίδες, κλιμακοστάσια κ.τ.λ. μέσω των οποίων το νερό μπορεί να βρει δίοδο και να κατακλύσει περισσότερα διαμερίσματα του πλοίου.

Σε «γενικές γραμμές» προσπαθούμε να αποτρέψουμε την εισροή υδάτων στα μεγαλύτερα διαμερίσματα. Η προσπάθεια αυτή, αποσκοπεί στην αποφυγή ελεύθερων επιφανειών. Αν σε έναν χώρο δηλαδή, η πληρότητα του νερού είναι αρκετή ώστε να δημιουργηθούν ελεύθερες επιφάνειες, τότε θα προκαλέσουν αρνητική επίδραση τόσο στην ευστάθεια του πλοίου όσο και στους χειρισμούς του, (*Pekka Ruronen 2007, Mironiuk 2010*).

³ <https://www.imo.org/en/KnowledgeCentre/ConferencesMeetings/Pages/SOLAS.aspx>

ΚΕΦΑΛΑΙΟ 2^ο: ΙΣΤΟΡΙΚΗ ΑΝΑΔΡΟΜΗ

Η επιβίωση ενός πλοίου μετά από βλάβη, άρχισε να απασχολεί τη διεθνή ναυτιλιακή κοινότητα από το δεύτερο μισό του 19^{ου} αιώνα. Η πρώτη χώρα που θέσπισε σχετική νομοθεσία, είναι η Μεγάλη Βρετανία. Η νέα νομοθεσία απαιτούσε, για πλοία μεταλλικής κατασκευής άνω των 100 τόνων, την ύπαρξη φρακτών πρύμνηθεν και πρόραθεν του μηχανοστασίου, (Κ. Σπύρου 2009).

Η επόμενη νομοθετική μεταρρύθμιση πραγματοποιήθηκε το 1914. Αφορμή στάθηκε το τραγικό δυστύχημα του «Τιτανικού». Αυτό είχε ως συνέπεια να κληθεί η πρώτη διεθνή συνδιάσκεψη που αφορούσε την ασφάλεια της ανθρώπινης ζωής στη θάλασσα. Ως αποτέλεσμα της συνδιάσκεψης ήταν η δημιουργία της διεθνούς σύμβασης για την ασφάλεια της ανθρώπινης ζωής στη θάλασσα (SOLAS). Με τη νέα σύμβαση, θεσπίστηκαν προδιαγραφές σχετικά με την στεγανή υποδιαίρεση των πλοίων.

Το 1948 έχουμε την δημιουργία του Διεθνούς Οργανισμού Ναυτιλίας (I.M.O.). Ο I.M.O. ιδρύθηκε μετά από συμφωνία σε διάσκεψη του O.H.E. που πραγματοποιήθηκε στη Γενεύη. Έχει έδρα το Λονδίνο, και περιλαμβάνει 174 κράτη μέλη. Αποτελεί έναν εξειδικευμένο οργανισμό των Ηνωμένων Εθνών, ο οποίος είναι υπεύθυνος για τη ρύθμιση ενός πλαισίου κανονισμών που αφορούν την προστασία του θαλάσσιου περιβάλλοντος και την ασφάλεια στη θάλασσα.

Το 1960, ο IMO προέβη στην αναθεώρηση της SOLAS με σκοπό την μελέτη της ευστάθειας των πλοίων μετά από βλάβη. Την δεκαετία του 1980, οι διατάξεις που αφορούσαν την επιβίωση των επιβατηγών πλοίων μετά από βλάβη, άρχισαν να ισχύουν και σε πλοία μεταφοράς ξηρού φορτίου.

Τα δυστυχήματα δύο επιβατηγών-οχηματαγωγών πλοίων, του «Herald of Free Enterprise» το 1987 και του «Estonia» το 1994, στάθηκαν η αφορμή ώστε ο I.M.O. να δραστηριοποιηθεί άμεσα προκειμένου να αναθεωρήσει τις μεθόδους ελέγχου ευστάθειας της SOLAS του 1990 και 1992 για τα επιβατηγά πλοία. Η νέα απαίτηση για τα επιβατηγά και οχηματαγωγά πλοία, ήταν να γίνεται ο έλεγχος ευστάθειας, έχοντας προσθέσει μία ποσότητα νερού στο κατάστρωμα των οχημάτων.

Μια Ευρωπαϊκή ομάδα ερευνητών από διάφορα επιστημονικά κέντρα και νηογνώμονες, χρηματοδοτήθηκαν για μία ερευνητική εργασία την οποία ονόμασαν «*HARDER*» (1999-2003). Η έρευνα αφορούσε την διευκρίνιση σοβαρών τεχνικών θεμάτων κατά τη διάρκεια προσαρμογής των κανονισμών από τις επιτροπές του *I.M.O.* στο θέμα της ευστάθειας του πλοίου μετά από βλάβη. Με βάση τα αποτελέσματα της έρευνας, προτάθηκε στον *I.M.O.* ένα καινούριο εναρμονισμένο πιθανό θεωρητικό μοντέλο εκτίμησης, *HARDER – S.L.F. 46*.⁴



Εικόνα 1: Διεθνής Οργανισμός Ναυτιλίας (*I.M.O.*)

https://en.wikipedia.org/wiki/International_Maritime_Organization

Τον Σεπτέμβριο του 2003, και κατά τη διάρκεια ολοκλήρωσης της εργασίας εναρμονισμού, δημιουργήθηκαν ενδοιασμοί σχετικά με τις επιπτώσεις των προτεινόμενων κανονισμών, σε θέματα που αφορούν την σχεδίαση των επιβατηγών πλοίων. Αυτό, είχε ως αποτέλεσμα, ο *I.M.O.* να επανεξετάσει του κανονισμούς και να προχωρήσει σε περαιτέρω έρευνες. Οι σχετικές προτάσεις αναθεώρησης που τέθηκαν για εξέταση στον *I.M.O.* είναι οι *HARDER - S.L.F.46* και *M.S.C.78*.

Το 2004 η πρόταση *HARDER – S.L.F. 46* αναθεωρήθηκε και προτάθηκαν οι *HARDER - S.L.F. 47* και *I.M.O. – M.S.C. 79*. Ωστόσο, τον Μάιο του 2005, είχαμε νέα αναθεώρηση ως προς τη μέθοδο εκτίμησης για πλοία μεγάλου μεγέθους την *I.M.O. – M.S.C. 80*. Το νέο πιθανοθεωρητικό μοντέλο *M.S.C.80*, εφαρμόστηκε σε όλα τα επιβατηγά και ξηρού φορτίου πλοία με ημερομηνία κατασκευής από 1^η Ιανουαρίου 2009.

Στις μέρες μας, υπάρχει μια σειρά διατάξεων, γνωστή ως «*Safe Return to Port*», στα κεφάλαια Π – 1, Π – 2 της *S.O.L.A.S* τα οποία έχουν στόχο να εξασφαλίσουν την ασφαλή επιστροφή του πλοίου στο λιμάνι μετά από βλάβη με ίδια μέσα πρόωσης.

⁴ <https://www.sciencedirect.com/science/article/abs/pii/S0925753516000369>

ΚΕΦΑΛΑΙΟ 3^ο: ΣΚΟΠΟΣ

Σκοπός της εργασίας είναι η σύγκριση της ντετερμινιστικής και πιθανοτικής μεθόδου για ευστάθεια μετά από βλάβη σε επιβατηγό - οχηματαγωγό πλοίο. Για την εκπόνησή της εργασίας, αρχικά σχεδιάσαμε το αντίστοιχο μοντέλο πλοίου, από ήδη υπάρχοντα σχέδια. Η μοντελοποίηση έγινε με την χρήση του λογισμικού «Rhino», το οποίο παρέχεται από τη σχολή των Ναυπηγών Μηχανικών, του Πανεπιστημίου Δυτικής Αττικής.

Το δεύτερο βήμα ήταν η εισαγωγή της γάστρας στο λογισμικό πρόγραμμα «*Modeler*» του «*MaxSurf*» και ο προσδιορισμός της θέσης του πλοίου με βάση την πρυμναία και πωραία κάθετο (*fore* και *aft perpendiculars*). Έπειτα, σύμφωνα με το σχέδιο διάταξης δεξαμενών (*capacity plan*) διαμορφώσαμε τα διαμερίσματα του πλοίου και τις δεξαμενές.

Στη συνέχεια δημιουργήσαμε τις τρεις καταστάσεις φόρτωσης του πλοίου ανάλογα με την πληρότητα των δεξαμενών, τον αριθμό των επιβατών, την πληρότητα του χώρου για τα αυτοκίνητα και τις προμήθειες. Όπως θα δούμε παρακάτω, πρόκειται για την κατάσταση 100% αναχώρησης, στην οποία είναι γεμισμένες οι δεξαμενές πετρελαίου και φρέσκου νερού και κατά συνέπεια οι δεξαμενές έρματος είναι άδειες. Ύστερα, είναι η μέση κατάσταση 50% όπου οι δεξαμενές φρέσκου νερού, πετρελαίου αλλά και έρματος έχουν πληρότητα περίπου 50%. Τέλος, έχουμε την κατάσταση άφιξης 10% κατά την οποία το πλοίο έχει σχεδόν άδειες δεξαμενές φρέσκου νερού και πετρελαίου. Παρόλο που οι δεξαμενές έρματος είναι γεμάτες, το κέντρο βάρους διατηρείται σχετικά ψηλά, γι' αυτό και η κατάσταση άφιξης είναι η δυσμενέστερη.

Τέλος, δημιουργήσαμε τα σενάρια βλάβης. Το πλοίο είναι επιβατηγό, με $1,350 < N \leq 6,000$, όπου N , ο αριθμός των επιβατών. Συνεπώς, βάση του κανονισμού *SOLAS* 1929, το πλοίο είναι πλοίο 3 διαμερισμάτων, που σημαίνει ότι σε κάθε κατάσταση βλάβης, θεωρούμε πως δημιουργείται ρήγμα σε 3 συνεχόμενα διαμερίσματα ταυτόχρονα.

ΚΕΦΑΛΑΙΟ 4^ο: ΘΕΩΡΗΤΙΚΟ ΥΠΟΒΑΘΡΟ

4.1 ΓΕΝΙΚΑ

Ένα πλοίο θεωρείται ασφαλές, όταν διαθέτει ικανοποιητική ευστάθεια τόσο στην άθικτη όσο και στην κατάσταση μετά από βλάβη. Στην προκειμένη περίπτωση, βλάβη θεωρείται ένα ρήγμα στη γάστρα του πλοίου, από το οποίο προκαλείται κατάκλυση του εσωτερικού του πλοίου.

Ένα πλοίο σε κατάσταση βλάβης, αντιμετωπίζει πρόβλημα ευστάθειας, καθώς με την εισροή του νερού, έχουμε προσθήκη βάρους, η οποία συνεπάγεται με αύξηση του βυθίσματος και πιθανόν, εγκάρσια κλίση. Συγχρόνως, επηρεάζεται το αρχικό μετακεντρικό ύψος, ενώ η⁵ ακτίνα μειώνεται, λόγω της αλλαγής επιφάνειας της ισάλου πλευσης. Αντίθετα η απόσταση του κέντρου άντωσης από το βασικό επίπεδο αυξάνεται λόγω της παράλληλης βύθισης.

Επίσης αξίζει να σημειωθεί ότι οι δυνητικά μεγάλες ελεύθερες επιφάνειες, μειώνουν επιπλέον το τελικό *GM*.

4.2 ΕΥΣΤΑΘΕΙΑ ΠΛΟΙΟΥ.

Με τον όρο ευστάθεια αναφερόμαστε στην ιδιότητα του πλοίου να διατηρεί την αρχική θέση ισορροπίας του παρά τις εξωτερικές δυνάμεις και ροπές που του ασκούνται.

Βασικά στοιχεία ευστάθειας πλοίου είναι:

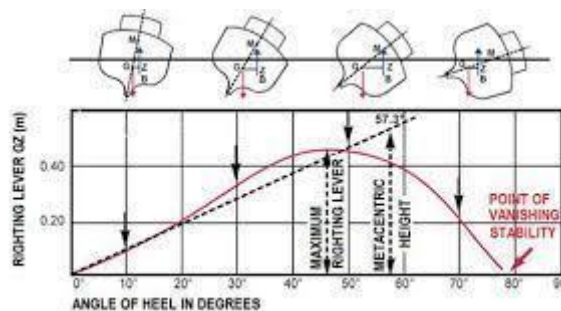
- Το κέντρο βάρους πλοίου,
- το κέντρο άντωσης πλοίου, που και τα δύο επενεργούν ως ζεύγος ευστάθειας,
- η ροπή ευστάθειας (και συνεπώς ο μοχλοβραχίονας ευστάθειας),
- το μετάκεντρο,
- το μετακεντρικό ύψος,
- ο βαθμός ευστάθειας και
- τέλος οι συνθήκες ευστάθειας στις διάφορες κλίσεις πλοίου.

Με τον όρο **θετική** ευστάθεια αναφερόμαστε στην θέση του μετάκεντρου (M). Όταν σε ένα πλοίο εφαρμοστεί μια εξωτερική δύναμη και εκείνο δεν ανατραπεί, αλλά επανέλθει στην αρχική του θέση ισορροπίας, τότε η θέση του μετάκεντρου εξακολουθεί να βρίσκεται πάνω από την θέση του κέντρου βάρους του (G). Αυτό οφείλεται στην ροπή επαναφοράς (GZ).

Στην αντίθετη περίπτωση, δηλαδή όταν το μετάκεντρο βρεθεί κάτω από την θέση το κέντρου βάρους, τότε θα έχουμε αντίθετη ροπή από την προηγούμενη, η οποία θα ανατρέψει το πλοίο. Αυτή η κατάσταση ονομάζεται **αρνητική** ευστάθεια.

Η τρίτη περίπτωση ευστάθειας είναι η **ουδέτερη**. Σε αυτή την περίπτωση η θέση του κέντρου βάρους συμπίπτει με την θέση του μετάκεντρου. Έτσι, δεν υπάρχει ροπή επαναφοράς και το πλοίο είναι αρκετά ασταθές.

Η ροπή ή μοχλοβραχίονας επαναφοράς εξαρτάται από το εκτόπισμα, την γωνία κατά το εγκάρσια και το ύψος του κέντρου βάρους KG από την βασική γραμμή (*Base Line*).



Εικόνα 2: Διάγραμμα Μοχλοβραχίονα επαναφοράς συναρτήσει της γωνίας κλίσης
<https://eclass.snd.edu.gr/modules/document/file>

4.3 ΜΕΘΟΔΟΙ ΜΕΛΕΤΗΣ ΕΥΣΤΑΘΕΙΑΣ ΜΕΤΑ ΑΠΟ ΒΛΑΒΗ

Η επίλυση τέτοιων προβλημάτων γίνεται με την βοήθεια δύο μεθόδων. Την «μέθοδο της χαμένης άντωσης» (*method of lost buoyancy*) και την «μέθοδο του επιπρόσθετου βάρους» (*method of added weight*). Αυτές οι δύο μέθοδοι αντιμετωπίζουν το ίδιο πρόβλημα αλλά με διαφορετικές προσεγγίσεις. (Τζαμπίρας, Γεώργιος Α., 2010)

Μέθοδος χαμένης άντωσης

Στη μέθοδο χαμένης άντωσης θεωρούμε ότι ο όγκος του κατακλυσμένου διαμερίσματος δεν συμβάλλει στην άντωση. Το πλοίο, ουσιαστικά αλλάζει θέση ώστε να υπάρξει νέα θέση ισορροπίας. Το

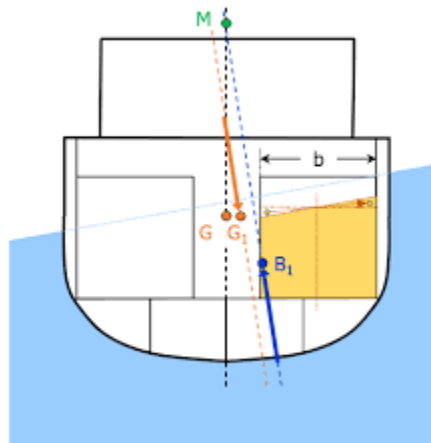
εκτόπισμα και το κέντρο βάρους του πλοίου παραμένουν σταθερά. Το νερό που εισέρχεται αποτελεί μια εξ αρχής, γνωστή μάζα της οποίας οι ελεύθερες επιφάνειές δεν επιδρούν στην ευστάθεια του πλοίου καθώς δεν θεωρείται πλέον μέρος του πλοίου.

Μέθοδος πρόσθετου βάρους

Αντίθετα, στην μέθοδο του πρόσθετου βάρους, η μάζα του νερού που εισέρχεται στους εσωτερικούς χώρους, θεωρείται ότι πλέον ανήκει στο πλοίο. Το νέο κέντρο βάρους προκύπτει από τις ροπές του άθικτου πλοίου και του νερού κατάκλυσης. Επίσης, με αυτή την μέθοδο λαμβάνεται υπόψη και η επίδραση των ελεύθερων επιφανειών που δημιουργούνται από το νερό της κατάκλυσης. Το μειονέκτημα σε αυτή την μέθοδο, είναι ότι το πρόσθετο βάρος δεν είναι γνωστό εξ αρχής και ο υπολογισμός του γίνεται σύμφωνα με την τελική του θέση ισορροπίας. Βασικό πλεονέκτημα της μεθόδου είναι η εύκολη μοντελοποίηση σε προγράμματα μέσω υπολογιστή στα οποία γίνεται ακριβής προσομοίωση της εξέλιξης του φαινομένου της κατάκλυσης του πλοίου με το πέρασμα του χρόνου.

4.4 Η ΕΠΙΔΡΑΣΗ ΤΩΝ ΕΛΕΥΘΕΡΩΝ ΕΠΙΦΑΝΕΙΩΝ

Οι ελεύθερες επιφάνειες δημιουργούνται στους εσωτερικούς χώρους και στις διάφορες δεξαμενές του πλοίου λόγω της μη πλήρωσης τους με το υγρό. Βασικό χαρακτηριστικό της ελεύθερης επιφάνειας είναι ότι αποκτά την ίδια κλίση με το πλοίο. Αυτό έχει ως αποτέλεσμα να μειώνεται η ροπή επαναφοράς, επηρεάζοντας αρνητικά την ευστάθεια του πλοίου.



Εικόνα 3: Μετατόπιση ρευστού εντός της δεξαμενής.

<https://eclass.hna.gr/modules/document/file.php>

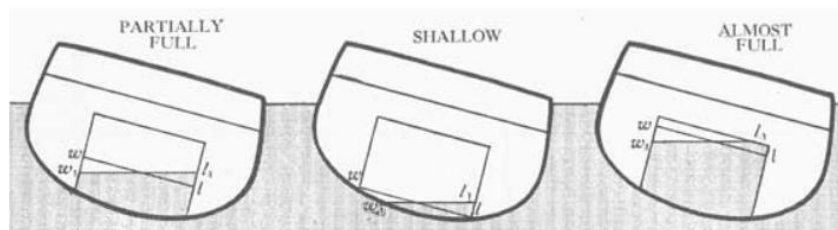
Οι πρώτες συστηματικές μελέτες, έγιναν για την μελέτη αυτών των φαινομένων το 1889, από τον καθηγητή του πανεπιστημίου της Γλασκόβης, *Jenkins*. Εκείνος, έπειτα από πειραματικές διαδικασίες κατόρθωσε να εκφράσει τα διάφορα μεγέθη που συνέβαλαν στο συγκεκριμένο φαινόμενο, με τον

παρακάτω μαθηματικό τύπο:

$$GM_v = GM - \frac{\gamma I}{\Delta}$$

Σύμφωνα με αυτή τη σχέση η επίδραση της ελεύθερης επιφάνειας, είναι ανεξάρτητη της ποσότητας υγρού και συμβάλλει στην μείωση του αρχικού μετακεντρικού ύψους (GM). Τα σύμβολα γ και I_F αναφέρονται στο ειδικό βάρος και στη δεύτερη ροπή επιφάνειας του υγρού αντίστοιχα. Με Δ συμβολίζεται το εκτόπισμα του πλοίου και με GM_v , το νέο μειωμένο μετακεντρικό ύψος λόγω της ελεύθερης επιφάνειας του ρευστού.

Η επίδραση των ελευθέρων επιφανειών βασίζεται σε δύο κύριους παράγοντες. Ο πρώτος παράγοντας εξαρτάται από το φαινόμενο «*pocketing*». Το φαινόμενο αυτό, παρουσιάζεται όταν η επιφάνεια του ρευστού «ακουμπάει» τον πυθμένα ή την κορυφή του χώρου στον οποίο εμπεριέχεται. Ουσιαστικά, με αυτό τον όρο αναφερόμαστε στη μείωση του πλάτους της ελεύθερης επιφάνειας.



Εικόνα 4: Φαινόμενο «*pocketing*».

<https://eclass.hna.gr/modules/document/file.php>

Ο δεύτερος παράγοντας, αφορά την χωρητικότητα του κατακλυσμένου διαμερίσματος. Αναφερόμαστε στην διαχωρητικότητα (*Surface Permeability*) δηλαδή, στην χωρητικότητα του νερού ενός χώρου. Η χωρητικότητα περιορίζεται από τα αντικείμενα που υπάρχουν εντός του χώρο που κατακλύζεται, αυτά μπορεί να είναι ενισχυτικά, στερεό μόνιμο έρμα κ.α. Έτσι επηρεάζεται και η συμβολή της ελεύθερης επιφάνειας.

4.5 ΜΕΘΟΔΟΙ ΕΚΤΙΜΗΣΗΣ ΕΥΣΤΑΘΕΙΑΣ ΕΠΕΙΤΑ ΑΠΟ ΚΑΤΑΚΛΥΣΗ.

Για την εκτίμηση της ευστάθειας ενός πλοίου έπειτα από βλάβη, έχουν αναπτυχθεί δύο βασικές μέθοδοι. Αυτές οι δύο μέθοδοι που αναλύονται παρακάτω, έχουν διαφορές στην θεωρητική και κατ' επέκταση στην πειραματική εφαρμογή τους. (Τζαμπίρας, Γεώργιος Δ., 2010)

- **Πιθανοτική Μέθοδος:** Αποτελεί επιστημονική προσέγγιση η οποία εφαρμόζεται σε εκτεταμένες βλάβες. Συνδυάζει την αρχική κατάσταση με περιπτώσεις βλάβης. Θεωρείται αρκετά αξιόπιστη

μέθοδος, καθώς τα αποτελέσματα προκύπτουν έπειτα από διερεύνηση πολύ μεγάλου αριθμού περιπτώσεων βλάβης. Επίσης, δίνει την δυνατότητα να μελετηθούν σπανιότερες περιπτώσεις βλάβης, οι οποίες δίνουν χαμηλά επίπεδα επιβίωσης του πλοίου.

- **Ντετερμινιστική Μέθοδος:** Θεωρείται ημι-εμπειρική μέθοδος. Εστιάζει σε συγκεκριμένες περιοχές του πλοίου και εφαρμόζεται σε περιπτώσεις βλάβης με συγκεκριμένα γεωμετρικά χαρακτηριστικά. Δηλαδή τα όρια εντός των οποίων κυμαίνεται το ρήγμα καθορίζεται από τις παρακάτω διαστάσεις:

Μήκος ρήματος (διάμηκες): ελάχιστο όριο = $\{0,03 L_{\text{πλοίου}} + \frac{3(m)}{11(m)}\}$

Εγκάρσιο μήκος ρήματος: από το εξωτερικό περίβλημα = $\frac{B}{5} m$ (B: πλάτος πλοίου)

Κατακόρυφη έκταση ρήματος: Από την βασική γραμμή αναφοράς προς το ανώτερο κατάστρωμα, χωρίς περιορισμό.

4.6 ΠΙΘΑΝΟΤΙΚΗ ΜΕΘΟΔΟΣ.

Η πιθανοτική μέθοδος αναπτύχθηκε για να καλύψει την ανάγκη μιας ορθολογικής προσέγγισης της επιβίωσης ενός πλοίου. Η δυνατότητα που μας παρέχει, είναι ο υπολογισμός της πιθανότητας επιβίωσης. Εφαρμόστηκε υποχρεωτικά σε επιβατηγά πλοία κατασκευής από 01/01/2009 και σε εμπορικά μήκους άνω των 80m.

Στην πιθανοτική μέθοδο, εστιάζουμε στον υπολογισμό των πιθανοτήτων να συμβούν τα εξής τρία βασικά ενδεχόμενα.

1. Στο πρώτο ενδεχόμενο θεωρούμε ότι το πλοίο έχει υποστεί ρήγμα.
2. Στο δεύτερο ενδεχόμενο θεωρούμε ότι το ρήγμα συνέβη σε κάποιο τμήμα του πλοίου, λαμβάνοντας υπόψη τις διαστάσεις του.
3. Στο τρίτο, θεωρούμε ότι το πλοίο επιβιώνει ύστερα από αυτό το ρήγμα.

Αξίζει να σημειώσουμε, ότι ο καθορισμός της βλάβης (ρήγμα), προέρχεται από στατιστική ανάλυση καταγεγραμμένων ατυχημάτων τα βασικότερα των οποίων προήλθαν από σύγκρουση, προσάραξη ή και έκρηξη.

Η πιθανότητα επιβίωσης, αποτελεί παράγοντα πολλών παραμέτρων. Την μεγαλύτερη επιρροή, φυσικά έχουν τα χαρακτηριστικά του πλοίου, δηλαδή οι κύριες διαστάσεις του, το βύθισμα του, η άθικτη ευστάθεια του, η υδατοστεγή υποδιαίρεση του, η διαχωρητότητα του και η διαπερατότητα των διαμερισμάτων του πλοίου.

Συνολικά, ο συντελεστής ασφαλείας του πλοίου, προκύπτει σύμφωνα με τους κανονισμούς από την σύγκριση του απαιτούμενου δείκτη υποδιαίρεσης (R) και του επιτευχθεί δείκτη υποδιαίρεσης (A).

4.6.1 ΑΠΑΙΤΟΥΜΕΝΟΣ ΔΕΙΚΤΗΣ ΥΠΟΔΙΑΙΡΕΣΗΣ R .

Η αλγεβρική προσέγγιση του απαιτούμενου δείκτη υποδιαίρεσης R , για επιβατηγά πλοία, εξαρτάται από το μήκος του πλοίου και τον αριθμό των επιβατών για τους οποίους έχει πιστοποιηθεί το πλοίο σύμφωνα με τον κανονισμό της SOLAS - Chapter II-1 Part B-1 - Stability - Regulation 6 - Required subdivision index R_1 . Στον παρακάτω τύπο γίνεται ο αλγεβρικός υπολογισμός του συντελεστή R .⁶

$$R = \frac{5000}{LS + 2,5N + 15225}$$

Όπου:

LS : το μήκος του πλοίου

N : τον αριθμό των επιβατών.

$$N = N_1 + 2 * N_2$$

N_1 : Ο αριθμός των επιβατών που αντιστοιχεί στο πλήθος των σωσίβιων λεμβών.

N_2 : Ο αριθμός των επιβατών και του πληρώματος του πλοίου.

Οι αποδεκτές τιμές του δείκτη R θέτονται από τον κανονισμό της SOLAS που αναφέραμε παραπάνω, όπως φαίνεται στον πίνακα:

Persons on board	R
$N < 400$	$R = 0.722$
$400 \leq N \leq 1,350$	$R = N / 7,580 + 0.66923$
$1,350 < N \leq 6,000$	$R = 0.0369 \times \ln(N + 89.048) + 0.579$
$N > 6,000$	$R = 1 - (852.5 + 0.03875 \times N) / (N + 5,000)$

Εικόνα 5: SOLAS/ Chapter II/ Pt B-1/ Reg. 7.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/915777/MSIS42_Damage_Stability_R05.20.pdf

4.6.2 ΕΠΙΤΕΥΧΘΗΣ ΔΕΙΚΤΗΣ ΥΠΟΔΙΑΙΡΕΣΗΣ A .

Ο επιτευχθείς δείκτης υποδιαίρεσης A υπολογίζεται αλγεβρικά από τον παρακάτω τύπο:

$$A = \sum_1^i p_i * s_i.$$

Όπου: i (ο αριθμός των διαμερισμάτων με βλάβη)

p : (πιθανότητα βλάβης)

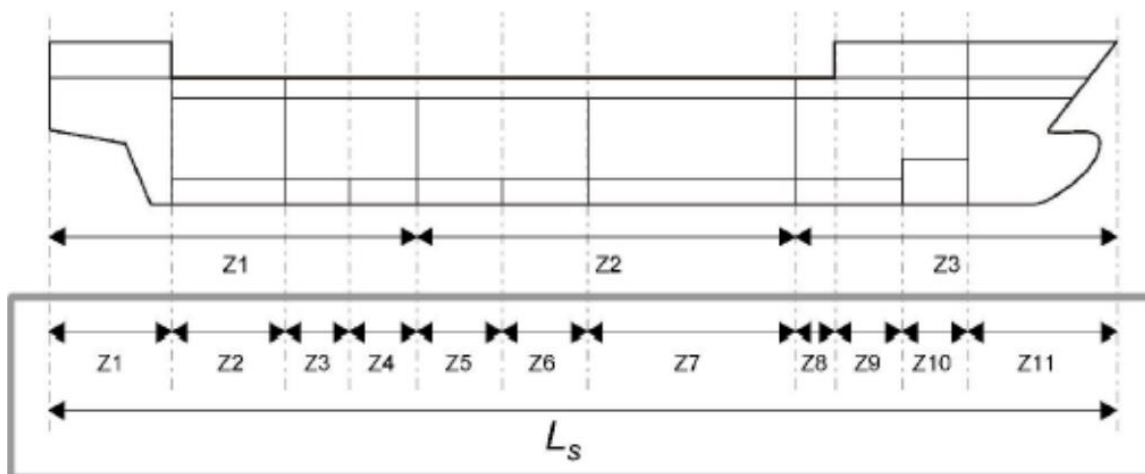
s : (πιθανότητα επιβίωσης)

⁶ <https://dergipark.org.tr/en/download/article-file/1044676>

Από την εξίσωση που γράψαμε, προκύπτει ότι ο δείκτης A αποτελεί το άθροισμα πολλαπλών περιπτώσεων βλάβης. Ο βασικότερος παράγοντας επιρροής του, είναι η γεωμετρική κατανομή της υδατοστεγούς διάταξης του πλοίου.

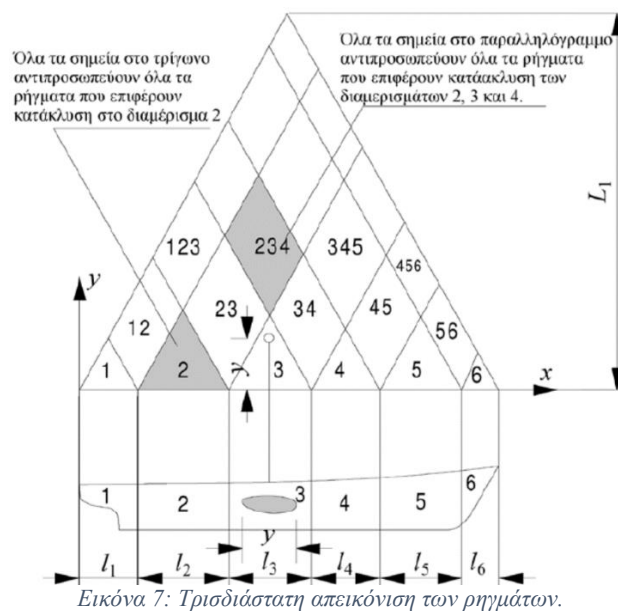
ΔΙΑΜΗΚΗΣ ΥΠΟΔΙΑΙΡΕΣΗ

Η διαμήκης υποδιαίρεση προκύπτει από το άθροισμα των επιμέρους τμημάτων. Ο καθορισμός των τμημάτων έγκειται στην εμπειρία του σχεδιαστή και στο μέγιστο μήκος της βλάβης $I_{max} = 60m$, το οποίο έχει τεθεί από τους κανονισμούς (*IMO 1991*). Γενικά, ο αριθμός των διαμερισμάτων πρέπει να είναι τέτοιος έτσι ώστε να μην γίνεται πολύπλοκος ο υπολογισμός, στην περίπτωση που έχουμε «πλεόνασμα» διαμερισμάτων. Δεν θα πρέπει ούτε να έχουμε «έλλειμμα» διαμερισμάτων, γιατί τότε θα έχουμε μεγαλύτερων διαστάσεων τμήματα, με αποτέλεσμα την μείωση της πιθανότητας επιβίωσης του πλοίου.



Εικόνα 6: Διαχωρισμός διαμερισμάτων κατάκλυσης. <https://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/A-1991-93.aspx>

Στο σχήμα που ακολουθεί, απεικονίζεται η διαμήκης θέση (x) και το εγκάρσιο μήκος (y) του ρήγματος συναρτήσει του μήκους του πλοίου.



<https://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/A-1991-93.aspx>

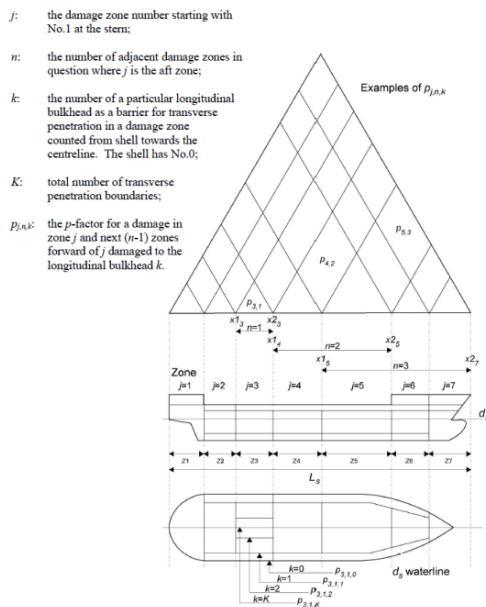
Τα τρίγωνα και τα παραλληλόγραμμα που απεικονίζονται αντιπροσωπεύουν τις αντίστοιχες πιθανότητες να κατακλυστεί ένα ή περισσότερα διαμερίσματα. Εκφράζονται με τον δείκτη p_i .

ΕΓΚΑΡΣΙΑ ΥΠΟΔΙΑΙΡΕΣΗ

Εκτός από την διαμήκη θέση και έκταση του ρήγματος, απαιτείται επίσης, η εξέταση του «βάθους» του ρήγματος. Σύμφωνα με τον κανονισμό *IMO Res. MSC 281*, το μέγιστο βάθος εισχώρησης είναι ίσο $(B/2)=1$.

Η πιθανότητα εισχώρησης σε ένα διαμέρισμα πλάτους b συμβολίζεται με r . Η πιθανότητα r έχει διορθωτικό χαρακτήρα σχετικά με την πιθανότητα κατάκλυσης. Συνοψίζοντας λοιπόν, η πιθανότητα να κατακλυστεί ένα πλευρικό διαμέρισμα είναι

$$p^*(1-r)$$



Εικόνα 8: Σενάρια και πιθανότητες πλευρικών ρηγμάτων

<https://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/A-1991-93.aspx>

4.6.3 ΥΠΟΛΟΓΙΣΜΟΣ ΠΙΘΑΝΟΤΗΤΑΣ ΕΠΙΒΙΩΣΗΣ.

Στη συνέχεια, εξετάζουμε την πιθανότητα επιβίωσης s του πλοίου, η οποία εξαρτάται από τον μοχλοβραχίονα επαναφοράς (GZ). Για δεδομένα το μετακεντρικό ύψος και το ύψος εξάλων,

με την χρήση της σχέσης: $GZ = \frac{GM * F}{B}$ υπολογίζουμε το GZ ,

Όπου με F συμβολίζονται οι ελεύθερες επιφάνειες.

Οι τιμές του s κυμαίνονται από 0 έως 1. Συγκεκριμένα, είναι ως εξής:

- για $S_i = 0$, η πιθανότητα επιβίωσης είναι μηδενική
- για $S_i = 1$, το πλοίο θα επιβιώσει 100%.

- για τιμές από 0 Si 1, απαιτείται περαιτέρω μελέτη για την πιθανότητα επιβίωσης.

Για τον υπολογισμό της χρησιμοποιούμε την σχέση: $S_i = \min (S_{in} \ \& \ S_{fin})$

Όπου:

- $S_{intermediate}$: η πιθανότητα επιβίωσης του πλοίου σε οποιοδήποτε στάδιο κατάκλυσης.

$$S_{in} = \sqrt[4]{\left[\frac{GZ_{max} * Range}{0,05 * 16} \right]}$$

Για γωνία κλίσης $\theta_{max} \geq 15^\circ$, τότε $S_{in} = 0$.

- S_{final} : η πιθανότητα επιβίωσης του πλοίου στην τελική θέση ισορροπίας του.

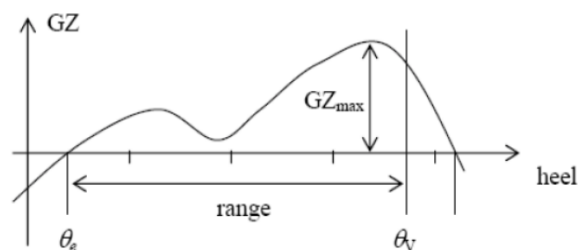
$$S_{fin} = K * \sqrt[4]{\left[\frac{GZ_{max} * Range}{0,12 * 16} \right]}$$

Όπου:

Για $\theta_e \leq 7^\circ$ τότε $K = 1$,

Για $7^\circ < \theta_e < 15^\circ$ τότε $K = \sqrt{\frac{15 - \theta_e}{8}}$

Για $15^\circ \leq \theta_e$ τότε $K = 0$



Εικόνα 9: Γραφική απεικόνιση GZ- θ

Ιδρυματικό αποθετήριο Πανεπιστημίου Δυτικής Αττικής

Αφού υπολογίσαμε την πιθανότητα κατάκλυσης των διαμερισμάτων και την πιθανότητα επιβίωσης, μπορούμε να υπολογίσουμε τον δείκτη A από το άθροισμα των

δεικτών A_s , A_p και A_l . Αυτοί οι δείκτες, αντιστοιχούν στα βυθίσματα d_s , d_p και d_l , για συγκεκριμένες καταστάσεις φόρτωσης.



Εικόνα 10: Καταστάσεις φόρτωσης σύμφωνα με τον IMO(2008)

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/915777/MSIS42_Damage_Stability_R05.20.pdf

Συνοψίζοντας, ο υπολογισμός του δείκτη A γίνεται με την χρήση της εξίσωσης:

$$A = 0.4 A_s + 0.4 A_p + 0.2 A_l$$

Όπου:

- A_s : Επιτευχθείς δείκτης σε βύθισμα d_s το οποίο αναφέρεται στην ίσαλο γραμμή φόρτωσης του πλοίου, κατά τους καλοκαιρινούς μήνες.
- A_l : Επιτευχθείς δείκτης σε βύθισμα d_l , το οποίο προκύπτει από το βάρος του έρματος, των των επιβατών και του πληρώματος.
- A_p : Επιτευχθείς δείκτης σε βύθισμα d_p . Το προκύπτει: $d_p = d_l + 60\% * (d_s - d_l)$
- A : Επίσης, ο δείκτης A , υπολογίζεται από το άθροισμα του γινομένου των επιμέρους πιθανοτήτων, των p (πιθανότητα βλάβης) και s (πιθανότητα επιβίωσης).

$$A = \sum_1^i p_i * s_i ,$$

i : ο αριθμός των διαμερισμάτων με βλάβη.

p : (πιθανότητα βλάβης)

s : (πιθανότητα επιβίωσης)

Εν κατακλείδι, ο υπολογισμός των δύο δεικτών αποσκοπεί στην σύγκρισή τους. Με την υπάρχουσα νομοθεσία, για να ικανοποιηθούν οι απαιτήσεις των κανονισμών για τα επιβατηγά πλοία, θα πρέπει: $A \geq R$

4.7 ΝΤΕΤΕΡΜΙΝΙΣΤΙΚΗ ΜΕΘΟΔΟΣ.

Στη ντετερμινιστική μέθοδο, έχουμε το ρήγμα το οποίο επηρεάζει την ευστάθεια, λόγω της εισροής νερού στο πλοίο. Για την υλοποίηση της συγκεκριμένης μεθόδου, δημιουργούμε καταστάσεις βλάβης, σε έναν αριθμό γειτονικών διαμερισμάτων. Όπως θα αναφέρουμε στο κεφάλαιο 2.7.2, η έκταση της βλάβης έχει συγκεκριμένα όρια, τα οποία δίνονται από κανονισμούς και εξαρτώνται από το μήκος και το πλάτος του πλοίου. Με το υδροστατικό πρόγραμμα *Max Surf Stability*, ελέγξαμε συγκεκριμένες

καταστάσεις βλάβης και διαπιστώσαμε πως η «συμπεριφορά» του πλοίου ικανοποιεί τα κριτήρια που έχουν τεθεί από τους αντίστοιχους κανονισμούς της SOLAS.

4.7.1. ΣΧΕΤΙΚΟΙ ΚΑΝΟΝΙΣΜΟΙ

Στις μέρες μας, το σύνολο των κανονισμών θέτονται από τη SOLAS90. Οι κανονισμοί που αφορούν το πλοίο που μελετάμε βρίσκονται στο Κεφάλαιο II –I, Παραρτήματα B.

Χρησιμοποιήθηκαν ντετερμινιστικές μέθοδοι, προκειμένου να εξακριβωθούν οι λόγοι που οδήγησαν στην βύθιση των πλοίων. Το αποτέλεσμα ήταν να έχουμε την εφαρμογή νέων κανονισμών.

Οι πρώτοι κανονισμοί, (SOLAS-1914, SOLAS-1929), είχαν επικεντρωθεί στον καθορισμό της ασφαλέστερης στεγανής υποδιαίρεσης του πλοίου. Τα όρια ενός πλοίου σε κατάσταση βλάβης, ήταν το μετακεντρικό ύψος, (*GM*), να παραμένει θετικό και η μέγιστη γωνία εγκάρσιας κλίσης να μην ξεπερνούσε τις 7⁰ ή τις 15⁰.

Αυτά τα κριτήρια αποτέλεσαν την βάση της νομοθεσίας, αλλά στην συνέχεια αποδείχτηκαν ελλιπή. Έτσι, οδηγηθήκαμε στην παρούσα σύμβαση, την SOLAS90. Αρχικά, στη νέα σύμβαση συμπεριλήφθηκαν οι καταστάσεις βλάβης του πλοίου, καθώς και η έννοια της διαχωρητότητας των διαμερισμάτων, δεξαμενών και λοιπών χώρων.

Ταυτόχρονα, αναλύθηκαν περαιτέρω τα ντετερμινιστικά κριτήρια σχετικά με τον μογλοβραχίονα επαναφοράς. Παρακάτω παραθέτουμε τα διαμορφωμένα κριτήρια όπως τελικά προέκυψαν:

- Σε περίπτωση κατάκλυσης, μέσω της μεθόδου χαμένης άντωσης, θα πρέπει να προκύπτει θετικό *GM*, σε απόσταση τουλάχιστον 0,05m. από την κατακόρυφη θέση του πλοίου.
- Σε περίπτωση ασύμμετρης κατάκλυσης ενός διαμερίσματος η τελική γωνία εγκάρσιας κλίσης δεν πρέπει να υπερβαίνει τις 7°. Αντίστοιχα, για δύο ή περισσότερα γειτονικά διαμερίσματα η τελική γωνία δεν πρέπει να υπερβαίνει τις 12°.
- Είναι απαγορευτικό, στην τελική θέση ισορροπίας του πλοίου, να βυθίζεται η γραμμή του ορίου βύθισης (*margin line*).
- Ως περιοχή θετικής ευστάθειας θεωρείται η περιοχή της καμπύλης μέχρι τις 15°.
- Το εμβαδόν που περικλείεται μεταξύ της καμπύλης *GZ* και της γωνία βύθισης, θα πρέπει να είναι μεγαλύτερο από 0,015 *mrad*.
- Η ελάχιστη τιμή του *GZ* θα πρέπει να είναι μεγαλύτερη από 0,1m. Στις περιπτώσεις που έχουμε επίδραση του ανέμου, μετακινήσεις επιβατών ή ρίψη σωσίβιων λέμβων, τότε θα πρέπει $GZ \geq 0,04 m$.

- Τέλος, το 1994 προστέθηκε ένας νέος κανονισμός που αφορά τα οχηματαγωγά πλοία που εκτελούν πλόες κυρίως στην Βόρεια Θάλασσα. Ο συγκεκριμένος κανονισμός, προβλέπει την κατάκλυση του καταστρώματος οχημάτων και την επίδραση του νερού, για στάθμη έως 50 cm.

4.7.2 ΣΤΕΓΑΝΗ ΥΠΟΔΙΑΙΡΕΣΗ

Σύμφωνα με τον κανονισμό της *SOLAS Chapter II-1, part B*, σημαντική προϋπόθεση για την μελέτη της ευστάθειας με την ντετερμινιστική μέθοδο, είναι ο καθορισμός του διαμερίσματος ή των διαμερισμάτων που θα κατακλυστούν.

Ο **συντελεστής υποδιαίρεσης F**, καθορίζει τον αριθμό των διαμερισμάτων που μπορούν να κατακλυστούν ταυτόχρονα. Σύμφωνα με τον κανονισμό 6 της *SOLAS*, για επιβατηγά πλοία, ανάλογα με τις τιμές που κυμαίνεται ο συντελεστής *F*, καθορίζονται τα εξής κριτήρια βλάβης.

- Για $0,50 < F \leq 1$, σε 1 διαμέρισμα.
- Για $0,33 < F \leq 0,5$, σε 2 διαμερίσματα.
- Για $0,00 < F \leq 0,33$, σε 3 διαμερίσματα.

Στην δική μας περίπτωση, ελέγξαμε τον συντελεστή, και προέκυψε, $F = 0,30$. Αυτό έχει ως αποτέλεσμα το πλοίο να αντέχει ταυτόχρονη κατάκλυση σε 3 διπλανά διαμερίσματα.

Το αποτέλεσμα προέκυψε έπειτα από την αλγεβρική επίλυση του τύπου της *SOLAS Chapter II-1, p 2.3*. για επιβατηγά πλοίο μήκους άνω των 71 μέτρων, επειδή το πλοίο μας είναι 124,2 μ.:

$$B = \frac{30,3}{L-42} + 0,18 \Leftrightarrow B = 0,548 \quad (1)$$

Ο συντελεστής υποδιαίρεσης συνδέεται αντιστρόφως ανάλογα με το μήκος του πλοίου, δηλαδή όσο αυξάνεται το μήκος, έχουμε μείωση του συντελεστή υποδιαίρεσης. Από το μήκος του πλοίου εξαρτάται αν θα έχουμε την συμβολή του κριτηρίου υπηρεσίας, *C_S*. Το κριτήριο υπηρεσίας εξαρτάται από τον όγκο εκτοπίσματος, το μήκος, τον όγκο του μηχανοστασίου, των δεξαμενών καυσίμου και τον αριθμό των επιβατών.

$$CS = 72 * \frac{M+2P}{V} * 0,18 \quad (2)$$

M: ο όγκος του μηχανοστασίου και των βοηθητικών χώρων του.

P=k*N=0,056L*1500 (N ο αριθμός των επιβατών)

V: ο όγκος κάτω από την *margin line*

Επίσης χρειάζεται να υπολογίσουμε τον συντελεστή $S = \frac{3,574 - 258L}{13} \quad (3)$

Με αντικατάσταση των τύπων (1),(2),(3) στον τύπο του F προκύπτει:

$$F = 1 - \frac{(1-B)*(CS-S)}{123-S} = 0.3$$

4.7.3 ΔΙΑΧΩΡΗΤΟΤΗΤΑ

Από τα προηγούμενα κεφάλαια, είναι προφανές ότι βασικό παράγοντα στην κατάκλυση, αποτελεί ο όγκος του νερού που θα εισέλθει. Είναι σαφές ότι η πραγματική ποσότητα ύδατος που μπορεί να κατακλύσει ένα διαμέρισμα, είναι μικρότερη από τον όγκο του διαμερίσματος. Αυτό, οφείλεται στο γεγονός ότι εντός των διαμερισμάτων συνήθως υπάρχουν διάφορα εξαρτήματα ή ενισχυτικά τα οποία έχουν συγκεκριμένο όγκο. Με τον όρο διαχωρητότητα (*permeability*), αναφερόμαστε στον όγκο του νερού που μπορεί να εισέλθει σε αυτόν.

Για την εκπόνηση της παρούσας εργασίας, οι τιμές της διαχωρητότητας των διαφόρων τμημάτων, είναι εκείνες που προβλέπει ο κανονισμός της *S.O.L.A.S./Chapter II -1/Regulation 7 – 3*.

Spaces	Permeability
Appropriated to stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Void spaces	0.95
Intended for liquids	0 or 0.95 ^{footnote}

Εικόνα 11: Permeability, *S.O.L.A.S./Chapter II -1/Regulation 7 – 3*

Spaces	Permeability at draught d_s	Permeability at draught d_p	Permeability at draught d_l
Dry cargo spaces	0.70	0.80	0.95
Container spaces	0.70	0.80	0.95
Ro-ro spaces	0.90	0.90	0.95
Cargo liquids	0.70	0.80	0.95

Εικόνα 12: Η διαχωρητότητα για επιμέρους χώρους, συναρτήσεως του βυθίσματος, *S.O.L.A.S./Chapter II -1/Regulation 7– 3*

4.7.4 ΚΑΝΟΝΙΣΜΟΣ 8 SOLAS 2020⁷.

Στην παρούσα εργασία χρησιμοποιήσαμε το κεφάλαιο 8.1 του συγκεκριμένου κανονισμού. Το κεφάλαιο εξετάζει την περίπτωση βλάβης του/των διαμερισμάτων σε μήκος $0,08 L$, πρύμνηθεν της προωραίας φρακτής. Απαιτήση του κανονισμού, είναι ο δείκτης επιβίωσης να ισούται με μονάδα και στις 3 καταστάσεις φόρτωσης που δημιουργήσαμε.

Επίσης, καλό θα ήταν να γίνει αναφορά και στα κεφάλαια 8.2 & 8.3, τα οποία αφορούν επιβατηγά πλοία με δυνατότητα μεταφοράς περισσότερους από 400 επιβάτες και εξετάζονται τα πλευρικά ρήγματα. Το βάθος εισχώρησης, πρέπει να είναι μικρότερο από $B/15$. Το μήκος του ρήγματος πρέπει να βρίσκεται μεταξύ $3m$ έως $0,03L$ και σε πλάτος $0,1B$. Αν η βλάβη βρίσκεται στην γραμμή φόρτωσης, τότε η εισχώρηση δεν θα πρέπει να υπερβαίνει τα $0,75 m$. Η πιθανότητα επιβίωσης, πρέπει να ισούται με την μονάδα και στις τρεις καταστάσεις φόρτωσης.

4.7.5 ΚΑΝΟΝΙΣΜΟΣ 9.9 SOLAS 2020⁸

Ο κανονισμός αυτός, πραγματεύεται τις κατασκευαστικές προδιαγραφές του διπυθμένου σε επιβατηγά πλοία. Συγκεκριμένα, το διπύθμενο πρέπει να τοποθετείται μεταξύ της προωραίας φρακτής σύγκρουσης μέχρι την πρυμναία φρακτή. Το ελάχιστο ύψος καθορίζεται από το $B/20$, χωρίς όμως να είναι μικρότερο των $0,076 m$ και να μην ξεπερνάει τα $2 m$. Όπως και στον προηγούμενο κανονισμό, η πιθανότητα επιβίωσης, πρέπει να ισούται με την μονάδα και στις τρεις καταστάσεις φόρτωσης.

2.7.6 ΚΑΝΟΝΙΣΜΟΣ IS CODE 2008.

Εκτός από τους κανονισμούς που αφορούν την ευστάθεια σε κατάσταση βλάβης, το πλοίο θα πρέπει να εναρμονίζεται και με κανονισμούς που αφορούν την άθικτη ευστάθειά του. Στα επιβατηγά πλοία, έχουμε τη δημιουργία ροπών για δύο λόγους. Ο πρώτος, είναι λόγω της μετακίνησης των επιβατών προς την μία πλευρά του πλοίου, όπου επηρεάζεται η εγκάρσια κλίση. Ο δεύτερος, είναι λόγω των καιρικών συνθηκών (λ.χ. πλευρικός άνεμος) που τείνουν να στρέψουν το πλοίο κατά το διάμηκες. Όλα αυτά, προβλέπονται από τον συγκεκριμένο κανονισμό ο οποίος είναι της *SOLAS* και ονομάζεται *Intact Stability Code*. Στην σημερινή του μορφή, θεσπίστηκε το 2008.

IS CODE 2008 CH. A2.2

7

[https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MSCResolutions/MSC.429\(98\)%20Rev.1.pdf](https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MSCResolutions/MSC.429(98)%20Rev.1.pdf)

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[https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MSCResolutions/MSC.429\(98\)%20Rev.1.pdf](https://wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MSCResolutions/MSC.429(98)%20Rev.1.pdf)

Στο κεφάλαιο του *IS Code 2008 Ch.A2.2* του *I.M.O.*, εξετάζονται τα όρια που έχουμε αναφέρει στην ενότητα 2.2, σχετικά με την καμπύλη *GZ*. Συγκεκριμένα, οι απαιτήσεις του κανονισμού είναι:

- Για $\theta < 30^\circ$ η περιοχή κάτω από την καμπύλη *GZ* θα πρέπει να είναι $\geq 0,055 \text{ mrad}$.
- Για $\theta < 40^\circ$ η περιοχή κάτω από την καμπύλη *GZ* θα πρέπει να είναι $\geq 0,09 \text{ mrad}$.
- Για $30^\circ < \theta < 40^\circ$ η περιοχή κάτω από την καμπύλη *GZ* θα πρέπει να είναι $\geq 0,03 \text{ mrad}$.
- Ελάχιστο *GZ* $\geq 0,2 \text{ m}$ για γωνία κλίσης $\theta \geq 30^\circ$.
- Η μέγιστη τιμή του *GZ* θα πρέπει να γίνεται για $\theta \geq 25^\circ$.
- Το αρχικό μετακεντρικό ύψος *GM*₀ δεν πρέπει να είναι μικρότερο από **0,15 m**.

Επιπλέον, επειδή πρόκειται για επιβατηγό πλοίο, ισχύουν τα παρακάτω:

- Η γωνία εγκάρσιας κλίσης θ την στιγμή που οι επιβάτες μετακινηθούν στην μία πλευρά του πλοίου, δεν πρέπει να ξεπερνά τις **10°**.
- Η γωνία εγκάρσιας κλίσης θ στην περίπτωση ελιγμών του πλοίου, δεν πρέπει να ξεπερνά τις 10° και πρέπει να υπολογίζεται όπως φαίνεται παρακάτω:⁹

$$M_R = 0.196 \frac{V_{20} \Delta}{L} (KG - d/2)$$

Όπου:

M_R: εγκάρσια ροπή [kNm]

V₀: η ταχύτητα του πλοίου [m/s]

L: μήκος ισάλου [m]

Δ : εκτόπισμα [tn]

d: μέσα βύθισμα [m]

KG: ύψος του κέντρου βάρους από την βασική γραμμή [m]

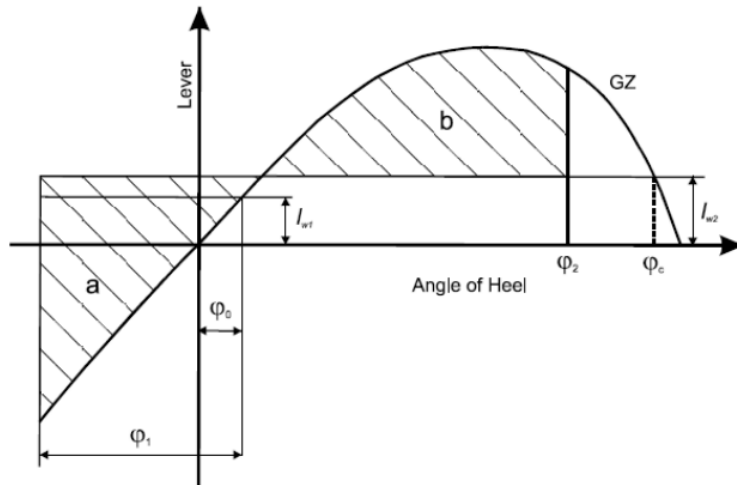
IS CODE 2008 CH. A2.3.1.1-2

Η ικανότητα ενός πλοίου να διατηρεί την ευστάθειά του, υπό την επίδραση του ανέμου καθώς και η μέγιστη κλίση που επιτρέπεται να πάρει το πλοίο, συμπεριλαμβάνονται στο παρόν κεφάλαιο.

Σε ένα πλοίο που ασκείται σταθερή πίεση, λόγω ανέμου, έχουμε μία τάση που ενεργεί κάθετα ως προς την *Center Line* του πλοίου, την οποία συμβολίζουμε με *Iw_L*. Λόγω της σταθερής πίεσης εμφανίζεται μία γωνία ισορροπίας (ϕ_0), η οποία δεν θα πρέπει να ξεπερνάει τις 16°. Ο ίδιος περιορισμός για την κλίση των 16° ισχύει και για την γωνία (ϕ_1), που αναφέρεται στην κλίση λόγω κυματισμού.

⁹ <https://www.imorules.com/GUID-E451298C-6D7E-4FBD-8E47-0B07FCC6F784.html>

Το σχήμα που ακολουθεί, μας βοηθάει να κατανοήσουμε τους περιορισμούς που θέτει ο κανονισμός και πως επηρεάζεται η ευστάθεια αν ξεπεραστούν τα όρια που θέτει.



Εικόνα 13: Διάγραμμα GZ συναρτήσει ανέμου και κυματισμού

(https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1151745/MSIS43_Intact_Stability_R05.23.pdf)

Τα όρια αφορούν την περιοχή **a** καθώς περικλείεται από τις γωνίες που προβλέπονται από τον κανονισμό. Όταν ξεπεραστούν τα όρια έχουμε την περιοχή **b**, όπου το πλοίο χάνει την ευστάθειά του και τείνει να ανατραπεί. **IS CODE 2008 CH. A3.1.**

Το κεφάλαιο **IS CODE 2008 CH. A3.1. της SOLAS**, θέτει το όριο των 10^0 κλίσης του πλοίου λόγω μετακίνησης των επιβατών ή λόγω ελιγμών του πλοίου.

Οι κανονισμοί που αναφέραμε, ήταν οι κανονισμοί που εξετάστηκαν στα πλαίσια της εργασίας προκειμένου να ελεγχθεί αν το πλοίο πληρεί τις απαιτήσεις ασφαλείας τόσο στην άθικτη κατάσταση όσο και στην κατάσταση βλάβης.

ΚΕΦΑΛΑΙΟ 5^ο: ΨΗΦΙΑΚΗ ΑΠΕΙΚΟΝΗΣΗ ΤΟΥ ΜΟΝΤΕΛΟΥ

5.1 ΑΝΑΠΑΡΑΣΤΑΣΗ ΓΕΩΜΕΤΡΙΑΣ

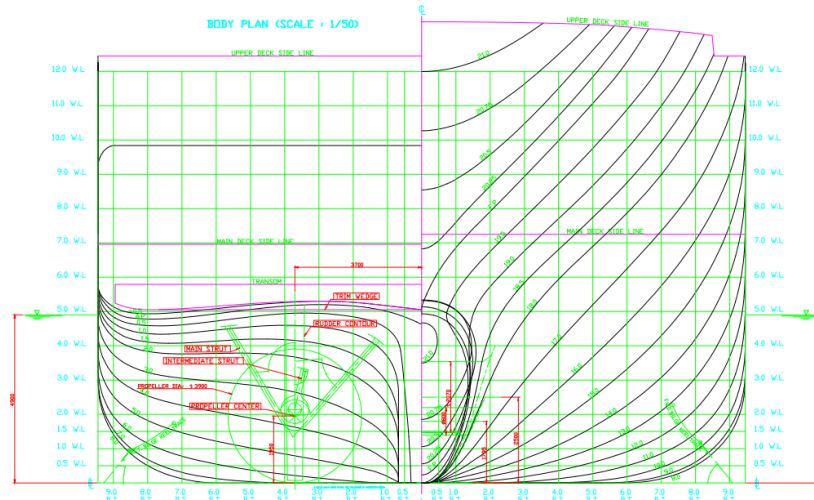
Τα σχέδια που μας δόθηκαν ήταν το σχέδιο γραμμών και το σχέδιο δεξαμενών. Ξεκινήσαμε σχεδιάζοντας την γάστρα σε τρισδιάστατη μορφή προκειμένου να την εισάγουμε στο κατάλληλο πρόγραμμα για τον έλεγχο ευστάθειας. Η τρισδιάστατη απεικόνιση έγινε μέσω του λογισμικού προγράμματος *Rhinoceros*.¹⁰

Στον πίνακα που ακολουθεί, καταγράψαμε τις κύριες διαστάσεις του οχηματαγωγού επιβατηγού (ROPAX) πλοίου.

ΚΥΡΙΕΣ ΔΙΑΣΤΑΣΕΙΣ	ΤΙΜΕΣ - ΜΟΝΑΔΕΣ
<i>Length O. A.</i>	124,2 m
<i>Length B. P.</i>	117 m
<i>Breadth</i>	18,9 m
<i>Depth M. Deck</i>	7.25 m
<i>Depth U. Deck</i>	12.45 m
<i>Draft Design</i>	4.9 m

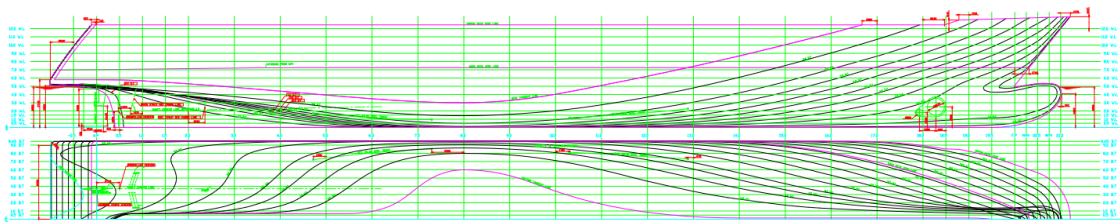
Πίνακας 1: ΚΥΡΙΕΣ ΔΙΑΣΤΑΣΕΙΣ ΠΛΟΙΟΥ

Παρακάτω βλέπουμε το σχέδιο γραμμών που μας δόθηκε:



Εικόνα 14: Body Plan

¹⁰ <https://www.rhino3d.com>

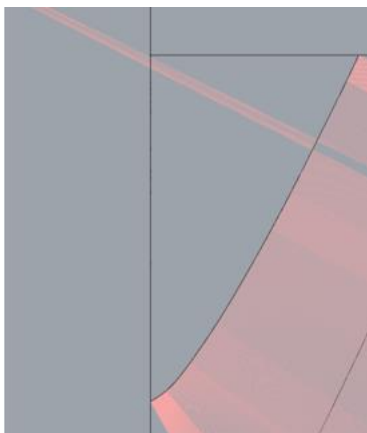


Εικόνα 15: Buttock & Water Lines Plan

Από το σχέδιο γραμμών και τις κύριες διαστάσεις που μας δόθηκαν διαμορφώσαμε την γάστρα του πλοίου μέχρι το κύριο κατάστρωμα. Αναπαραστήσαμε την γάστρα μέχρι το κύριο κατάστρωμα επειδή σε αυτή την φάση η υπερκατασκευή δεν χρησιμεύει στην μελέτη, καθώς δεν συνεισφέρει στην άντωση λόγω ανοιγμάτων. Η δυσκολία της διαμόρφωσης της γάστρας έγκειται στην συνεχή μεταβολή της καμπυλότητας των ναυπηγικών γραμμών. Μέσω της εντολής *Curvature Analysis*, του προγράμματος μπορέσαμε και ελέγξαμε αν η καμπυλότητα είναι καλή.

Η απόσταση μεταξύ των νομέων του πλοίου αναφέρεται στο σχέδιο γενικής διάταξης και δεν είναι ίσο σε όλο το μήκος του πλοίου. Η απόσταση των νομέων μεταξύ της πρώτης και της τελευταίας φρακτής είναι 800mm. Πλώρα και πρύμα είναι φυσικό να «πυκνώνουν» οι νομείς λόγω των ιδιαιτεροτήτων στην μορφή της γάστρας. Εκεί η απόσταση των νομέων είναι 600 mm. Αφού τοποθετήσαμε τους νομείς, ελέγξαμε την καμπυλότητα τους.

Η εξομάλυνση των νομέων με τα σημεία ελέγχου, έχει καθοριστικό ρόλο στην εισαγωγή των επιφανειών του πλοίου. Τυχών απότομες αλλαγές θα δημιουργήσουν ασυνέχειες στην γάστρα, με αποτέλεσμα να μην αντιπροσωπεύεται η πραγματικότητα, καθώς στην πραγματικότητα η γάστρα είναι “λεία”.



Εικόνα 16: Νομέας με απότομη μεταβολή της καμπυλότητας.

Η εισαγωγή των επιφανειών στο *Rhino* έγινε με την επιλογή *NetworkSrf*. Τα σημεία που χρήζουν ιδιαίτερης προσοχής είναι ο βολβός και η πρύμνη του πλοίου, λόγω της ιδιαιτερότητας στην μορφή τους.

Κατόπιν ελέγξαμε την επιφάνεια για τυχόν ανωμαλίες και ασυνέχειες της γάστρας με τις εντολές *Surface Curvature Analysis* και *Zebra Analysis*. Όπως απεικονίζεται στις παρακάτω εικόνες, εάν έχει γίνει σωστά η εξομάλυνση των καμπυλών, τότε δεν θα υπάρχουν μεγάλες μεταβολές στην ομοιομορφία των γραμμών της ψηφιακής απεικόνισης.



Εικόνα 17: Εισαγωγή επιφανειών και εξομάλυνση.



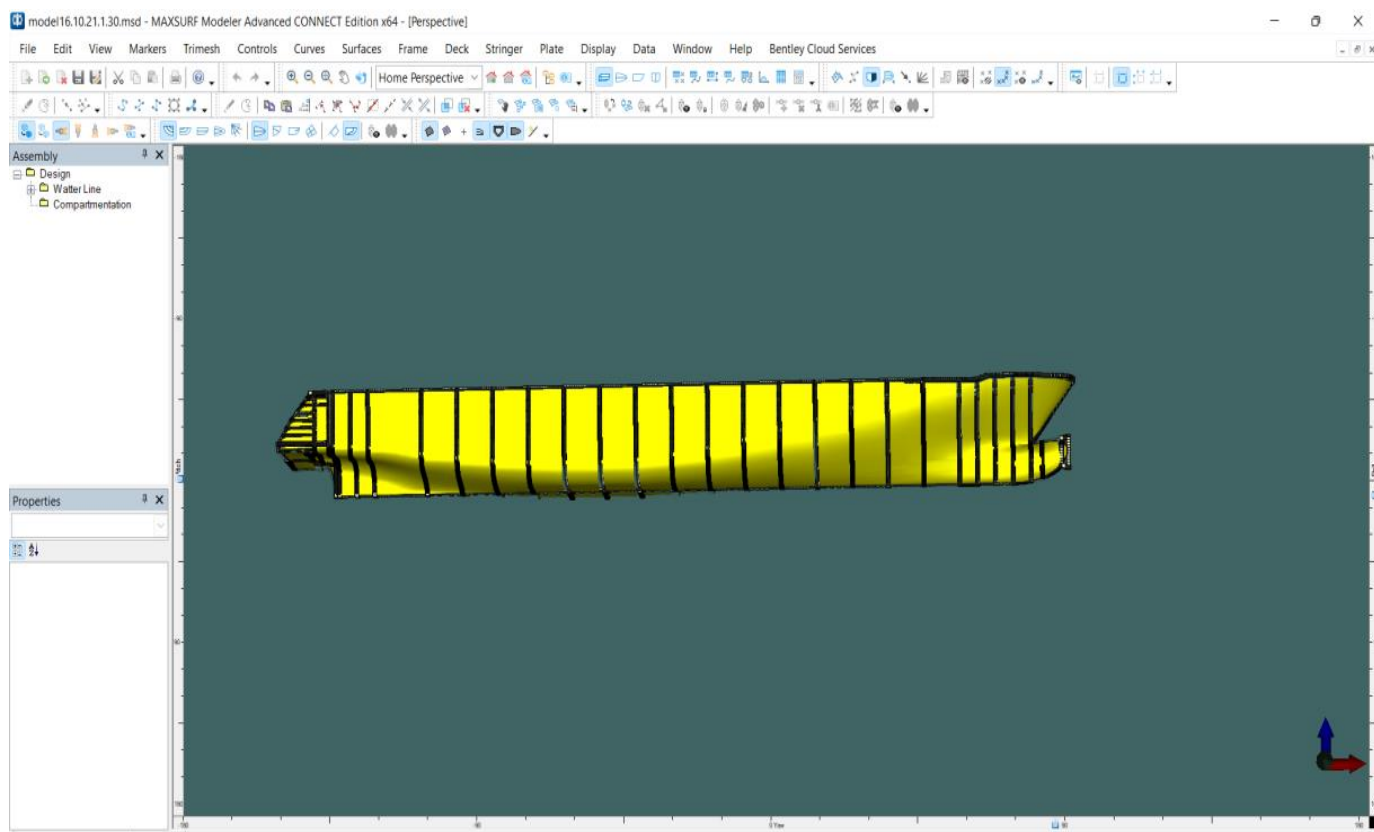
Εικόνα 18: Zebra Analysis στο βολβό

5.2 ΤΟ ΛΟΓΙΣΜΙΚΟ ΠΕΡΙΒΑΛΛΟΝ ΤΟΥ MAX SURF

5.2.1 «MAXSURF MODELER DESIGN»

Στην συνέχεια κάναμε εισαγωγή της γάστρας στο λογισμικό πρόγραμμα «**MAXSURF MODELER DESIGN**»¹¹. Το συγκεκριμένο πρόγραμμα αποτελεί ένα ευρέως λειτουργικό λογισμικό επειδή παρέχει υψηλές και ακριβείς επιδόσεις στην σχεδίαση.

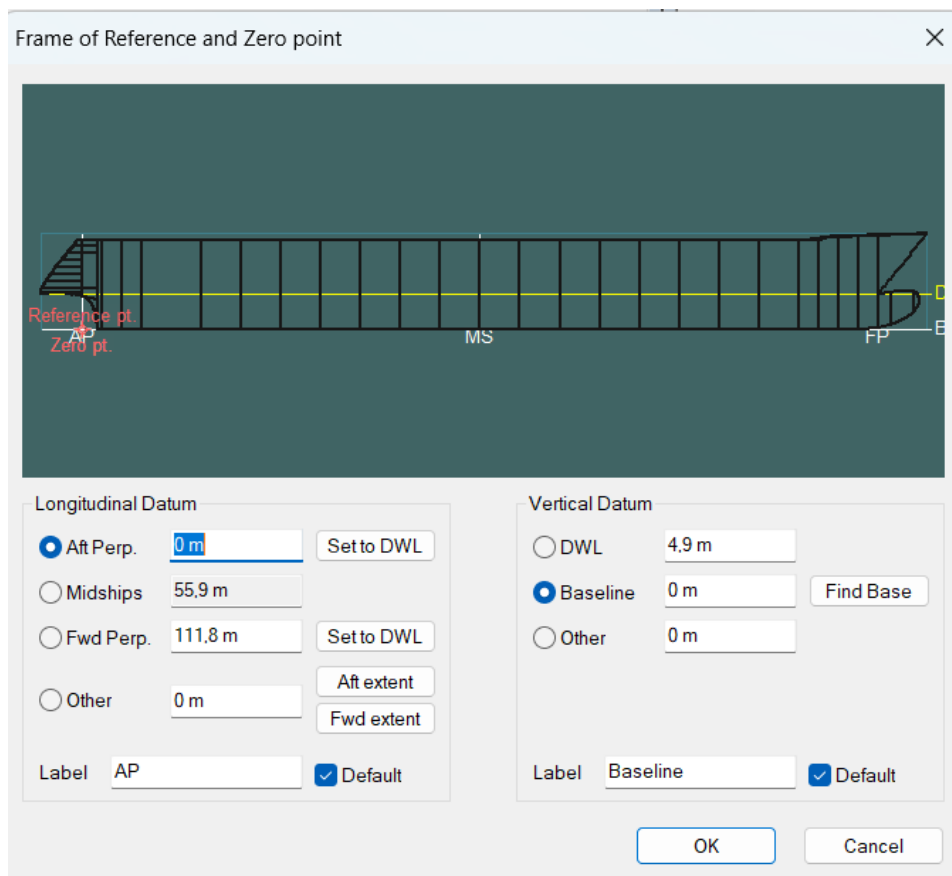
Αρχικά, ορίσαμε από το *Rhino*, την αρχή των αξόνων (0,0,0), ώστε να συμπίπτει με την πυρναία κάθετο (*aft perpendicular*). Σε αυτό το σημείο υπάρχει ο νομέας αναφοράς (*frame of reference*) όπου εισάγουμε το μήκος μεταξύ καθέτων και το βύθισμα σχεδίασης.



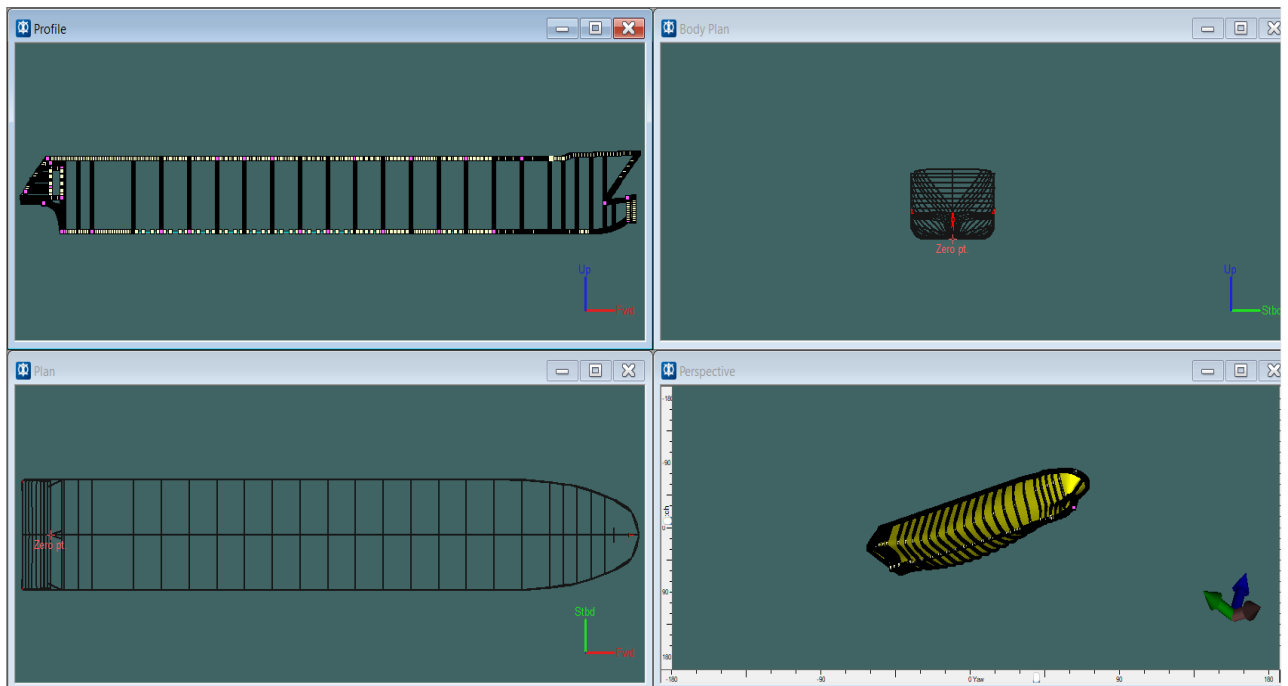
Εικόνα 19: Μοντέλο της γάστρας του πλοίου, στο λογισμικό MAXSURF Modeler.

¹¹ <https://maxsurf.net/modeler>

Με την εισαγωγή του σχεδίου, το πρόγραμμα μας εμφανίζει ένα «παράθυρο» με κάποιες βασικές επιλογές. Αρχικά επιλέξαμε τον αριθμό των τομών, αυτό δείχνει την ακρίβεια που θα έχει το μοντέλο μας. Εμείς θεωρήσαμε ότι τα 300 *sections* θα μας δώσουν επαρκή ακρίβεια. Στη συνέχεια με την επιλογή *Frame of Reference*, ορίσαμε την αρχή των αξόνων όπως αναφέραμε στην παραπάνω παράγραφο. Με την εισαγωγή της γάστρας, το πρόγραμμα μας δίνει την δυνατότητα εποπτείας του πλοίου από τέσσερις οπτικές, την πλάγια όψη, την πρόσοψη, την κάτοψη και μία τρισδιάστατη όψη την οποία μπορούμε να χειριστούμε.



Εικόνα 20: Τοποθέτηση του μοντέλου στο πρόγραμμα.



Εικόνα 21: Όψεις στο υπολογιστικό πρόγραμμα MAX SURF.

5.2.2. «MAXSURF STABILITY DESIGN»

Σύμφωνα με την προηγούμενη παράγραφο, η πειραματική διαδικασία της κατάκλυσης του πλοίου, χωρίζεται σε δύο μέρη. Το πρώτο είναι η αναπαράσταση της γάστρας του πλοίου στο λογισμικό *MAXSURF MODELER*. Στο δεύτερο μέρος, εισάγουμε στο λογισμικό πρόγραμμα *MAXSURF STABILITY*, το τρισδιάστατο μοντέλο της γάστρας και μέσω αυτού ξεκινάει η διαδικασία της ευστάθειας του πλοίου. Στο λογισμικό πρόγραμμα *MAXSURF STABILITY*, δημιουργούμε την εσωτερική διαμόρφωση του χώρου, (δεξαμενές και διαμερίσματα). Το πρόγραμμα είναι έτσι διαμορφωμένο ώστε να μπορεί να εκτελέσει «Ανάλυση κατάστασης ισορροπίας» και «Ανάλυση βαθμονόμησης των δεξαμενών». Οι αντίστοιχες επιλογές, όπως αναφέρονται στο πρόγραμμα είναι οι «*Equilibrium Condition Analysis*» και «*Tank Calibration Analysis*».

Αρχικά μέσω της ανάλυσης «*Equilibrium Condition Analysis*», υπολογίζεται η κατάσταση ισορροπίας του πλοίου στην εκάστοτε κατάσταση φόρτωσης. Με αυτόν τον τρόπο υπολογίζονται το βύθισμα, η εγκάρσια και διαμήκης κλίση του πλοίου.

Μέσω της δεύτερης ανάλυσης, «*Tank Calibration Analysis*», υπολογίζεται η διαμήκης και εγκάρσια κλίση και η στάθμη του ύδατος στο εσωτερικό των δεξαμενών σε κάθε ποσοστό πληρότητας.

Όπως έχουμε ήδη αναφέρει η μέθοδος που χρησιμοποιεί το συγκεκριμένο πρόγραμμα για τον υπολογισμό της ευστάθειας μετά από βλάβης είναι της «χαμένης άντωσης». Οι εσωτερικοί χώροι αναφέρονται ως «*tanks*» και «*compartments*». Για την έναρξη της διαδικασίας των υπολογισμών πρέπει να οριστούν τα δεδομένα, του όγκου των κατακλύσιμων μεγεθών, η διαχωρητότητά τους, το είδος του ρευστού και η γεωμετρία τους. Τα δεδομένα για τις διαστάσεις και τις συντεταγμένες τα λαμβάνουμε από το *Capacity Plan*. Αρχικά ορίσαμε τις δεξαμενές στην επιλογή με το όνομα «*Room Definition*». Εκεί, καταγράψαμε τις συντεταγμένες των ακμών της εκάστοτε δεξαμενής, το όνομα της και το είδος του υγρού που περιέχει ώστε το πρόγραμμα να επιλέξει το ειδικό βάρος του υγρού.

Στην εικόνα που ακολουθεί φαίνονται τις συντεταγμένες των σημείων προκειμένου να εισάγουμε τις δεξαμενές και τους χώρους του πλοίου. Κατά συνέπεια φαίνονται οι τιμές του όγκου των δεξαμενών. Οι τιμές αναφέρονται σε πληρότητα 100%. Σύμφωνα με τους κανονισμούς που αναφέραμε στην παράγραφο 2.7.3, η διαχωρητότητα των δεξαμενών (*permeability*) είναι στο 95%.

Το σχέδιο των δεξαμενών (*Capacity Plan*) φαίνεται στο παράρτημα.

model rev. with prob.msd - MAXSURF Stability Advanced CONNECT Edition x64 - [Input]

File Edit View Case Analysis Results Display Data Window Help Bentley Cloud Services

Home Profile

Large Angle Stability Departure 100% Intact Free to trim Stability results not available

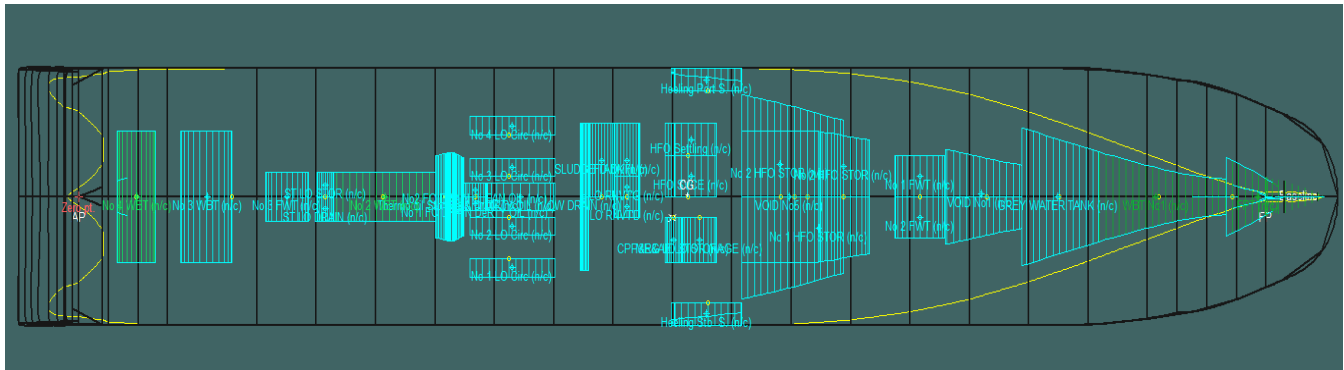
Properties	Name	Type	Intact Perm. %	Damaged Perm. %	Specific gravity	Fluid type	Boundary Surfaces	Aft m	Fore m	F.Port m	F.Stbd. m	F.Top m	F.Bott. m	A.Port m	A.Stbd. m	A.Top m	A.Bott. m	Formed	Calibrate
4	Heeling Port	Tank	95	95	1,025	none		55,800	62,400	-9,450	-7,800	7,250	2,050	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
5	Heeling Stb	Tank	95	95	1,025	none		55,800	62,400	7,800	9,450	7,250	2,050	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
6	HFO Settling	Tank	95	95	0,98	none		55,200	60,000	-5,400	-3,000	6,450	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
7	HFO SVCE	Tank	95	95	0,98	none		55,200	60,000	-3,000	0,000	6,450	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
8	CPR&RG LO STOR	Tank	95	95	0,9	none		55,200	56,800	1,500	4,800	4,400	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
9	ME&AE LO STORAGE	Tank	95	95	0,9	none		56,800	60,000	-1,500	4,800	4,400	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
10	LO RNVTD	Tank	95	95	0,9	none		50,400	52,800	-1,500	0,000	3,000	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
11	LO RNVTD	Tank	95	95	0,9	none		50,400	52,800	0,000	1,500	3,000	1,200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
12	FO OVFL	Tank	95	95	0,98	none		50,400	52,800	-5,400	0,000	1,200	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
13	SLUDGE TANK	Tank	95	95	1	none		48,000	50,400	-5,400	0,000	1,200	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
14	CW DRAIN	Tank	95	95	1	none		47,200	48,000	-5,400	5,400	1,200	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
15	DIRTY OIL	Tank	95	95	1	none		38,400	44,800	-1,006	1,006	1,300	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
16	No 1 FO DRAIN DIRTY OIL	Tank	95	95	1	none		36,232	38,400	0,000	1,006	1,300	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
17	No2 FO DRAIN CLEAN OIL	Tank	95	95	1	none		36,232	38,400	-1,006	0,000	1,300	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
18	No 1 LO Circ	Tank	95	95	0,9	none		36,800	44,800	4,553	5,893	1,300	0,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
19	No 2 LO Circ	Tank	95	95	0,9	none		36,800	44,800	1,503	2,843	1,300	0,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
20	No 3 LO Circ	Tank	95	95	0,9	none		36,800	44,800	-2,843	-1,503	1,300	0,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
21	No 4 LO Circ	Tank	95	95	0,9	none		36,800	44,800	-5,893	-4,533	1,300	0,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
22	Thermo oil Storage & Dr Tk	Tank	95	95	0,75	none		34,680	35,391	-3,221	3,221	1,300	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
23	Thermo oil Storage & Dr Tk	Linked Tank	95	95	0,75	none		35,391	36,232	-2,850	2,850	1,300	0,000	-3,221	3,221	Prismatic	Prismatic	Yes	No
24	Thermo oil Storage & Dr Tk	Linked Tank	95	95	0,75	none		33,600	34,680	-3,221	3,221	1,300	0,000	-3,000	3,000	Prismatic	Prismatic	Yes	No
25	No 2 WBT	Tank	95	95	1,025	Sea Water		24,000	33,600	-1,800	1,800	3,600	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
26	STLO STOR	Tank	95	95	0,9	none		22,400	24,000	-1,800	0,000	3,600	1,900	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
27	STLO DRAIN	Tank	95	95	0,9	none		22,400	24,000	0,000	1,800	3,600	1,900	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
28	No 4 WBT	Tank	95	95	1,025	Sea Water		3,600	7,200	-4,800	4,800	7,096	3,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
29	No 3 WBT	Tank	95	95	1,025	Sea Water		9,600	14,400	-4,800	4,800	7,178	2,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
30	No 3 FW/T	Tank	95	95	1	none		17,600	21,600	-1,800	1,800	7,250	3,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
31	MGO SERVICE	Tank	100	100	0,85	none		55,200	60,000	3,000	5,400	6,450	4,400	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
32	No 1 HFO STOR SB	Tank	95	95	0,98	none		69,635	74,400	0,000	4,200	6,100	3,600	Prismatic	4,800	Prismatic	Prismatic	Yes	Yes
33	No 1 HFO STOR SB	Linked Tank	95	95	0,98	none		62,400	69,635	0,000	4,800	6,100	3,600	Prismatic	4,800	Prismatic	Prismatic	Yes	No
34	No 2 HFO STOR PS	Tank	95	95	0,98	none		69,635	74,400	-4,200	0,000	6,100	3,600	4,800	Prismatic	Prismatic	Prismatic	Yes	Yes
35	No 2 HFO STOR PS	Linked Tank	95	95	0,98	none		62,400	69,635	-4,800	0,000	6,100	3,600	Prismatic	4,800	Prismatic	Prismatic	Yes	No
36	No 1 FW/T	Tank	95	95	1	none		76,800	81,600	-3,000	0,000	7,250	3,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
37	No 2 FW/T	Tank	95	95	1	none		76,800	81,600	3,000	0,000	7,250	3,600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
38	Blge Dirty	Tank	95	95	1	none		52,800	55,200	-5,400	-3,600	1,200	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
39	Blge Clean	Tank	95	95	1	none		52,800	55,200	-3,600	-1,500	1,200	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
40	STEERING GEAR ROOM	Compartment	95	95	1	none		-1,200	7,200	-12,000	12,000	7,250	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No
41	SI OCE	Compartment	95	95	1	none		3,200	7,200	-12,000	12,000	7,250	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No
42	SI OCE	Compartment	95	95	1	none		44,400	49,600	-19,000	7,500	0,000	0,000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No

Room Definition | Sounding Pipes | Cross-Flood Definition | Key Points | Margin Line Points | Modulus | Bu

Ready C:\Users\aspil\OneDrive\Υπολογιστής\Deterministic\model rev. with prob\model rev. with prob.msd NUM 219 stations; Skin-N; Medium; Cor.VCG

Εικόνα 24: Room Definition

Στην συνέχεια διαμορφώσαμε το τρισδιάστατο μοντέλο *Max Surf*. Στις εικόνες που ακολουθούν βλέπουμε την διαμόρφωση του μοντέλου, έπειτα από την εισαγωγή των δεξαμενών και των διαμερισμάτων:



Εικόνα 25: Κάτοψη στο *MAXSURF STABILITY*, των δεξαμενών.

TANKS	VOLUME [m3] +2%			
	CAPACITY PLA	MAX SUR	DIFFERENC	URL - 5
Water Ballast No.1	115,3	116,337	0,9%	+ 2%
Water Ballast No.2	107,335	108,6	1,2%	+ 2%
Water Ballast No.3	184,7	185,338	0,3%	+ 2%
Water Ballast No.4	102,83	104,678	1,8%	+ 2%
FPT (WBT)	84,3	85,393	1,3%	+ 2%
GREY WATER TANK	119,9	119,826	0,1%	+ 2%
VOID No1	28,9	28,615	1,0%	+ 2%
VOID No5	101,9	102,46	0,5%	+ 2%
HEELING PORT S.	49,04	49,337	0,6%	+ 2%
HEELING STB S.	49,04	49,337	0,6%	+ 2%
HFO SETTling	55,06	55,195	0,2%	+ 2%
HFO SVCE	68,17	68,994	1,2%	+ 2%
CPP & RG LO STOR	16,26	16,051	1,3%	+ 2%
ME + AE LO STORAGE	32,12	32,102	0,1%	+ 2%
LO RNV'T' G	6,25	6,156	1,5%	+ 2%
LO RNV'T' D	6,25	6,156	1,5%	+ 2%
FO OVFL	14,89	14,745	1,0%	+ 2%
SLUDGE TANK	15,273	15,23	0,3%	+ 2%
CW DRAIN	10,006	9,849	1,6%	+ 2%
DIRTY OIL	16,1	16,35	1,6%	+ 2%
No1 FO DRAIN D. OIL	2,68	2,694	0,5%	+ 2%
No2 FO DRAIN C. OIL	2,68	2,694	0,5%	+ 2%
No1 LO CIRC	7,02	7,129	1,6%	+ 2%
No2 LO CIRC	7,02	7,129	1,6%	+ 2%
No3 LO CIRC	7,02	7,129	1,6%	+ 2%
No4 LO CIRC	7,02	7,129	1,6%	+ 2%
THERM. OIL. STORAGE + DR. TK	20,48	20,26	1,1%	+ 2%
ST LO STOR	4,7	4,651	1,0%	+ 2%
ST LO DRAIN	4,7	4,651	1,0%	+ 2%
MGO SERVICE	22,61	22,687	0,3%	+ 2%
No1 HFO, STOR STB	134,6	133,405	0,9%	+ 2%
No1 HFO, STOR PS	134,6	133,405	0,9%	+ 2%
No1 FWT	50,51	49,932	1,1%	+ 2%
No2 FWT	50,51	49,932	1,1%	+ 2%
No3 FWT	50,27	49,932	0,7%	+ 2%
BILGE DIRTY	4,79	4,842	1,1%	+ 2%
BILGE CLEAN	5,73	5,745	0,3%	+ 2%

Εικόνα 29: ΔΙΑΦΟΡΑ ΟΓΚΩΝ ΜΕΤΑΞΥ MAXSURF STABILITY,- C.P.

	LCG [m] +1%			
TANKS	CAPACITY PLAN	MAX SUR	DIFFERENC	URL
Water Ballast No.1	101,3	101,38	0,1%	+ 1%
Water Ballast No.2	28,39	28,823	1,5%	+ 1%
Water Ballast No.3	12	12,067	0,6%	+ 1%
Water Ballast No.4	5,46	5,439	0,4%	+ 1%
FPT (WBT)	111,84	111,015	0,7%	+ 1%
GREY WATER TANK	92,15	92,149	0,0%	+ 1%
VOID No1	84,86	84,965	0,1%	+ 1%
VOID No5	66,84	66,841	0,0%	+ 1%
HEELING PORT S.	58,74	59,113	0,6%	+ 1%
HEELING STB S.	58,74	59,113	0,6%	+ 1%
HFO SETTling	57,5	57,67	0,3%	+ 1%
HFO SVCE	57,5	57,67	0,3%	+ 1%
CPP & RG LO STOR	56	56	0,0%	+ 1%
ME + AE LO STORAGE	58,4	58,4	0,0%	+ 1%
LO RNVT' G	51,6	51,6	0,0%	+ 1%
LO RNVT' D	51,6	51,6	0,0%	+ 1%
FO OVFL	51,6	51,599	0,0%	+ 1%
SLUDGE TANK	49,2	49,2	0,0%	+ 1%
CW DRAIN	47,6	47,6	0,0%	+ 1%
DIRTY OIL	41,6	41,6	0,0%	+ 1%
No1 FO DRAIN D. OIL	37,32	37,316	0,0%	+ 1%
No2 FO DRAIN C. OIL	37,32	37,316	0,0%	+ 1%
No1 LO CIRC	40,79	40,8	0,0%	+ 1%
No2 LO CIRC	40,79	40,8	0,0%	+ 1%
No3 LO CIRC	40,79	40,8	0,0%	+ 1%
No4 LO CIRC	40,79	40,8	0,0%	+ 1%
THERM. OIL. STORAGE + DR. TK	34,92	34,91	0,0%	+ 1%
ST LO STOR	23,2	23,2	0,0%	+ 1%
ST LO DRAIN	23,2	23,2	0,0%	+ 1%
MGO SERVICE	57,6	57,67	0,1%	+ 1%
No1 HFO, STOR STB	68,29	68,288	0,0%	+ 1%
No1 HFO, STOR PS	68,29	68,288	0,0%	+ 1%
No1 FWT	79,2	79,2	0,0%	+ 1%
No2 FWT	79,2	79,2	0,0%	+ 1%
No3 FWT	19,6	19,6	0,0%	+ 1%
BILGE DIRTY	53,998	53,998	0,0%	+ 1%
BILGE CLEAN	54	54	0,0%	+ 1%

Εικόνα 30: ΔΙΑΦΟΡΑ LCG MAXSURF STABILITY, -C.P.

VCG [m] +1%				
Στήλη1	Στήλη2	Στήλη3	Στήλη4	Στήλη5
TANKS	CAPACITY PLAN	MAX SURF	DIFFERENCE	URL - 5
Water Ballast No.1	2,16	2,149	0,5%	+ 1%
Water Ballast No.2	1,8	1,813	0,7%	+ 1%
Water Ballast No.3	5,017	5,056	0,8%	+ 1%
Water Ballast No.4	5,5	5,489	0,2%	+ 1%
FPT (WBT)	3,69	3,716	0,7%	+ 1%
GREY WATER TANK	2,24	2,245	0,2%	+ 1%
VOID No1	0,74	0,746	0,8%	+ 1%
VOID No5	0,7	0,703	0,4%	+ 1%
HEELING PORT S.	4,7	4,777	1,6%	+ 1%
HEELING STB S.	4,7	4,777	1,6%	+ 1%
HFO SETTling	3,87	3,825	1,2%	+ 1%
HFO SVCE	3,8	3,825	0,7%	+ 1%
CPP & RG LO STOR	2,8	2,8	0,0%	+ 1%
ME + AE LO STORAGE	2,8	2,8	0,0%	+ 1%
LO RNVT' G	2,1	2,1	0,0%	+ 1%
LO RNVT' D	2,1	2,1	0,0%	+ 1%
FO OVFL	0,6	0,601	0,2%	+ 1%
SLUDGE TANK	0,59	0,6	1,7%	+ 1%
CW DRAIN	0,6	0,6	0,0%	+ 1%
DIRTY OIL	0,64	0,65	1,6%	+ 1%
No1 FO DRAIN D. OIL	0,64	0,65	1,6%	+ 1%
No2 FO DRAIN C. OIL	0,64	0,65	1,6%	+ 1%
No1 LO CIRC	0,96	0,95	1,0%	+ 1%
No2 LO CIRC	0,96	0,95	1,0%	+ 1%
No3 LO CIRC	0,96	0,95	1,0%	+ 1%
No4 LO CIRC	0,96	0,95	1,0%	+ 1%
THERM. OIL. STORAGE + DR. TK	0,66	0,65	1,5%	+ 1%
ST LO STOR	2,75	2,75	0,0%	+ 1%
ST LO DRAIN	2,75	2,75	0,0%	+ 1%
MGO SERVICE	5,43	5,425	0,1%	+ 1%
No1 HFO, STOR STB	4,85	4,85	0,0%	+ 1%
No1 HFO, STOR PS	4,85	4,85	0,0%	+ 1%
No1 FWT	5,43	5,425	0,1%	+ 1%
No2 FWT	5,43	5,425	0,1%	+ 1%
No3 FWT	5,42	5,425	0,1%	+ 1%
BILGE DIRTY	0,61	0,61	0,0%	+ 1%
BILGE CLEAN	0,6	0,61	1,7%	+ 1%

Εικόνα 31: ΔΙΑΦΟΡΑ VCG ΜΕΤΑΞΥ MAXSURF STABILITY, -C.P.

Στήλη1	TCG [m] + 0.5% of B (B=18,9m)	Στήλη2	Στήλη3	Στήλη
TANKS	CAPACITY PLAN	MAX SURF	DIFFERENCE	URL - 5
Water Ballast No.1	0,1	0	1,000	+ 0,047
Water Ballast No.2	-0,02	0	1,000	+ 0,047
Water Ballast No.3	0,1	0	1,000	+ 0,047
Water Ballast No.4	0,1	0	1,000	+ 0,047
FPT (WBT)	0,1	0	1,000	+ 0,047
GREY WATER TANK	0,1	0	1,000	+ 0,047
VOID No1	0,03	0	1,000	+ 0,047
VOID No5	0,01	0	1,000	+ 0,047
HEELING PORT S.	-7,73	-8,585	0,111	+ 0,047
HEELING STB S.	7,73	8,585	0,111	+ 0,047
HFO SETTling	-4,07	-4,2	0,032	+ 0,047
HFO SVCE	-1,49	-1,5	0,007	+ 0,047
CPP & RG LO STOR	3,15	3,15	0,000	+ 0,047
ME + AE LO STORAGE	3,15	3,15	0,000	+ 0,047
LO RNVT' G	-0,75	-0,75	0,000	+ 0,047
LO RNVT' D	0,75	0,75	0,000	+ 0,047
FO OVFL	-2,69	-2,696	0,002	+ 0,047
SLUDGE TANK	-2,7	-2,7	0,000	+ 0,047
CW DRAIN	0,1	0	1,000	+ 0,047
DIRTY OIL	0,1	0	1,000	+ 0,047
No1 FO DRAIN D. OIL	0,5	0,503	0,006	+ 0,047
No2 FO DRAIN C. OIL	-0,5	-0,503	0,006	+ 0,047
No1 LO CIRC	5,23	5,223	0,001	+ 0,047
No2 LO CIRC	2,18	2,173	0,003	+ 0,047
No3 LO CIRC	-2,18	-2,173	0,003	+ 0,047
No4 LO CIRC	-5,23	-5,213	0,003	+ 0,047
THERM. OIL. STORAGE + DR. TK	0,1	0,1	0,000	+ 0,047
ST LO STOR	-0,9	-0,9	0,000	+ 0,047
ST LO DRAIN	0,9	0,9	0,000	+ 0,047
MGO SERVICE	3,45	4,2	0,217	+ 0,047
No1 HFO, STOR STB	2,34	2,344	0,002	+ 0,047
No1 HFO, STOR PS	-2,34	-2,344	0,002	+ 0,047
No1 FWT	1,5	-1,5	2,000	+ 0,047
No2 FWT	-1,5	1,5	2,000	+ 0,047
No3 FWT	0,1	0	1,000	+ 0,047
BILGE DIRTY	-4,49	-4,493	0,001	+ 0,047
BILGE CLEAN	-2,55	-2,55	0,000	+ 0,047

Εικόνα 32: ΔΙΑΦΟΡΑ ΜΕΤΑΞΥ ΤΟΥ TCG, MAXSURF STABILITY, - C.P.

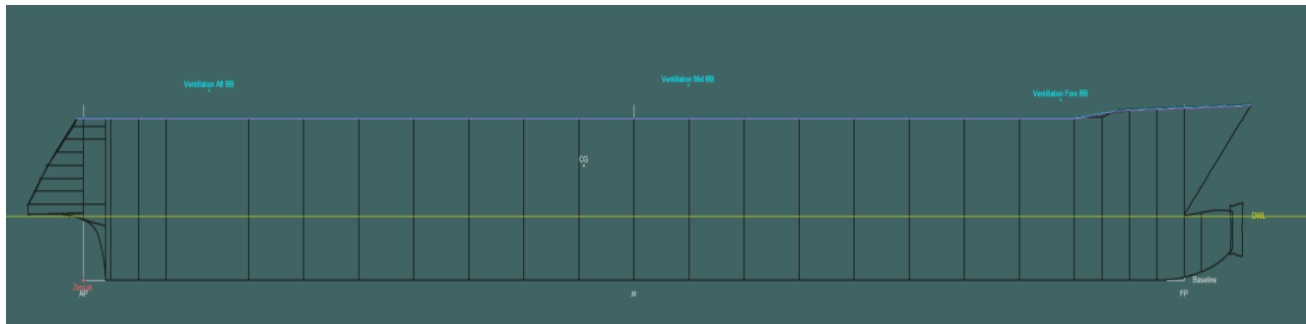
□ **DOWN FLOODING POINTS**

Τα «*Downflooding points*» ή «*Key points*», είναι τα ανοίγματα του πλοίου, κυρίως εξαερισμοί, τα οποία μπορούν να αποτελέσουν σημεία εισροής υδάτων, σε περίπτωση μεγάλης κλίσης του πλοίου. Θεωρούμε ότι είναι απροστάτευτα επειδή δεν είναι υδατοστεγή ή καιροστεγή. Για τον λόγο αυτό, πρέπει να τα συμπεριλάβουμε στην μελέτη.

Κατά τον έλεγχο, τόσο της άθικτης όσο και της κατάσταση βλάβης, μας ενδιαφέρει η γωνία κλίσης και οι αντίστοιχες τιμές του μοχλοβραχίονα επαναφοράς GZ, έως ότου να έχουμε βύθιση των ανοιγμάτων.

	Name	Long. Pos. m	Offset m	Height m	Type	Linked to	Flood from	Intact (use for intact case)	Damage (use for damage cases)	Flow into Tank when immersed
1	Ventilation Fore PS	99,200	-9,375	13,800	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Ventilation Fore SB	99,200	9,375	13,800	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Ventilation Mid PS	61,414	-9,444	14,904	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Ventilation Mid SB	61,414	9,444	14,904	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Ventilation Aft PS	12,777	-9,450	14,541	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Ventilation Aft SB	12,777	9,450	14,541	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Εικόνα 33: Καθορισμός των KEY POINTS, στο ROOM DEFINITION.



Εικόνα 34: Τα KEY POINTS είναι τα VENTILLATIONS που φαίνονται στο σχέδιο.

ΚΕΦΑΛΑΙΟ 6^ο: ΕΛΕΓΧΟΣ ΕΥΣΤΑΘΕΙΑΣ

6.1 ΜΕΛΕΤΗ ΑΘΙΚΤΗΣ ΕΥΣΤΑΘΕΙΑΣ ΜΕ ΤΗΝ ΝΤΕΤΕΡΜΙΝΙΣΤΙΚΗ ΜΕΘΟΔΟ.

Σύμφωνα με την ντετερμινιστική μέθοδο, δημιουργήσαμε τρεις καταστάσεις φόρτωσης. Με αυτόν τον τρόπο ελέγξαμε την **άθικτη ευστάθεια** για κάθε κατάσταση φόρτωσης και εάν τα αποτελέσματα που προκύπτουν συμμορφώθηκαν με τους κανονισμούς.

1. 1^ο Load Case, Πληρότητα στο 100%

Η πρώτη κατάσταση φόρτωσης αφορά την μέγιστη πληρότητα των δεξαμεμών του πλοίου κατά την αναχώρηση του. Σε αυτή την κατάσταση, το εκτόπισμα του πλοίου έχει αυξηθεί, καθώς έχουμε συμπεριλάβει το βάρος των επιβατών, του πληρώματος, των αποσκευών και τις προμήθειες.

Στους πίνακες που ακολουθούν φαίνεται η πληρότητα των δεξαμεμών στην συγκεκριμένη κατάσταση φόρτωσης:

Loadcase - Departure 100%

Damage Case - Intact

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Fluid analysis method: Use corrected VCG

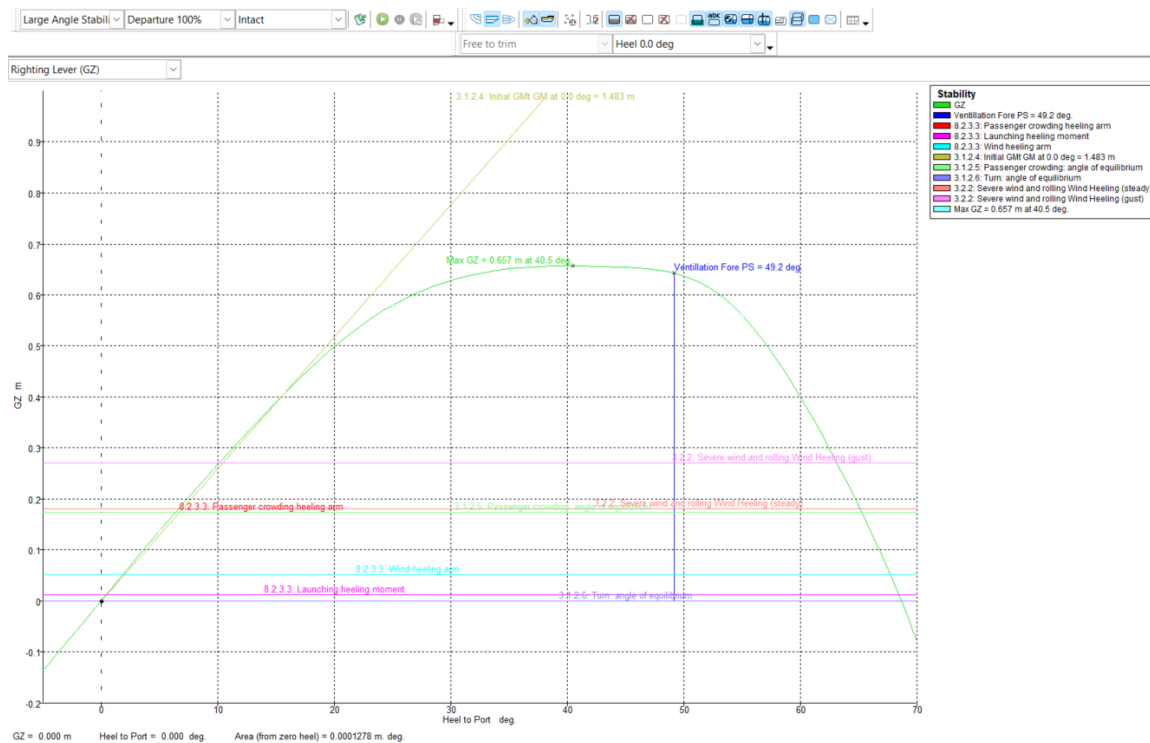
Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.288	2.344	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.288	-2.344	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.670	-4.200	3.329	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.670	-1.500	3.329	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.670	4.200	5.231	4.578	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.985	-0.546	4.435	152.436	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	101.329	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	58.865	-8.294	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.017	8.473	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	29.129	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.688	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.000	3.150	2.320	4.312	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.400	3.150	2.480	8.625	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	2.173	0.880	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	-2.173	0.880	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.800	-5.213	0.880	1.509	Maximum

Πίνακας 2: Load Case 1, 100%, Departure.

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.910	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.108	1.381	1.638	61.351	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.247	0.000	0.335	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.200	-2.696	0.030	31.493	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	41.600	0.000	0.032	4.344	Maximum
No 1 FO DRAIN DéRTY OIL	5%	2.694	0.135	2.694	0.135	37.316	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.316	-0.503	0.033	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.600	0.000	0.030	83.981	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.953	-4.354	0.047	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.000	-2.548	0.030	1.852	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.603	-0.428	0.238	479.328	
Total Loadcase			6012.404	1583.013	926.838	50.792	0.000	8.622	1069.145	
FS correction								0.178		
VCG fluid								8.799		

Πίνακας 3: Load Case 1, 100% Departure

Στην εικόνα που ακολουθεί παρατηρούμε πως έχει διαμορφωθεί η καμπύλη του μοχλοβραχίονα επαναφοράς.



Εικόνα 35: Καμπύλη GZ σε κατάσταση αναχώρησης.

Στους επόμενους πίνακες γίνεται λεπτομερής αναφορά για την διαμόρφωση του μογλοβραχίονα επαναφοράς συναρτήσει των κύριων γεωμετρικών χαρακτηριστικών και των *Key Points* από την *Margin Line*.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-0.631	-0.496	-0.268	0.000	0.268	0.497	0.632	0.650	0.641	0.407	-0.078	-0.728	-1.437	-2.124	-2.733	-3.214	-3.517	-3.607	-3.417	-2.746	-1.383	-0.000	
Area under GZ curve from zero heel m.deg	10.9279	5.2341	1.3479	0.0007	1.3583	5.2383	10.9907	17.4398	23.9859	29.4542	31.2750	27.3367	16.5256	-1.3234	-25.6968	-55.5587	-89.3769	-125.1948	-160.5941	-191.9882	-212.9535	-219.7819	
Displacement t	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012
Draft at FP m	4.460	4.639	4.645	4.600	4.645	4.639	4.461	3.979	3.060	1.676	-0.827	-9.045	n/a	-24.345	-15.965	-13.157	-11.764	-10.979	-10.554	-10.391	-10.463	-10.513	
Draft at AP m	3.653	4.194	4.519	4.668	4.519	4.194	3.652	2.735	1.198	-1.288	-6.171	-19.839	n/a	-32.761	-19.174	-14.475	-12.034	-10.551	-9.632	-9.169	-9.079	-9.049	
WL Length m	123.320	123.329	123.380	117.803	123.380	123.329	123.320	123.313	123.333	123.357	121.353	122.819	123.508	123.910	124.143	124.216	124.026	123.474	122.678	122.311	121.119	120.003	
Beam max extents on WL m	18.704	19.416	19.187	18.900	19.187	19.416	18.704	17.545	16.254	14.627	13.764	12.643	12.451	12.643	13.212	13.895	14.536	15.057	16.253	19.655	19.192	18.904	
Wetted Area m ²	2334.924	2337.008	2334.416	2318.163	2334.093	2336.231	2334.286	2331.535	2351.367	2334.565	2325.975	2289.376	2293.981	2310.446	2331.369	2359.338	2403.136	2466.313	2570.584	2797.261	2942.843	2945.975	
Waterpl. Area m ²	1707.754	1718.791	1727.622	1717.179	1727.635	1718.802	1707.735	1726.134	1716.790	1548.863	1408.286	1275.623	1229.719	1224.615	1255.113	1316.612	1407.378	1530.274	1709.325	2016.500	2149.500	2123.269	
Prismatic coeff. (Cp)	0.633	0.603	0.579	0.596	0.579	0.603	0.633	0.656	0.666	0.672	0.692	0.696	0.709	0.726	0.750	0.780	0.818	0.841	0.815	0.774	0.762	0.762	
Block coeff. (Cb)	0.364	0.382	0.443	0.565	0.443	0.382	0.364	0.373	0.404	0.462	0.526	0.611	0.608	0.533	0.476	0.439	0.424	0.419	0.410	0.386	0.508	0.760	
LCB from zero pt. (+ve fwd) m	50.828	50.814	50.798	50.787	50.797	50.813	50.831	50.841	50.865	50.875	50.906	50.899	50.890	50.872	50.850	50.826	50.804	50.786	50.768	50.756	50.759	50.761	
LCF from zero pt. (+ve fwd) m	51.267	49.835	48.752	48.749	48.751	49.834	51.268	52.796	53.438	55.635	56.055	54.129	53.658	53.264	52.869	52.463	52.047	51.704	51.483	51.347	52.853	52.847	
Max deck inclination deg	30.0019	20.0011	10.0002	0.0349	10.0002	20.0011	30.0019	40.0025	50.0028	60.0029	70.0028	80.0014	90.0000	99.9991	109.9990	119.9994	129.9999	139.9997	149.9975	159.9917	169.9759	179.2503	
Trim angle (+ve by stern) deg	-0.4137	-0.2279	-0.0647	0.0349	-0.0643	-0.2276	-0.4144	-0.6377	-0.9541	-1.5187	-2.7367	-5.5149	n/a	-4.3049	-1.6444	-0.6758	-0.1382	0.2195	0.4728	0.6265	0.7095	0.7497	

Πίνακας 4: Κύριες διαστάσεις και συντελεστές.

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion pos = 93.583 m)		43.2	n/a	7.707	5.990	4.103	2.238	0.507	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion pos = 93.583 m)		43.5	n/a	7.783	6.064	4.172	2.301	0.560	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore PS	Downflooding point	49.2	0	9.192	7.402	5.449	3.479	1.605	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore SB	Downflooding point	159.3	0	9.192	10.658	11.862	12.854	13.656	14.219	14.347	14.016	13.409	12.483	11.227	9.673	7.871	5.892	3.828	1.786	-	-	-
Ventilation Mid PS	Downflooding point	55.1	0	10.273	8.519	6.604	4.638	2.728	0.918	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Mid SB	Downflooding point	152.8	0	10.273	11.799	13.064	14.081	14.869	15.386	15.459	15.076	14.302	13.136	11.598	9.732	7.602	5.294	2.916	0.595	-	-	-
Ventilation Aft PS	Downflooding point	57.3	0	9.881	8.214	6.443	4.625	2.861	1.201	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Aft SB	Downflooding point	152.5	0	9.881	11.496	12.907	14.075	15.009	15.678	15.927	15.753	15.060	13.894	12.302	10.339	8.076	5.608	3.055	0.565	-	-	-

Πίνακας 5: Key Points

Το λογισμικό πρόγραμμα *Max Surf*, μας δίνει την δυνατότητα να εξετάζει αν τα αποτελέσματα εγκρίνονται ή απορρίπτονται από τους κανονισμούς.(*IS Code, 2008*)

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.486	Pass	+1115.00
	8.2.3.3: Launching heeling moment	0.040	m	0.648	Pass	+1520.00
	8.2.3.3: Wind heeling arm	0.040	m	0.607	Pass	+1417.50
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.03	Pass	+99.97
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 30	3.1513	m.deg	10.9907	Pass	+248.77
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 40	5.1566	m.deg	17.4398	Pass	+238.20
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 30 to 40	1.7189	m.deg	6.4491	Pass	+275.19
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.2: Max GZ at 30 or greater	0.200	m	0.659	Pass	+229.50
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.3: Angle of maximum GZ	25.0	deg	45.5	Pass	+81.82
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.4: Initial GMT	0.150	m	1.483	Pass	+888.67
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.5: Passenger crowding: angle of equilibrium	10.0	deg	6.4	Pass	+36.14
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.6: Turn: angle of equilibrium	10.0	deg	0.0	Pass	+100.14
A.749(18) Ch3 - Design criteria applicable to all ships	3.2.2: Severe wind and rolling				Pass	
	Angle of steady heel shall not be greater than (\leq)	16.0	deg	6.6	Pass	+58.44
	Angle of steady heel / Deck edge immersion angle shall not be greater than (\leq)	80.00	%	15.27	Pass	+80.91
	Area1 / Area2 shall not be less than (\geq)	100.00	%	106.56	Pass	+6.56

Πίνακας 6: Έλεγχος κριτηρίων ασφαλείας.

2. 2^o Load Case, Πληρότητα στο 50%

Στην δεύτερη κατάσταση φόρτωσης θεωρούμε ότι η αρχική πληρότητα συγκεκριμένων δεξαμεμών και προμηθειών έχει μειωθεί κατά 50% από τις αρχικές ποσότητες. Στον πίνακα που ακολουθεί έχουμε καταγράψει τις νέες τιμές, όπως έχουν διαμορφωθεί:

Loadcase - Half Load 50%

Damage Case - Intact

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Fluid analysis method: Use corrected VCG

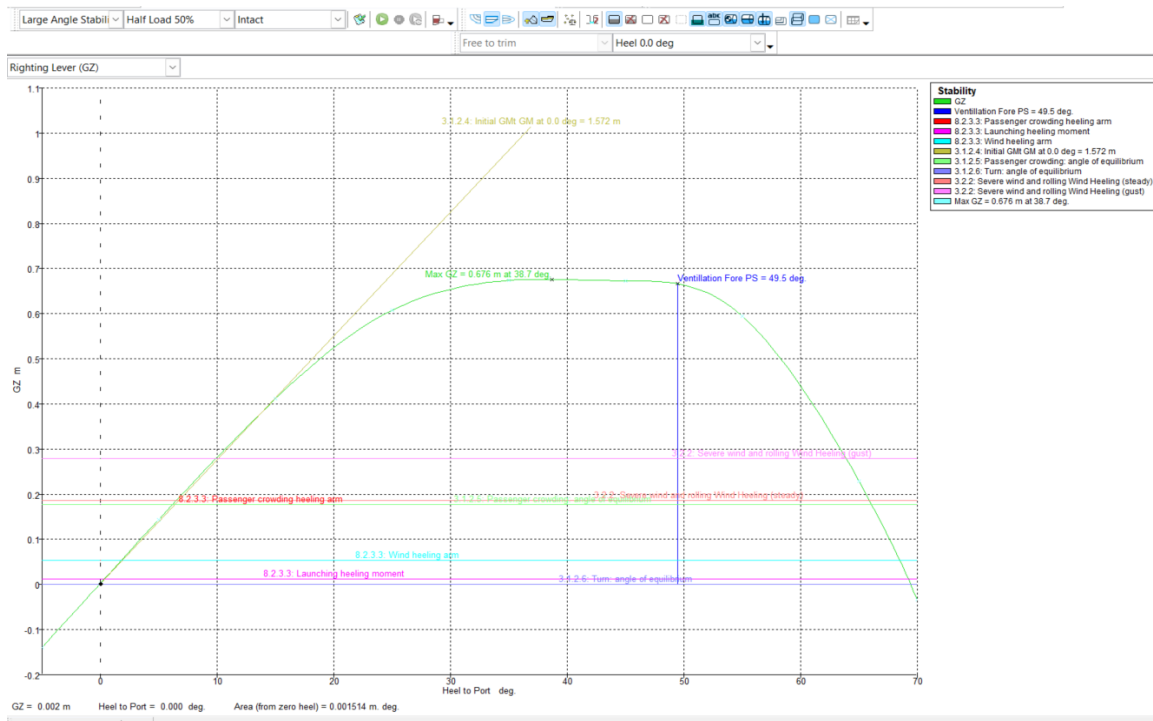
Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.581	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.282	2.344	4.225	101.406	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.282	-2.344	4.225	101.406	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.666	-4.200	1.731	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.666	-1.500	3.326	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.666	4.200	5.230	4.578	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.164	-0.303	3.925	253.842	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	76.898	-1.253	3.600	0.000	Maximum

Πίνακας 7: Load Case 2, 50%, Half Load.

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.199	1.500	4.513	10.800	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.466	0.500	5.121	10.800	
.WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.502	0.000	1.521	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	58.937	-8.375	2.348	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	55.833	8.598	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.766	27.830	-0.091	4.473	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.000	3.150	1.840	4.312	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.400	3.150	2.000	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNVD	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.794	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.794	2.173	0.880	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	36.989	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.200	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.910	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.966	118.649	60.441	44.967	1.935	1.429	58.398	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.168	0.000	1.276	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.199	-2.699	0.240	31.493	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.596	0.000	0.260	4.344	Maximum
No 1 FO DRAIN DERTY OIL	40%	2.694	1.077	2.694	1.077	37.316	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.316	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.600	0.000	0.120	83.981	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.991	-4.476	0.197	1.166	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	53.999	-2.550	0.180	1.852	Maximum
TOTAL MISC	38.28%	176.325	67.501	176.325	67.501	78.793	-0.398	0.972	479.328	
Total Loadcase			5871.556	1583.013	786.314	50.894	0.002	8.615	899.654	
FS correction								0.153		
VCG fluid								8.768		

Πίνακας 8: Load Case 2, 50%, Half Load.

Στην εικόνα που ακολουθεί παρατηρούμε πως έχει διαμορφωθεί η καμπύλη του μοχλοβραχίονα επαναφοράς:



Εικόνα 36: Καμπύλη GZ σε κατάσταση 50% πληρότητας.

Στους επόμενους πίνακες γίνεται λεπτομερής αναφορά για την διαμόρφωση του μοχλοβραχίονα επαναφοράς συναρτήσει των κύριων γεωμετρικών χαρακτηριστικών και των *Key Points* από την *Margin Line*.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
Wetted Area m ²	2307.660	2311.302	2307.594	2294.023	2307.297	2311.067	2307.374	2303.425	2322.500	2302.214	2294.106	2260.108	2265.428	2281.382	2302.391	2331.435	2374.429	2435.969	2539.741	2764.764	2925.897	2928.714
Waterpl. Area m ²	1693.092	1706.510	1715.841	1708.316	1715.907	1706.519	1693.111	1710.752	1716.246	1542.689	1401.212	1271.342	1226.117	1221.089	1250.862	1310.824	1398.941	1517.499	1691.954	1994.222	2149.946	2123.525
Prismatic coeff. (Cp)	0.631	0.601	0.576	0.595	0.576	0.601	0.631	0.653	0.663	0.669	0.689	0.694	0.707	0.725	0.749	0.781	0.819	0.844	0.818	0.777	0.764	0.764
Block coeff. (Cb)	0.362	0.379	0.439	0.564	0.439	0.379	0.362	0.372	0.399	0.456	0.527	0.608	0.602	0.527	0.471	0.435	0.422	0.420	0.412	0.387	0.505	0.761
LCB from zero pt. (+ve fwd) m	50.937	50.919	50.907	50.890	50.901	50.918	50.936	50.948	50.971	50.984	51.010	51.008	50.999	50.981	50.958	50.933	50.909	50.890	50.872	50.859	50.862	50.863
LCF from zero pt. (+ve fwd) m	51.328	49.918	48.899	48.834	48.896	49.917	51.327	52.841	53.446	55.734	55.865	54.022	53.568	53.180	52.791	52.395	51.992	51.683	51.502	51.453	52.929	52.928
Max deck inclination deg	30.0022	20.0013	10.0003	0.0210	10.0003	20.0013	30.0022	40.0028	50.0031	60.0033	70.0031	80.0016	90.0000	99.9990	109.9988	119.9993	129.9999	139.9998	149.9977	159.9922	169.9974	179.2726
Trim angle (+ve by stern) deg	-0.4454	-0.2487	-0.0798	0.0210	-0.0783	-0.2485	-0.4450	-0.6797	-1.0048	-1.6136	-2.8908	-5.8004	n/a	-4.5687	-1.7676	-0.7502	-0.1876	0.1850	0.4476	0.6076	0.6871	0.7274

Πίνακας 9: Κύριες διαστάσεις και συντελεστές.

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion position = 93.583 m)		43.6	n/a	7.799	6.059	4.168	2.300	0.564	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion position = 93.583 m)		43.9	n/a	7.875	6.133	4.237	2.362	0.618	0.963	2.512	3.993	5.210	6.191	6.938	7.435	7.660	7.593	7.417	7.067	6.233	4.879	3.325
Ventilation	Downflooding point	49.5	0	9.259	7.470	5.513	3.538	1.659	0.089	1.837	3.543	4.985	6.192	7.161	7.870	8.292	8.399	8.156	7.526	6.485	5.021	3.405

Πίνακας 10: Key Points

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Fore PS																						
Ventilation Fore SB	Downflooding point	159.6	0	9.259	10.726	11.926	12.913	13.710	14.273	14.399	14.074	13.477	12.556	11.303	9.749	7.946	5.964	3.896	1.849	0.073	1.766	3.405
Ventilation Mid PS	Downflooding point	55.5	0	10.350	8.596	6.681	4.714	2.803	0.994	0.813	2.577	4.195	5.644	6.896	7.913	8.656	9.082	9.139	8.772	7.923	6.567	4.989
Ventilation Mid SB	Downflooding point	153.1	0	10.350	11.876	13.141	14.157	14.944	15.462	15.543	15.169	14.403	13.241	11.703	9.835	7.701	5.387	3.002	0.672	1.463	3.287	4.989
Ventilation Aft PS	Downflooding point	58.1	0	9.970	8.303	6.536	4.723	2.963	1.304	0.315	1.867	3.406	4.857	6.164	7.281	8.162	8.751	8.985	8.790	8.068	6.785	5.244
Ventilation Aft SB	Downflooding point	152.9	0	9.970	11.585	13.000	14.173	15.111	15.781	16.052	15.890	15.204	14.040	12.447	10.478	8.206	5.727	3.163	0.660	1.604	3.503	5.244

Πίνακας 11: Key Points

Κάναμε πάλι έλεγχο των αποτελεσμάτων προκειμένου να βεβαιώσουμε ότι συμμορφώνονται με τους κανονισμούς. Στον πίνακα 12 βλέπουμε τα αποτελέσματα:

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.503	Pass	+1157.50
	8.2.3.3: Launching heeling moment	0.040	m	0.669	Pass	+1572.50
	8.2.3.3: Wind heeling arm	0.040	m	0.627	Pass	+1467.50
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.15	Pass	+99.85
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 30	3.1513	m.deg	11.5408	Pass	+266.22
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 40	5.1566	m.deg	18.2236	Pass	+253.40
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 30 to 40	1.7189	m.deg	6.6828	Pass	+288.78
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.2: Max GZ at 30 or greater	0.200	m	0.681	Pass	+240.50
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.3: Angle of maximum GZ	25.0	deg	46.4	Pass	+85.46
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.4: Initial GMT	0.150	m	1.572	Pass	+948.00
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.5: Passenger crowding: angle of equilibrium	10.0	deg	6.2	Pass	+38.04
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.6: Turn: angle of equilibrium	10.0	deg	-0.1	Pass	+100.76
A.749(18) Ch3 - Design criteria applicable to all ships	3.2.2: Severe wind and rolling				Pass	
	Angle of steady heel shall not be greater than (<=)	16.0	deg	6.5	Pass	+59.52
	Angle of steady heel / Deck edge immersion angle shall not be greater than (<=)	80.00	%	14.75	Pass	+81.56
	Area1 / Area2 shall not be less than (>=)	100.00	%	108.86	Pass	+8.86

Πίνακας 12: Έλεγχος κριτηρίων ασφαλείας

3. 3^o Load Case, πληρότητα στην κατάσταση άφιξης 10%.

Η πληρότητα στην κατάσταση άφιξης 10% αντιστοιχεί θεωρητικά στην επιστροφή του караβιού, γι' αυτό και αναφερόμαστε σε αυτήν ως «Arrival». Συνήθως σε αυτά τα ποσοστά πληρότητας είναι οι δεξαμενές καυσίμου και φρέσκου νερού. Αντίθετα οι δεξαμενές έρματος και λυμάτων έχουν την μέγιστη πληρότητα. Στον πίνακα που ακολουθεί έχουμε καταγράψει τις αντίστοιχες πληρότητες ανά δεξαμενή:

Loadcase - Arrival 10%

Damage Case - Intact

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Fluid analysis method: Use corrected VCG

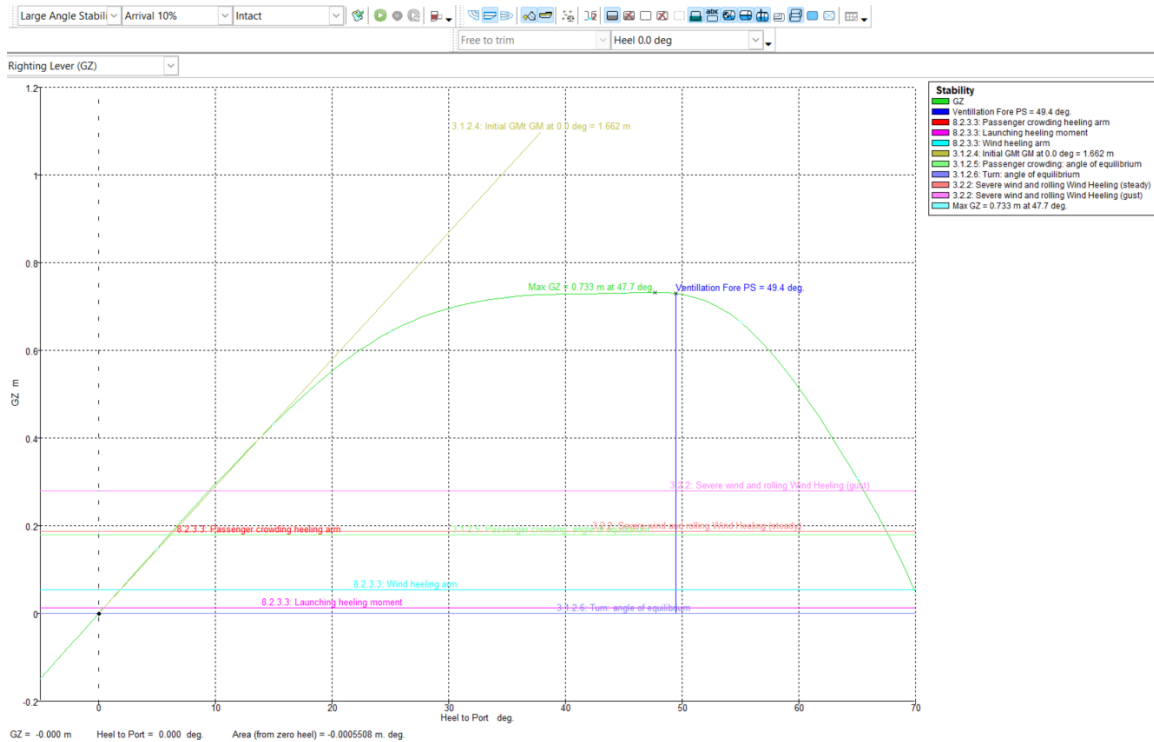
Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.583	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	68.271	2.344	3.725	101.406	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	62.592	-1.600	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.666	-4.200	1.997	5.279	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.665	-1.500	1.731	10.310	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.665	4.200	4.919	4.578	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.488	56.362	60.164	-0.369	2.855	152.436	
.FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.599	0.000	3.783	15.552	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.198	-1.500	3.783	10.800	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.198	1.500	3.783	10.800	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.332	0.000	3.783	37.152	
.WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.881	-8.280	2.050	0.000	Maximum
Heeling Stb	15%	50.570	7.586	49.337	7.401	58.979	8.424	2.576	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.089	34.681	0.117	3.753	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.000	3.150	1.360	4.312	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.399	3.150	1.360	8.625	Maximum

Πίνακας 13: Load Case 3, 10%, «Arrival Load»

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	40.772	-5.213	0.635	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.200	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.909	0.000	0.065	39.958	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	48.909	0.914	1.243	57.020	
MISC										
GREY WATER TANK	80%	119.826	95.861	119.826	95.861	92.151	0.000	1.961	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.200	-2.700	0.420	31.493	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.599	0.000	0.455	4.344	Maximum
No 1 FO DRAIN DêRTY OIL	80%	2.694	2.155	2.694	2.155	37.316	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.316	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.600	0.000	0.480	83.981	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.997	-4.491	0.492	1.166	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.000	-2.550	0.480	1.852	Maximum
TOTAL MISC	78.26%	176.325	137.992	176.325	137.992	78.256	-0.413	1.504	479.328	
Total Loadcase			5847.707	1583.013	753.227	50.995	0.000	8.540	823.222	
FS correction								0.141		
VCG fluid								8.681		

Πίνακας 14: Load Case 3, 10%, «Arrival Load».

Όπως και στις προηγούμενες καταστάσεις φόρτωσης, έτσι και στην παρούσα παραθέτουμε το διάγραμμα της καμπύλης GZ:



Εικόνα 37: Καμπύλη GZ για 10% πληρότητα

Αντίστοιχα με τα προηγούμενα σενάρια φόρτωσης, παραθέτουμε τους πίνακες για την αναλυτική περιγραφή του μοχλοβραχίονα επαναφοράς συναρτήσει των κύριων γεωμετρικών χαρακτηριστικών και των *Key Points* με σημείο αναφοράς την *Margine Line*.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.701	-0.552	-0.296	0.000	0.295	0.551	0.700	0.724	0.730	0.520	0.049	-0.597	-1.306	-1.998	-2.615	-3.109	-3.432	-3.549	-3.395	-2.767	-1.405	-0.001
Area under GZ curve from zero heel m.deg	12.1289	5.8014	1.4910	0.0008	1.4850	5.7721	12.1468	19.3040	26.6495	33.1289	36.1629	33.5207	24.0232	7.4654	15.6830	44.4297	77.2951	112.3944	147.3799	178.7791	199.9917	206.9327
Displacement t	5847	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848
Draft at FP m	4.413	4.588	4.592	4.548	4.591	4.588	4.413	3.931	3.000	1.612	-0.928	-9.298	n/a	-24.643	-16.121	-13.266	-11.850	-11.051	-10.614	-10.439	-10.500	-10.549
Draft at AP m	3.491	4.054	4.391	4.542	4.392	4.054	3.491	2.546	0.973	-1.638	-6.738	-21.008	n/a	-33.933	-19.745	-14.839	-12.292	-10.745	-9.782	-9.286	-9.190	-9.160
WL Length m	123.322	123.332	123.397	117.424	123.397	123.332	123.322	123.316	123.337	123.362	121.302	122.795	123.492	123.900	124.140	124.224	124.044	123.518	122.730	122.266	121.076	119.918
Beam max extents on WL m	18.527	19.352	19.185	18.900	19.185	19.352	18.527	17.367	16.254	14.662	13.669	12.643	12.451	12.643	13.186	13.821	14.404	14.837	15.988	19.315	19.193	18.904

Πίνακας 15: Κύριες διαστάσεις και συντελεστές

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
Wetted Area m ²	2303.457	2307.332	2303.202	2289.000	2303.216	2307.498	2303.463	2299.223	2317.313	2297.739	2290.669	2255.828	2261.118	2277.117	2298.325	2326.955	2369.671	2431.276	2534.900	2759.447	2923.279	2925.889
Waterpl. Area m ²	1690.636	1704.061	1713.122	1704.986	1713.174	1704.071	1690.656	1708.108	1715.531	1542.172	1402.078	1271.524	1226.214	1221.116	1250.719	1310.357	1397.960	1515.571	1689.117	1990.033	2149.461	2123.010
Prismatic coeff. (Cp)	0.631	0.601	0.576	0.595	0.576	0.601	0.631	0.653	0.663	0.669	0.688	0.694	0.707	0.725	0.750	0.781	0.819	0.847	0.821	0.780	0.767	0.767
Block coeff. (Cb)	0.362	0.379	0.438	0.565	0.438	0.379	0.362	0.372	0.399	0.456	0.525	0.607	0.599	0.525	0.469	0.434	0.420	0.422	0.413	0.389	0.506	0.764
LCB from zero pt. (+ve fwd) m	51.040	51.021	51.008	50.994	51.004	51.021	51.039	51.050	51.073	51.087	51.113	51.112	51.103	51.085	51.061	51.036	51.012	50.992	50.972	50.959	50.962	50.963
LCF from zero pt. (+ve fwd) m	51.371	49.968	48.965	48.923	48.962	49.968	51.371	52.891	53.481	55.768	55.914	54.042	53.583	53.193	52.803	52.407	52.007	51.707	51.539	51.504	52.939	52.938
Max deck inclination deg	30.0025	20.0016	10.0005	0.0029	10.0005	20.0016	30.0025	40.0031	50.0033	60.0035	70.0033	80.0017	90.0000	99.9989	109.9987	119.9992	129.9998	139.9999	149.9979	159.9926	169.9978	179.2880
Trim angle (+ve by stern) deg	-0.4727	-0.2738	-0.1029	-0.0029	-0.1017	-0.2736	-0.4725	-0.7098	-1.0388	-1.6656	-2.9751	-5.9796	n/a	-4.7503	-1.8562	-0.8064	-0.2268	-0.1565	-0.4263	-0.5913	-0.6715	-0.7120

Πίνακας 16: Κύριες διαστάσεις και συντελεστές

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion position = 93.583 m)		43.6	n/a	7.822	6.055	4.164	2.296	0.561	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion position = 93.583 m)		43.9	n/a	7.898	6.129	4.232	2.358	0.615	0.964	2.514	3.995	5.214	6.195	6.942	7.438	7.662	7.594	7.381	7.037	6.208	4.854	3.300
Ventilation	Downflooding point	49.5	0	9.252	7.463	5.506	3.532	1.653	0.093	1.842	3.548	4.992	6.198	7.167	7.876	8.297	8.403	8.159	7.527	6.486	5.023	3.407

Πίνακας 17: Key Points

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Fore PS																						
Ventilation Fore SB	Downflooding point	159.6	0	9.252	10.719	11.919	12.907	13.705	14.269	14.394	14.069	13.470	12.549	11.296	9.743	7.940	5.960	3.894	1.847	0.074	1.767	3.407
Ventilation Mid PS	Downflooding point	55.6	0	10.359	8.605	6.690	4.723	2.813	1.004	0.800	2.564	4.181	5.630	6.882	7.899	8.643	9.070	9.128	8.761	7.914	6.558	4.980
Ventilation Mid SB	Downflooding point	153.2	0	10.359	11.884	13.150	14.167	14.954	15.472	15.555	15.183	14.417	13.256	11.717	9.849	7.714	5.399	3.013	0.682	1.454	3.279	4.980
Ventilation Aft PS	Downflooding point	58.3	0	9.999	8.331	6.565	4.753	2.993	1.333	0.280	1.829	3.365	4.815	6.123	7.242	8.124	8.717	8.955	8.763	8.046	6.763	5.222
Ventilation Aft SB	Downflooding point	153	0	9.999	11.613	13.029	14.203	15.141	15.810	16.086	15.928	15.245	14.082	12.488	10.518	8.243	5.761	3.193	0.686	1.582	3.481	5.222

Πίνακας 18: Key Points

Έλεγχος κριτηρίων ευστάθειας για την περίπτωση της 10% πληρότητας.

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.562	Pass	+1305.00
	8.2.3.3: Launching heeling moment	0.040	m	0.728	Pass	+1720.00
	8.2.3.3: Wind heeling arm	0.040	m	0.687	Pass	+1617.50
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.03	Pass	+99.97
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 30	3.1513	m.deg	12.1468	Pass	+285.45
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 0 to 40	5.1566	m.deg	19.3040	Pass	+274.35
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.1: Area 30 to 40	1.7189	m.deg	7.1571	Pass	+316.38
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.2: Max GZ at 30 or greater	0.200	m	0.740	Pass	+270.00
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.3: Angle of maximum GZ	25.0	deg	46.4	Pass	+85.46
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.4: Initial GMT	0.150	m	1.662	Pass	+1008.00
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.5: Passenger crowding: angle of equilibrium	10.0	deg	6.0	Pass	+40.03
A.749(18) Ch3 - Design criteria applicable to all ships	3.1.2.6: Turn: angle of equilibrium	10.0	deg	0.0	Pass	+99.84
A.749(18) Ch3 - Design criteria applicable to all ships	3.2.2: Severe wind and rolling				Pass	
	Angle of steady heel shall not be greater than (<=)	16.0	deg	6.3	Pass	+60.83
	Angle of steady heel / Deck edge immersion angle shall not be greater than (<=)	80.00	%	14.28	Pass	+82.15
	Area1 / Area2 shall not be less than (>=)	100.00	%	117.55	Pass	+17.55

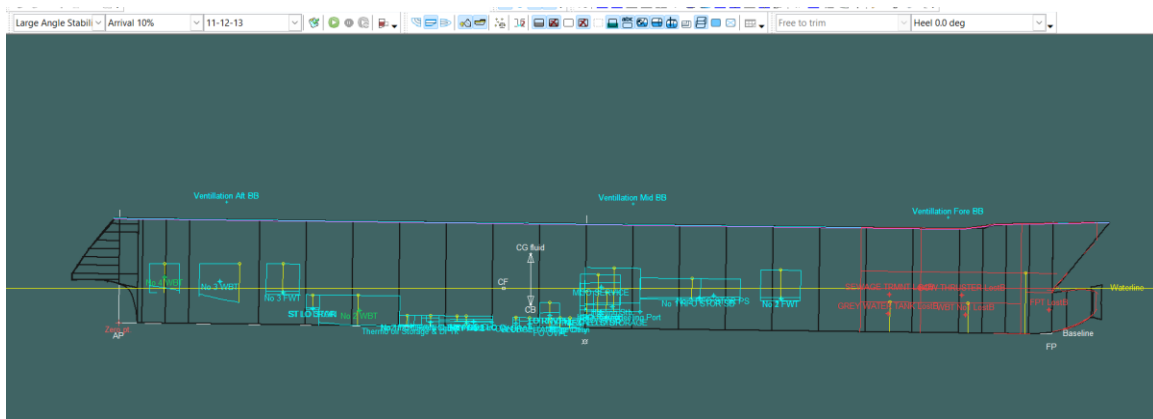
Πίνακας 19: Έλεγχος κριτηρίων ασφαλείας στην κατάσταση Arrival 10%

6.2 ΜΕΛΕΤΗ ΕΥΣΤΑΘΕΙΑΣ ΜΕΤΑ ΑΠΟ ΚΑΤΑΚΛΥΣΗ, ΜΕ ΤΗΝ ΝΤΕΤΕΡΜΙΝΙΣΤΙΚΗ ΜΕΘΟΔΟ.

Σε αυτό το σημείο της εργασίας θα μελετήσουμε την ευστάθεια, ενώ δημιουργούμε κάποια σενάρια κατάκλυσης στα διαμερίσματα του πλοίου. Συγκεκριμένα ελέγξαμε την περίπτωση όπου το ρήγμα εκτείνεται σε τρία διαμερίσματα.

Σκοπός μας, είναι να μελετήσουμε πως επηρεάζεται ο μοχλοβραχίονας επαναφοράς, **GZ** καθώς και η νέα θέση ισορροπίας του πλοίου. Σε καμία περίπτωση δεν πρέπει να βυθιστεί η *margin line*.

Η μελέτη έγινε στο υπολογιστικό πρόγραμμα *Max Surf*. Το ρήγμα εκτείνεται σε τρία διαμερίσματα και το βάθος εισχώρησης είναι 3,78 m. Για την κατακόρυφη έκτασή του δεν έχουμε κάποιο περιορισμό.



Εικόνα 38: Απεικόνιση βλάβης τριών γειτονικών διαμερισμάτων.

Στην συνέχεια διαμορφώσαμε τα παρακάτω σενάρια κατάκλυσης. Στην εικόνα φαίνονται τα τρία διαμερίσματα που έχουν υποστεί κατάκλυση, οι δεξαμενές που εμπεριέχονται σε αυτά και έχουν υποστεί βλάβη.

Room	Intact	1-2-3	2-3-4	3-4-5	4-5-6	5-6-7	6-7-8	7-8-9	8-9-10	9-10-11	10-11-12	11-12-13
1 Case type	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
2 Has RoRo spaces	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑
3 WBT No1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
4 FPT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
5 GREY WATER TANK	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑
6 Heeling Port	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑
7 Heeling Stb	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8 HFO Settling	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9 HFO SVCE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10 CPP&RG LO STOR	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11 ME&AE LO STORAGE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12 LO RNVT'G	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13 LO RNVT'D	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14 FO OVFL	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15 SLUDGE TANK	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16 CW DRAIN	☐	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑
17 DIRTY OIL	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18 No 1 FO DRAIN DeRTY OIL	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19 No2 FO DRAIN CLEAN OIL	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20 No 1 LO Circ	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21 No 2 LO Circ	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22 No 3 LO Circ	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23 No 4 LO Circ	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑
24 Thermo oil Storage & Dr Tk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25 No 2 WBT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26 ST LO STOR	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
27 ST LO DRAIN	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28 No 4 WBT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
29 No 3 WBT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
30 No 3 FWT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
31 MGO SERVICE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
32 No 1 HFO STOR SB	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
33 No 2 HFO STOR PS	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
34 No 1 FWT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
35 No 2 FWT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
36 Bilge Dirty	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Εικόνα 39: Σενάρια Βλάβης για πληρότητα 100%,50%,10%

36 Bilge Dirty	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
37 Bilge Clean	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
38 STEERING GEAR ROOM	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
39 SLOPE	☐	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐
40 AUX EQPMNT	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐
41 AUX ER	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐
42 ER	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐
43 WORKSHOP	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐
44 HEELING	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐
45 HFO STORAGE	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐
46 FW ROOM 1,2	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐
47 AC PLANT ROOM	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑
48 SEWAGE TRMNT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑
49 BOW THRUSTER	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
50 FORE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
51 ABV STEERING GEAR ROOM	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
52 ABV SLOPE	☐	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐
53 ABV AUX EQPMNT	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐
54 ABV AUX ER (RO-RO)	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐
55 ABV ER	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☐
56 ABV WORKSHOP	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐
57 ABV HEELING	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐
58 ABV HFO STORAGE	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐
59 ABV FW ROOM 1,2	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐
60 ABV AC PLANT ROOM	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑
61 ABV SEWAGE TRMNT	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑
62 ABV BOW THRUSTER	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑

Εικόνα 40: Σενάρια Βλάβης για πληρότητα 100%,50%,10%

Κατόπιν ελέγξαμε τα υποθετικά σενάρια βλάβης για τις τρεις καταστάσεις φόρτωσης του πλοίου. Κάνουμε αυτή την διάκριση, επειδή, όπως έχουμε προαναφέρει με την αλλαγή στην πληρότητα των δεξαμενών έχουμε αλλαγή στο βάρος του πλοίου και στην κατανομή του βάρους που συνεπάγεται με

διαφοροποίηση του κέντρου βάρους του πλοίου (KG). Επίσης η διαφοροποίηση στην πληρότητα των δεξαμενών του πλοίου συνεπάγεται την εμφάνιση ελεύθερων επιφανειών.

1. Load Case, με πληρότητα 100%

Στην συνέχεια παρουσιάζουμε τα αποτελέσματα που προέκυψαν από τον έλεγχο ευστάθειας, μέσω του *Max Surf*. Ενδεικτικά θα παρουσιάσουμε αναλυτικά τους πίνακες και τα διαγράμματα, μόνο για το πρώτο σενάριο της κατάκλυσης τριών παρακείμενων διαμερισμάτων.

Loadcase - Departure 100%

Damage Case - 1-2-3

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

STEERING GEAR ROOM[] Fully flooded 95

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

ABV STEERING GEAR ROOM[] Fully flooded 95

ABV SLOPE[] Fully flooded 85

ABV AUX EQPMNT[] Fully flooded 85

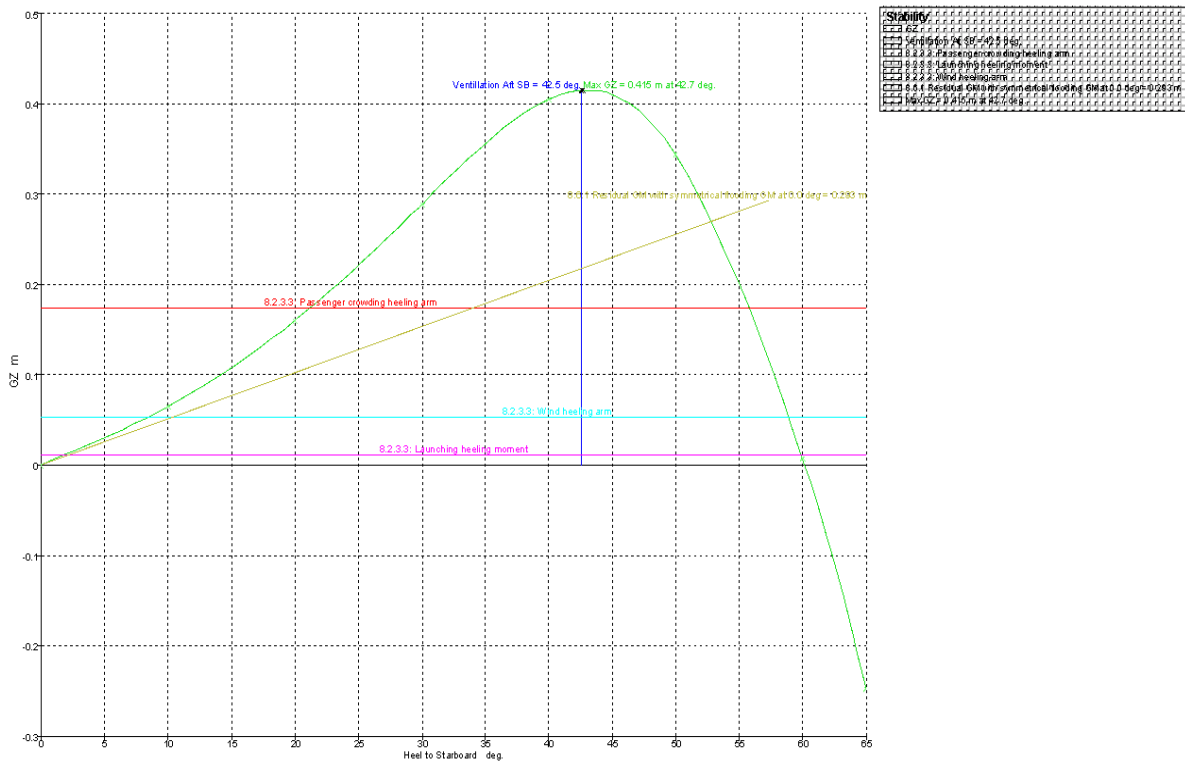
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.288	2.344	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.288	-2.344	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.670	-4.200	3.329	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.670	-1.500	3.329	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.670	4.200	5.231	4.578	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.985	-0.546	4.435	152.436	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	101.329	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	58.865	-8.294	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.017	8.473	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	29.129	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.688	0.346	5.117	365.231	

Εικόνα 41: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.000	3.150	2.320	4.312	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.400	3.150	2.480	8.625	Maximum
LO RNVTVG	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	2.173	0.880	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	-2.173	0.880	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.800	-5.213	0.880	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.910	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.108	1.381	1.638	61.351	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.247	0.000	0.335	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.200	-2.696	0.030	31.493	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	41.600	0.000	0.032	4.344	Maximum
No 1 FO DRAIN DÉRTY OIL	5%	2.694	0.135	2.694	0.135	37.316	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.316	-0.503	0.033	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.600	0.000	0.030	83.981	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.953	-4.354	0.047	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.000	-2.548	0.030	1.852	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.603	-0.428	0.238	479.328	
Total Loadcase			6012.404	1583.013	926.838	50.792	0.000	8.622	1069.145	
FS correction								0.178		
VCG fluid								8.799		

Εικόνα 42: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 43: Διάγραμμα μογλοβραχίονα επαναφοράς, GZ

Παραθέτουμε τους παρακάτω πίνακες με τα αποτελέσματα που προέκυψαν από τον έλεγχο ευστάθειας και ικανοποίησης των κανονισμών, έπειτα από κατάκλυση τριών παρακειμένων διαμερισμάτων στην κατάσταση αναχώρησης 100%. Αναλυτικότερα τα αποτελέσματα των υπόλοιπων περιπτώσεων βλάβης τα παραθέτουμε στο παράρτημα που ακολουθεί.

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	42.6	Pass	+184.06
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	1.7516	Pass	+103.81
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.238	Pass	+495.00
	8.2.3.3: Launching heeling moment	0.040	m	0.400	Pass	+900.00
	8.2.3.3: Wind heeling arm	0.040	m	0.360	Pass	+800.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.293	Pass	+486.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.1	Pass	+100.91
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.15	Pass	+99.85

Εικόνα 48: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 1-2-3

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	42.0	Pass	+179.72
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	2.7953	Pass	+225.26
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.306	Pass	+665.00
	8.2.3.3: Launching heeling moment	0.040	m	0.468	Pass	+1070.00
	8.2.3.3: Wind heeling arm	0.040	m	0.428	Pass	+970.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.533	Pass	+966.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+100.51
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.09	Pass	+99.91

Εικόνα 49: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 2-3-4

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	39.5	Pass	+163.21
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.3169	Pass	+285.95
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.341	Pass	+752.50
	8.2.3.3: Launching heeling moment	0.040	m	0.503	Pass	+1157.50
	8.2.3.3: Wind heeling arm	0.040	m	0.462	Pass	+1055.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.684	Pass	+1268.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.1	Pass	+98.24
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.31	Pass	+99.69

Εικόνα 50: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 3-4-5

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	44.6	Pass	+197.32
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.8359	Pass	+462.70
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.399	Pass	+897.50
	8.2.3.3: Launching heeling moment	0.040	m	0.561	Pass	+1302.50
	8.2.3.3: Wind heeling arm	0.040	m	0.521	Pass	+1202.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.028	Pass	+1956.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-1.0	Pass	+113.68
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-2.19	Pass	+102.19

Εικόνα 51: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 4-5-6

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	43.1	Pass	+187.19
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.9142	Pass	+471.81
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.449	Pass	+1022.50
	8.2.3.3: Launching heeling moment	0.040	m	0.612	Pass	+1430.00
	8.2.3.3: Wind heeling arm	0.040	m	0.571	Pass	+1327.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.437	Pass	+2774.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.8	Pass	+88.24
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.88	Pass	+98.12

Εικόνα 52: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 5-6-7

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	40.5	Pass	+169.73
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.3850	Pass	+410.24
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.454	Pass	+1035.00
	8.2.3.3: Launching heeling moment	0.040	m	0.616	Pass	+1440.00
	8.2.3.3: Wind heeling arm	0.040	m	0.575	Pass	+1337.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.484	Pass	+2868.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.8	Pass	+87.86
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	2.06	Pass	+97.94

Εικόνα 53: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 6-7-8

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.2	Pass	+141.21
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.0938	Pass	+260.00
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.412	Pass	+930.00
	8.2.3.3: Launching heeling moment	0.040	m	0.574	Pass	+1335.00
	8.2.3.3: Wind heeling arm	0.040	m	0.533	Pass	+1232.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.808	Pass	+1516.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	2.5	Pass	+63.99
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	6.52	Pass	+93.48

Εικόνα 54: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 7-8-9

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.2	Pass	+141.35
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.1895	Pass	+271.13
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.417	Pass	+942.50
	8.2.3.3: Launching heeling moment	0.040	m	0.579	Pass	+1347.50
	8.2.3.3: Wind heeling arm	0.040	m	0.538	Pass	+1245.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.546	Pass	+992.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+100.53
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.10	Pass	+99.90

Εικόνα 55: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 8-9-10

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	35.8	Pass	+138.74
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.7897	Pass	+340.97
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.454	Pass	+1035.00
	8.2.3.3: Launching heeling moment	0.040	m	0.616	Pass	+1440.00
	8.2.3.3: Wind heeling arm	0.040	m	0.575	Pass	+1337.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.721	Pass	+1342.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+100.41
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.08	Pass	+99.92

Εικόνα 56: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 9-10-11

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	34.5	Pass	+129.77
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.8370	Pass	+462.83
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.487	Pass	+1117.50
	8.2.3.3: Launching heeling moment	0.040	m	0.649	Pass	+1522.50
	8.2.3.3: Wind heeling arm	0.040	m	0.608	Pass	+1420.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.023	Pass	+1946.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+100.30
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.06	Pass	+99.94

Εικόνα 57: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 10-11-12

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	39.5	Pass	+163.50
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	6.1569	Pass	+616.42
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.591	Pass	+1377.50
	8.2.3.3: Launching heeling moment	0.040	m	0.754	Pass	+1785.00
	8.2.3.3: Wind heeling arm	0.040	m	0.713	Pass	+1682.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.376	Pass	+2652.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+100.21
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.04	Pass	+99.96

Εικόνα 58: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 11-12-13

2. Load Case, με πληρότητα 50%

Επαναλαμβάνουμε τον έλεγχο της ευστάθειας έπειτα από κατάκλυση, με πληρότητα 50% των δεξαμενών και των χώρων που έχουμε περιγράψει στην ενότητα 3. Στην συνέχεια παραθέτουμε τα σενάρια βλάβης και τα αποτελέσματα από τον έλεγχο των κανονισμών.

	Room	Intact	1-2-3	2-3-4	3-4-5	4-5-6	5-6-7	6-7-8	7-8-9	8-9-10	9-10-11	10-11-12	11-12-13
1	Case type	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Has RoRo spaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	WBT No1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	FPT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5	GREY WATER TANK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Heeling Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Heeling Stb	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	HFO Settling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	HFO SVCE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	CPP&RG LO STOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	ME&AE LO STORAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	LO RNVT'G	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	LO RNVT'D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	FO OVFL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	SLUDGE TANK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	CW DRAIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	DIRTY OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	No 1 FO DRAIN DéRTY OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	No2 FO DRAIN CLEAN OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	No 1 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	No 2 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	No 3 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	No 4 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Thermo oil Storage & Dr Tk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	No 2 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	ST LO STOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	ST LO DRAIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	No 4 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	No 3 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	No 3 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	MGO SERVICE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	No 1 HFO STOR SB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	No 2 HFO STOR PS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	No 1 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	No 2 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	Bilge Dirty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Εικόνα 59: Διαμερίσματα και δεξαμενές υπό βλάβη.

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	45.2	Pass	+201.41
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.1164	Pass	+495.35
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.417	Pass	+942.50
	8.2.3.3: Launching heeling moment	0.040	m	0.583	Pass	+1357.50
	8.2.3.3: Wind heeling arm	0.040	m	0.541	Pass	+1252.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.136	Pass	+2172.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.8	Pass	+110.77
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-1.70	Pass	+101.70

Εικόνα 64: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 4-5-6

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	43.7	Pass	+191.14
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.2465	Pass	+510.49
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.466	Pass	+1065.00
	8.2.3.3: Launching heeling moment	0.040	m	0.632	Pass	+1480.00
	8.2.3.3: Wind heeling arm	0.040	m	0.591	Pass	+1377.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.543	Pass	+2986.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.6	Pass	+90.79
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.45	Pass	+98.55

Εικόνα 65: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 5-6-7

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	41.3	Pass	+175.45
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.7606	Pass	+453.95
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.469	Pass	+1072.50
	8.2.3.3: Launching heeling moment	0.040	m	0.635	Pass	+1487.50
	8.2.3.3: Wind heeling arm	0.040	m	0.593	Pass	+1382.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.446	Pass	+2792.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.4	Pass	+93.67
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.06	Pass	+98.94

Εικόνα 66: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 6-7-8

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	37.3	Pass	+148.35
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.4513	Pass	+301.59
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.433	Pass	+982.50
	8.2.3.3: Launching heeling moment	0.040	m	0.599	Pass	+1397.50
	8.2.3.3: Wind heeling arm	0.040	m	0.558	Pass	+1295.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.904	Pass	+1708.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	1.9	Pass	+72.89
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	4.85	Pass	+95.15

Εικόνα 67: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 7-8-9

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.8	Pass	+145.40
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.4506	Pass	+301.51
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.439	Pass	+997.50
	8.2.3.3: Launching heeling moment	0.040	m	0.605	Pass	+1412.50
	8.2.3.3: Wind heeling arm	0.040	m	0.564	Pass	+1310.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.615	Pass	+1130.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.2	Pass	+102.82
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-0.54	Pass	+100.54

Εικόνα 68: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 8-9-10

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.9	Pass	+146.25
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.9647	Pass	+361.33
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.451	Pass	+1027.50
	8.2.3.3: Launching heeling moment	0.040	m	0.618	Pass	+1445.00
	8.2.3.3: Wind heeling arm	0.040	m	0.576	Pass	+1340.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.755	Pass	+1410.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.2	Pass	+102.32
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-0.44	Pass	+100.44

Εικόνα 69: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 9-10-11

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	37.1	Pass	+147.57
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.1546	Pass	+499.79
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.463	Pass	+1057.50
	8.2.3.3: Launching heeling moment	0.040	m	0.632	Pass	+1480.00
	8.2.3.3: Wind heeling arm	0.040	m	0.590	Pass	+1375.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.113	Pass	+2126.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.1	Pass	+101.60
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-0.30	Pass	+100.30

Εικόνα 70: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 10-11-12

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	42.2	Pass	+181.26
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	6.4703	Pass	+652.89
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.551	Pass	+1277.50
	8.2.3.3: Launching heeling moment	0.040	m	0.720	Pass	+1700.00
	8.2.3.3: Wind heeling arm	0.040	m	0.678	Pass	+1595.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.465	Pass	+2830.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.1	Pass	+101.21
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.20	Pass	+99.80

Εικόνα 71: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 11-12-13

3. Load Case, με πληρότητα 10%, «κατάσταση άφιξης»

Επαναλαμβάνουμε τον έλεγχο της ευστάθειας έπειτα από κατάκλυση, με πληρότητα 10% των δεξαμενών και των χώρων που έχουμε περιγράψει στην ενότητα 3. Στην συνέχεια παραθέτουμε τα σενάρια βλάβης και τα αποτελέσματα από τον έλεγχο των κανονισμών.

	Room	Intact	1-2-3	2-3-4	3-4-5	4-5-6	5-6-7	6-7-8	7-8-9	8-9-10	9-10-11	10-11-12	11-12-13
1	Case type	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Has RoRo spaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	WBT No1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	FPT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5	GREY WATER TANK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Heeling Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Heeling Stb	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	HFO Settling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	HFO SVCE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	CPP&RG LO STOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	ME&AE LO STORAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	LO RNVT'G	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	LO RNVT'D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	FO OVFL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	SLUDGE TANK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	CW DRAIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	DIRTY OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	No 1 FO DRAIN DêRTY OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	No2 FO DRAIN CLEAN OIL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	No 1 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	No 2 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	No 3 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	No 4 LO Circ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Thermo oil Storage & Dr Tk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	No 2 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	ST LO STOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	ST LO DRAIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	No 4 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	No 3 WBT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	No 3 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	MGO SERVICE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	No 1 HFO STOR SB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	No 2 HFO STOR PS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	No 1 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	No 2 FWT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	Bilge Dirty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Εικόνα 72: Διαμερίσματα και δεξαμενές υπό βλάβη

36	Bilge Dirty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	Bilge Clean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	STEERING GEAR ROOM	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	SLOPE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	AUX EQPMNT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41	AUX ER	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42	ER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43	WORKSHOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44	HEELING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45	HFO STORAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46	FW ROOM 1,2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47	AC PLANT ROOM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
48	SEWAGE TRMNT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
49	BOW THRUSTER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
50	FORE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
51	ABV STEERING GEAR ROOM	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
52	ABV SLOPE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53	ABV AUX EQPMNT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54	ABV AUX ER (RO-RO)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55	ABV ER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56	ABV WORKSHOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57	ABV HEELING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58	ABV HFO STORAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59	ABV FW ROOM 1,2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
60	ABV AC PLANT ROOM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
61	ABV SEWAGE TRMNT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
62	ABV BOW THRUSTER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Εικόνα 73: Διαμερίσματα και δεξαμενές υπό βλάβη

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	43.6	Pass	+190.59
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	2.5280	Pass	+194.16
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.332	Pass	+730.00
	8.2.3.3: Launching heeling moment	0.040	m	0.499	Pass	+1147.50
	8.2.3.3: Wind heeling arm	0.040	m	0.457	Pass	+1042.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.507	Pass	+914.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.1	Pass	+99.29
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.11	Pass	+99.89

Εικόνα 74: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 1-2-3

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	41.2	Pass	+174.87
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	2.9989	Pass	+248.95
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.369	Pass	+822.50
	8.2.3.3: Launching heeling moment	0.040	m	0.535	Pass	+1237.50
	8.2.3.3: Wind heeling arm	0.040	m	0.494	Pass	+1135.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.729	Pass	+1358.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	1.8	Pass	+74.17
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	4.20	Pass	+95.80

Εικόνα 75: Έλεγχος έπειτα βλάβη των Διαμερισμάτων 2-3-4

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	40.3	Pass	+168.71
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.0052	Pass	+366.05
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.424	Pass	+960.00
	8.2.3.3: Launching heeling moment	0.040	m	0.591	Pass	+1377.50
	8.2.3.3: Wind heeling arm	0.040	m	0.549	Pass	+1272.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.882	Pass	+1664.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.4	Pass	+94.14
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.01	Pass	+98.99

Εικόνα 76: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 3-4-5

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	45.3	Pass	+202.25
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.4499	Pass	+534.15
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.465	Pass	+1062.50
	8.2.3.3: Launching heeling moment	0.040	m	0.632	Pass	+1480.00
	8.2.3.3: Wind heeling arm	0.040	m	0.590	Pass	+1375.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.234	Pass	+2368.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	-0.6	Pass	+108.74
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	-1.37	Pass	+101.37

Εικόνα 77: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 4-5-6

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	43.4	Pass	+189.51
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.4498	Pass	+534.14
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.513	Pass	+1182.50
	8.2.3.3: Launching heeling moment	0.040	m	0.679	Pass	+1597.50
	8.2.3.3: Wind heeling arm	0.040	m	0.638	Pass	+1495.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.645	Pass	+3190.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.9	Pass	+87.39
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.99	Pass	+98.01

Εικόνα 78: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 5-6-7

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	41.0	Pass	+173.23
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.9397	Pass	+474.79
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.516	Pass	+1190.00
	8.2.3.3: Launching heeling moment	0.040	m	0.683	Pass	+1607.50
	8.2.3.3: Wind heeling arm	0.040	m	0.641	Pass	+1502.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.481	Pass	+2862.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.8	Pass	+88.99
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	1.85	Pass	+98.15

Εικόνα 79: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 6-7-8

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.9	Pass	+145.99
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.6654	Pass	+326.50
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.483	Pass	+1107.50
	8.2.3.3: Launching heeling moment	0.040	m	0.650	Pass	+1525.00
	8.2.3.3: Wind heeling arm	0.040	m	0.608	Pass	+1420.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.998	Pass	+1896.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	2.2	Pass	+68.21
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	5.69	Pass	+94.31

Εικόνα 80: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 7-8-9

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	36.6	Pass	+143.75
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	3.7636	Pass	+337.93
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.488	Pass	+1120.00
	8.2.3.3: Launching heeling moment	0.040	m	0.655	Pass	+1537.50
	8.2.3.3: Wind heeling arm	0.040	m	0.613	Pass	+1432.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.690	Pass	+1280.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+99.40
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.11	Pass	+99.89

Εικόνα 81: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 8-9-10

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	37.3	Pass	+148.97
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	4.1944	Pass	+388.06
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.475	Pass	+1087.50
	8.2.3.3: Launching heeling moment	0.040	m	0.645	Pass	+1512.50
	8.2.3.3: Wind heeling arm	0.040	m	0.602	Pass	+1405.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	0.848	Pass	+1596.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+99.47
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.10	Pass	+99.90

Εικόνα 82: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 9-10-11

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	38.7	Pass	+157.95
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	5.5287	Pass	+543.32
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.465	Pass	+1062.50
	8.2.3.3: Launching heeling moment	0.040	m	0.638	Pass	+1495.00
	8.2.3.3: Wind heeling arm	0.040	m	0.595	Pass	+1387.50
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.249	Pass	+2398.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+99.63
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.07	Pass	+99.93

Εικόνα 83: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 10-11-12

Code	Criteria	Value	Units	Actual	Status	Margin %
SOLAS, II-1/8	8.2.3.1: Range of residual positive stability	15.0	deg	43.8	Pass	+192.27
SOLAS, II-1/8	8.2.3.2: Area under residual GZ curve	0.8594	m.deg	6.8090	Pass	+692.29
SOLAS, II-1/8	8.2.3.3: Maximum residual GZ (method 1)				Pass	
	8.2.3.3: Passenger crowding heeling arm	0.040	m	0.554	Pass	+1285.00
	8.2.3.3: Launching heeling moment	0.040	m	0.727	Pass	+1717.50
	8.2.3.3: Wind heeling arm	0.040	m	0.684	Pass	+1610.00
SOLAS, II-1/8	8.6.1 Residual GM with symmetrical flooding	0.050	m	1.589	Pass	+3078.00
SOLAS, II-1/8	8.6.2: Heel angle at equilibrium for unsymmetrical flooding - GZ based	7.0	deg	0.0	Pass	+99.73
SOLAS, II-1/8	8.6.3: Margin line immersion - GZ based (EquilAngle ratio)	100.00	%	0.04	Pass	+99.96

Εικόνα 84: Έλεγχος έπειτα από βλάβη των Διαμερισμάτων 11-12-13

6.3 ΜΕΛΕΤΗ ΕΥΣΤΑΘΕΙΑΣ ΜΕ ΤΗΝ ΠΙΘΑΝΟΤΙΚΗ ΜΕΘΟΔΟ.

Σε αυτή την παράγραφο πραγματοποιήσαμε μελέτη της ευστάθειας του ίδιου *ROPAX* πλοίου, σύμφωνα με την μέθοδο του Πιθανοτικού μοντέλου¹³. Σύμφωνα με το θεωρητικό μοντέλο που αναπτύξαμε στην παράγραφο 2.6, σκοπός είναι να ελέγξουμε αν ικανοποιούνται οι προϋποθέσεις και η σχέση $A \geq R$, μεταξύ του Επιτευχθέντα Δείκτη υποδιαίρεσης (A) και του Απαιτούμενου Δείκτη υποδιαίρεσης (R).

Οι υπολογισμοί έγιναν στο λογισμικό πρόγραμμα *Max Surf*. Επιλέξαμε το παράθυρο «*Load Case*» ώστε να κάναμε εισαγωγή των δεδομένων του πλοίου. Στην συνέχεια υπολογίσαμε τον δείκτη υποδιαίρεσης *A* για τρεις καταστάσεις βύθισης.

	Item	Value	Units	Selected
1	Probabilistic damage			<input type="checkbox"/>
2	Resolution -- MSC.421(98), MSC.216(82) or MSC.19(58)	MSC.216(82)		<input type="checkbox"/>
3	Do automatic combinations of vertical damage ?	Yes		<input type="checkbox"/>
4				<input type="checkbox"/>
5	Loadcases			<input type="checkbox"/>
6	Deepest subdivision draft (summer loadline) Loadcase	Departure 100%	draft: 4.634 m	<input checked="" type="checkbox"/>
7	Partial subdivision draft Loadcase	Half Load 50%	draft: 4.555 m	<input checked="" type="checkbox"/>
8	Light service draft Loadcase	Arrival 10%	draft: 4.545 m	<input checked="" type="checkbox"/>
9				<input type="checkbox"/>
10	Vessel parameters			<input type="checkbox"/>
11	Type -- Cargo or Passenger	Passenger		<input type="checkbox"/>
12	Lifeboat capacity N_1	0		<input type="checkbox"/>
13	Permitted max. num. of persons in excess of N_1: N_2	0		<input type="checkbox"/>
14	Subdivision length L_s	118.200	m	<input type="checkbox"/>
15	Aft terminal of L_s	-1.200	m	<input type="checkbox"/>
16	Fwd terminal of L_s	117.000	m	<input type="checkbox"/>
17	Mid L_s	57.900	m	<input type="checkbox"/>
18	Intact displacement at subdivision draft (Arrival 10%)	5847.701	t	<input type="checkbox"/>
19	max. moulded breadth at or below deepest subdivision draft: B	18.900	m	<input type="checkbox"/>
20	max. number of adjacent zones to consider	1		<input type="checkbox"/>
21	min. probability (p.r.v) of damage to consider	0.000100		<input type="checkbox"/>
22	max. trim angle to consider	40.0	deg	<input type="checkbox"/>
23	Limit longitudinal extent of damage? (L_max=60.000; J_max=0.30303)	Limit		<input type="checkbox"/>
24	Limit vertical extent of damage?	Limit		<input type="checkbox"/>
25	max. vertical extent of damage	17.134	m	<input type="checkbox"/>
26	Damaged side -- Starboard or Port	Starboard		<input type="checkbox"/>
27	Zone 1 located at bow or stern?	Stem		<input type="checkbox"/>
28				<input type="checkbox"/>
29	MSC.216(82) -- Required subdivision index			<input type="checkbox"/>
30	Pax ships: $R = 1 - 5000 / (L_s + 2.5 N + 15225)$	0.67412		<input type="checkbox"/>
31	Reduction factor for R	1.000		<input type="checkbox"/>
32	Required subdivision index (applying reduction factor)	0.67412		<input type="checkbox"/>
33	Factor of R for required subdivision index for each loadcase	0.900		<input type="checkbox"/>
34	Required subdivision index for each loadcase	0.60671		<input type="checkbox"/>

Πίνακας 20: Δεδομένα *EUROPAX*

Όπως φαίνεται και στον πίνακα το πρόγραμμα έκανε τον υπολογισμό για τα τρία διαφορετικά βυθίσματα. Τα οποία αντιστοιχούν στις αντίστοιχες καταστάσεις φόρτωσης του πλοίου.

¹³ <https://repository.kallipos.gr/handle/11419/5219>

Οι δεξαμενές που θεωρήσαμε ότι συμβάλουν στην μελέτη είναι οι αντίστοιχες με το ντετερμινιστικό μοντέλο.

Properties	Name	Type	Intact Perm. %	Damaged Perm. %	Specific gravity	Fluid type	Boundary Surfaces	Alt m	Fore m	F.Port m	F.Sbd. m	F.Top m	F.Bott. m	A.Port m	A.Sbd. m	A.Top m	A.Bott. m	Formed	Calibrate
4	Heeling Pit	Tank	95	95	1.025	none	none	55.800	62.400	-9.450	-7.800	7.250	2.050	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
5	Heeling Sth	Tank	95	95	1.025	none	none	55.800	62.400	7.800	9.450	7.250	2.050	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
6	HFO Settling	Tank	95	95	0.98	none	none	55.200	60.000	-6.400	-3.000	6.450	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
7	HFO SWCE	Tank	95	95	0.98	none	none	55.200	60.000	-3.000	0.000	6.450	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
8	CFP&AE LO STOR	Tank	95	95	0.9	none	none	55.200	56.800	1.500	4.800	4.400	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
9	ME&AE LO STORAGE	Tank	95	95	0.9	none	none	56.800	60.000	1.500	4.800	4.400	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
10	LO RIVTIG	Tank	95	95	0.9	none	none	50.400	52.800	-1.500	0.000	3.000	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
11	LO RIVTID	Tank	95	95	0.9	none	none	50.400	52.800	0.000	1.500	3.000	1.200	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
12	FO OVFL	Tank	95	95	0.98	none	none	50.400	52.800	-6.400	0.000	1.200	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
13	SLUDGE TANK	Tank	95	95	1	none	none	48.000	50.400	-6.400	0.000	1.200	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
14	CW DRAN	Tank	95	95	1	none	none	47.200	48.000	-6.400	5.400	1.200	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
15	DRY OIL	Tank	95	95	1	none	none	38.400	44.800	-1.006	1.006	1.300	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
16	No 1 FO DRAIN/DRY OIL	Tank	95	95	1	none	none	36.232	38.400	0.000	1.006	1.300	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
17	No 2 FO DRAIN/CLEAN OIL	Tank	95	95	1	none	none	36.232	38.400	-1.006	0.000	1.300	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
18	No 1 LO Circ	Tank	95	95	0.9	none	none	36.800	44.800	-4.553	5.893	1.300	0.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
19	No 2 LO Circ	Tank	95	95	0.9	none	none	36.800	44.800	1.503	2.843	1.300	0.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
20	No 3 LO Circ	Tank	95	95	0.9	none	none	36.800	44.800	-2.943	-1.503	1.300	0.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
21	No 4 LO Circ	Tank	95	95	0.9	none	none	36.800	44.800	-6.993	-4.533	1.300	0.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
22	Thermo oil Storage & Dr Tk	Tank	95	95	0.75	none	none	34.680	35.391	-3.221	3.221	1.300	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
23	Thermo oil Storage & Dr Tk	Linked Tank	95	95	0.75	none	none	35.391	36.232	-2.850	2.850	1.300	0.000	-3.221	3.221	Prismatic	Prismatic	Yes	No
24	Thermo oil Storage & Dr Tk	Linked Tank	95	95	0.75	none	none	33.600	34.680	-3.221	3.221	1.300	0.000	-3.000	3.000	Prismatic	Prismatic	Yes	No
25	No 2 WBT	Tank	95	95	1.025	Sea Water	none	24.000	33.600	-1.800	1.800	3.600	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
26	ST LO STOR	Tank	95	95	0.9	none	none	22.400	24.000	-1.800	0.000	3.600	1.900	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
27	ST LO DRAIN	Tank	95	95	0.9	none	none	22.400	24.000	0.000	1.800	3.600	1.900	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
28	No 4 WBT	Tank	95	95	1.025	Sea Water	none	3.600	7.200	-4.800	4.800	7.696	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
29	No 3 WBT	Tank	95	95	1.025	none	none	9.600	14.400	-4.800	4.800	7.178	2.600	Prismatic	Prismatic	Prismatic	Prismatic	3.267	Yes
30	No 3 FW T	Tank	95	95	1	none	none	17.600	21.600	-1.800	1.800	7.250	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
31	MGO SERVICE	Tank	100	100	0.85	none	none	55.200	60.000	3.000	5.400	6.450	4.400	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
32	No 1 HFO STOR SB	Tank	95	95	0.98	none	none	69.636	74.400	0.000	4.200	6.100	3.600	Prismatic	4.800	Prismatic	Prismatic	Yes	Yes
33	No 1 HFO STOR SB	Linked Tank	95	95	0.98	none	none	62.400	69.636	0.000	4.800	6.100	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No
34	No 2 HFO STOR PS	Tank	95	95	0.98	none	none	69.636	74.400	-4.200	0.000	6.100	3.600	Prismatic	4.800	Prismatic	Prismatic	Yes	Yes
35	No 2 HFO STOR PS	Linked Tank	95	95	0.98	none	none	62.400	69.636	-4.800	0.000	6.100	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No
36	No 1 FW T	Tank	95	95	1	none	none	76.800	81.600	-3.000	0.000	7.250	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
37	No 2 FW T	Tank	95	95	1	none	none	76.800	81.600	0.000	3.000	7.250	3.600	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
38	Blge Dirty	Tank	95	95	1	none	none	52.800	55.200	-6.400	-3.600	1.200	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
39	Blge Clean	Tank	95	95	1	none	none	52.800	55.200	-3.600	-1.500	1.200	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	Yes
40	STEERING GEAR ROOM	Compartment	95	95		none	none	-1.200	7.200	-12.000	12.000	7.250	0.000	Prismatic	Prismatic	Prismatic	Prismatic	Yes	No

Εικόνα 85: Room Definition, Probabilistic method.

Όπως επίσης και τα «Down flooding Points», όπως φαίνεται στο πίνακα που ακολουθεί:

	Name	Long. Pos. m	Offset m	Height m	Type	Linked to	Flood from	Intact (use for intact case)	Damage (use for damage cases)	Flow into Tank when immersed
1	Ventilation Fore PS	99,200	-9,375	13,800	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Ventilation Fore SB	99,200	9,375	13,800	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Ventilation Mid PS	61,414	-9,444	14,904	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Ventilation Mid SB	61,414	9,444	14,904	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Ventilation Aft PS	12,777	-9,450	14,541	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Ventilation Aft SB	12,777	9,450	14,541	Downflooding point	None	Sea	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Πίνακας 21: Down Flooding Points

Διαμέριση του πλοίου.

Όσο αφορά την διαμέριση του πλοίου, έχουμε συμπεριλάβει τα καταστρώματα του πλοίου και τις διαμήκης φρακτές.

	Zones	Shell half-beam m	Num. L.Bhds	b 1 m	b 2 m
1	1 adjacent zone				
2	Zone 1, 1	9.450	0	n/a	n/a
3	Zone 2, 1	9.450	0	n/a	n/a
4	Zone 3, 1	9.450	1	4.800	n/a
5	Zone 4, 1	9.450	1	4.800	n/a
6	Zone 5, 1	9.450	0	n/a	n/a
7	Zone 6, 1	9.450	1	5.400	n/a
8	Zone 7, 1	9.450	1	5.400	n/a
9	Zone 8, 1	9.450	1	4.800	n/a
10	Zone 9, 1	9.450	0	n/a	n/a
11	Zone 10, 1	9.450	0	n/a	n/a
12	Zone 11, 1	9.450	0	n/a	n/a
13	Zone 12, 1	9.450	0	n/a	n/a
14	Zone 13, 1	9.450	0	n/a	n/a

Πίνακας 23: Διαμήκη ενισχυτικά ανά ζώνη υποδιαίρεσης (b_i)

	Zones	Num. Decks	H 1 m	H 2 m	H 3 m	H 4 m	H 5 m	H 6 m
1	1 adjacent zone							
2	Zone 1, 1	2	7.250	12.450	n/a	n/a	n/a	n/a
3	Zone 2, 1	2	7.250	12.450	n/a	n/a	n/a	n/a
4	Zone 3, 1	3	3.600	7.250	12.450	n/a	n/a	n/a
5	Zone 4, 1	3	0.000	3.600	7.250	n/a	n/a	n/a
6	Zone 5, 1	4	1.300	4.400	7.250	12.450	n/a	n/a
7	Zone 6, 1	4	0.000	1.300	4.400	7.400	n/a	n/a
8	Zone 7, 1	5	1.300	2.050	6.800	7.250	12.450	n/a
9	Zone 8, 1	5	1.300	2.050	6.800	7.250	12.450	n/a
10	Zone 9, 1	5	1.300	2.050	6.800	7.250	12.450	n/a
11	Zone 10, 1	5	1.200	3.600	7.250	9.750	12.450	n/a
12	Zone 11, 1	5	1.200	3.600	7.250	9.750	12.450	n/a
13	Zone 12, 1	4	3.600	7.250	9.750	12.450	n/a	n/a
14	Zone 13, 1	2	7.250	12.450	n/a	n/a	n/a	n/a

Πίνακας 24: Κατάστρωμα ανά ζώνη (H_i)

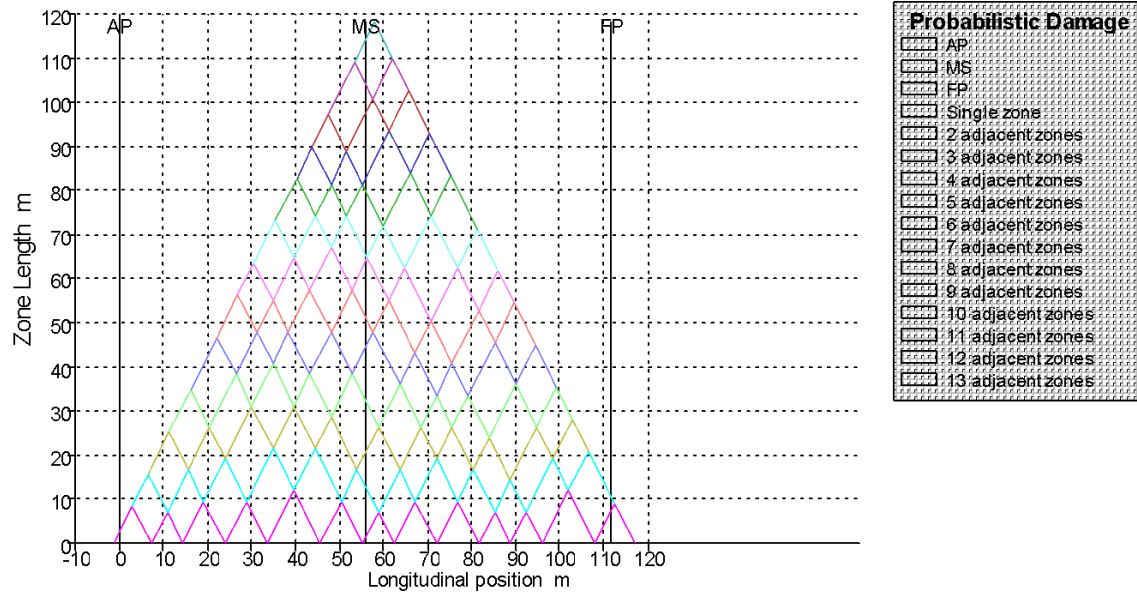
Τα αποτελέσματα της μελέτης, σχετικά με τον απαιτούμενο δείκτη υποδιαίρεσης (R) και τον επιτευχθέντα δείκτη υποδιαίρεσης (A) τα καταγράψαμε στον πίνακα που ακολουθεί:

	A	R	
Attained subdivision index	0.899033	0.850985	Pass
MSC.216(82)			Pass

Πίνακας 25: Πίνακας αποτελεσμάτων δεικτών

Σύμφωνα με τα αποτελέσματα, ο επιτευχθέντας δείκτης υποδιαίρεσης ικανοποιεί το κριτήριο καθώς $A > R$, και το πλοίο πληροί τα κριτήρια ευστάθειας μετά από βλάβη.

Τέλος, το τρίγωνο πρόβλεψης πιθανοτήτων κατάκλυσης που προκύπτει είναι το ακόλουθο:



Εικόνα 86: Τρίγωνο πιθανοτήτων κατάκλυσης

ΚΕΦΑΛΑΙΟ 7^ο: ΠΑΡΑΤΗΡΗΣΕΙΣ - ΣΥΜΠΕΡΑΣΜΑΤΑ

Όπως έχουμε ήδη αναφέρει στόχος της εργασίας είναι η σύγκριση του πιθανοτικού και του ντετερμινιστικού μοντέλου σε ένα οχηματαγωγό πλοίο. Σε αυτό το κεφάλαιο παραθέτουμε τις κύριες διαφορές που εντοπίσαμε κατά την εφαρμογή τους και τα αποτελέσματα που προέκυψαν για το υπό μελέτη πλοίο.

Η διαφοροποίηση των μεθόδων εντοπίζεται από την επιστημονική προσέγγιση που έχουν για το ίδιο πρόβλημα. Αρχικά η πιθανοτική μέθοδος έχει ως σκοπό τον υπολογισμό της πιθανότητας επιβίωσης του πλοίου σύμφωνα με τα κριτήρια των αντίστοιχων κανονισμών, χωρίς να υπάρχουν αυστηρές προδιαγραφές σχετικά με τα γεωμετρικά χαρακτηριστικά, την έκταση και την θέση της βλάβης. Αυτό έχει ως αποτέλεσμα η σχεδίαση της στεγανής υποδιαίρεσης του πλοίου να «αφήνεται» στην κρίση του σχεδιαστή. Όμως αυτό δεν σημαίνει ότι τα όρια είναι ελαστικότερα και λιγότερο απαιτητικά από εκείνα της ντετερμινιστικής μεθόδου. Στον αντίποδα η προσδιοριστική μέθοδος θέτει συγκεκριμένα χαρακτηριστικά ως προς το ρήγμα που θα δημιουργηθεί, το οποίο μάλιστα καθορίζεται αναλογικά με τις κυρίες διαστάσεις του πλοίου. Απώτερος στόχος της μεθόδου είναι η σχεδίαση της βέλτιστης υποδιαίρεσης του πλοίου προκειμένου να ικανοποιούνται οι απαιτήσεις των κανονισμών. Οδηγούμαστε στο συμπέρασμα ότι η προσδιοριστική μέθοδος στηρίζεται αρκετά στην στεγανή υποδιαίρεση και κρίνεται από την ευστάθεια που προκύπτει, από τα κριτήρια των κανονισμών.

Συνεπώς αν ικανοποιούνται τα κριτήρια ευστάθειας σε όλες τις καταστάσεις, αλλά ειδικά κατά τη δυσμενέστερη κατάσταση φόρτωσης (άφιξης 10%) τότε το πλοίο θεωρείται ασφαλές. Σχετικά με το πλοίο που μελετήσαμε συμπεράναμε, προκύπτει ότι ικανοποιεί τα κριτήρια ευστάθειας τόσο σε άθικτη ευστάθεια όσο και μετά από βλάβη. Θεωρήσαμε δηλαδή ότι έχουμε βλάβη που εκτείνεται σε τρία διαμερίσματα και στη συνέχεια κάναμε έλεγχο ευστάθειας μετά από βλάβη. Το αποτέλεσμα του ελέγχου ήταν το πλοίο να περάσει με επιτυχία τον έλεγχο και για τις τρεις καταστάσεις φόρτωσης.

Στην πιθανοτική μέθοδο μας δίνεται η δυνατότητα να μελετήσουμε ένα μεγαλύτερο εύρος πιθανών ρηγμάτων καθώς δεν στοχεύει μόνο στην δυσμενέστερη κατάσταση. Έτσι μελετάμε ένα πολύ μεγαλύτερο σύνολο σεναρίων έστω και φαινομενικά ακίνδυνων, των οποίων όμως η συνολική επιρροή θα μπορούσε να συνεισφέρει αρνητικά στην τελική κατάσταση ευστάθειας. Όσον αφορά το πλοίο της εργασίας προέκυψε ότι ο επιτευχθείς δείκτης υποδιαίρεσης (A) είναι μεγαλύτερος από τον απαιτούμενο δείκτη υποδιαίρεσης (R), το οποίο αποτελεί κριτήριο που ικανοποιεί τους κανονισμούς.

Εν κατακλείδι, και οι δύο μέθοδοι αποτελούν τις πιο λειτουργικές και αξιόπιστες μεθόδους για τον έλεγχο ευστάθειας των πλοίων τόσο για την άθικτη όσο και στην περίπτωση που παρουσιαστεί ρήγμα στο πλοίο.

Συγκεκριμένα για το πλοίο που μελετήσαμε, ικανοποίησε όλους τους απαραίτητους κανονισμούς και κρίθηκε ασφαλές για κατάκλυση τριών γειτονικών διαμερισμάτων, και στις δύο μεθόδους ελέγχου.

ΚΕΦΑΛΑΙΟ 8^ο: ΠΡΟΤΑΣΕΙΣ

Ορμώμενοι από την παρούσα εργασία, θέλουμε να θέσουμε κάποιες προτάσεις που αφορούν αντικείμενα μελέτης τα οποία δεν κατορθώσαμε να μελετήσουμε κατά τη διάρκεια της εκπόνησης της εργασίας.

Οι προτάσεις που παραθέτουμε στη συνέχεια αφορούν την μελέτη σχετικά με:

- Την επίδραση στον δείκτη υποδιαίρεσης, των εσωτερικών ανοιγμάτων από τα οποία μπορεί να γίνει η εισροή ύδατος μεταξύ δύο γειτονικών διαμερισμάτων.
- Αξιολόγηση της ευστάθειας του πλοίου με δεδομένα που αφορούν τις προδιαγραφές των υλικών του πλοίου. Αναφερόμαστε σε μια μελέτη κατά την οποία θα εξετασθεί πως επηρεάζεται η ευστάθεια του πλοίου ανάλογα με το υλικό κατασκευής πλοίου, ώστε να γίνουν πιθανές βελτιστοποιήσεις.
- Λόγω των αυξημένων απαιτήσεων των πλοιοκτητών, προτείνουμε να γίνει μελέτη βελτιστοποίησης, προκειμένου να ικανοποιούνται τα κριτήρια ευστάθειας σε μεγαλύτερης χωρητικότητας και πολυτελέστερα πλοία.
- Θα θέλαμε να προτείνουμε την ενίσχυση των ερευνητικών κέντρων προκειμένου να τεθούν νέες μέθοδοι μελέτης, οι οποίες ενδεχομένως να βρίσκονται σε δοκιμαστικό στάδιο.
- Τέλος, θα είχε ενδιαφέρον να γίνει η αντίστοιχη μελέτη με εφαρμογή των συγκεκριμένων μεθόδων και σε άλλου είδους ναυπηγήματα.

ΚΕΦΑΛΑΙΟ 9^ο:

9.1 ΔΙΑΔΙΚΤΥΑΚΗ ΒΙΒΛΙΟΓΡΑΦΙΑ

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 - 1: «The Ship Stability Research Centre (SSRC)», Department of Naval Architecture and Marine Engineering, The Universities of Glasgow and Strathclyde, UK.
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ΠΑΡΑΡΤΗΜΑ

1. ΜΕΛΕΤΗ ΕΥΣΤΑΘΕΙΑΣ ΜΕΤΑ ΑΠΟ ΚΑΤΑΚΛΥΣΗ, ΜΕ ΤΗΝ ΝΤΕΤΕΡΜΙΝΙΣΤΙΚΗ ΜΕΘΟΔΟ.

Στο παράρτημα παραθέτουμε τους πίνακες με τα στοιχεία για τα *Load Cases* και τα σενάρια κατάκλυσης.

Loadcase - Departure 100%

Loadcase - Departure 100%

Damage Case - 1-2-3

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
STEERING GEAR ROOM[]	Fully flooded		95	
SLOPE[]	Fully flooded	95		
AUX EQPMNT[]	Fully flooded	95		
ABV STEERING GEAR ROOM[]	Fully flooded		95	
ABV SLOPE[]	Fully flooded	85		
ABV AUX EQPMNT[]	Fully flooded	85		

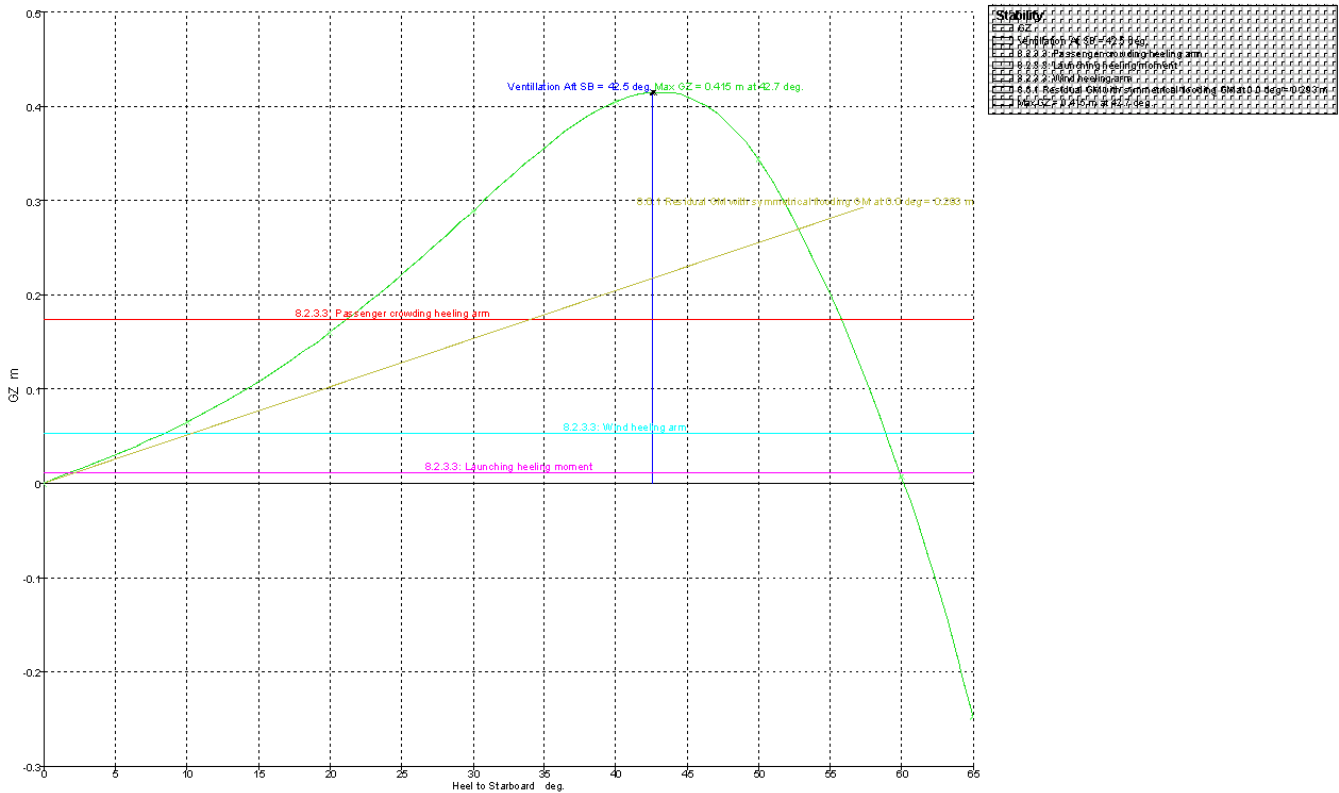
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.288	2.344	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.288	-2.344	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.670	-4.200	3.329	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.670	-1.500	3.329	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.670	4.200	5.231	4.578	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.985	-0.546	4.435	152.436	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	101.329	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	58.865	-8.294	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.017	8.473	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	29.129	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.688	0.346	5.117	365.231	

Εικόνα 87: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.000	3.150	2.320	4.312	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.400	3.150	2.480	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	2.173	0.880	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	-2.173	0.880	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.800	-5.213	0.880	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.910	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.108	1.381	1.638	61.351	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.247	0.000	0.335	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.200	-2.696	0.030	31.493	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	41.600	0.000	0.032	4.344	Maximum
No 1 FO DRAIN DÉRTY OIL	5%	2.694	0.135	2.694	0.135	37.316	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.316	-0.503	0.033	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.600	0.000	0.030	83.981	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.953	-4.354	0.047	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.000	-2.548	0.030	1.852	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.603	-0.428	0.238	479.328	
Total Loadcase			6012.404	1583.013	926.838	50.792	0.000	8.622	1069.145	
FS correction								0.178		
VCG fluid								8.799		

Εικόνα 88: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 89: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-0.288	-0.159	-0.064	0.000	0.065	0.160	0.289	0.405	0.343	0.008	-0.541	-1.184	-1.840	-2.455	-2.980	-3.368	-3.554	-3.471	-3.035	-2.233	-1.182	-0.000	
Area under GZ curve from zero heel m.deg	3.6127	1.3916	0.3046	0.0007	0.3118	1.4080	3.6298	7.1704	11.1186	13.0906	10.5506	1.9660	-	13.1674	34.6968	61.9618	93.8422	128.6455	164.0254	196.8664	223.4703	240.7047	246.6745
Displacement t	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6013	6012	6013	6013	6012	6012
Draft at FP m	2.868	3.307	3.529	3.612	3.530	3.308	2.868	2.077	0.657	-	-	-	n/a	39.888	23.887	18.424	15.615	13.898	12.791	12.158	11.958	11.957	-
Draft at AP m	6.589	6.581	6.543	6.506	6.542	6.580	6.588	6.442	6.253	6.188	6.476	7.757	n/a	2.341	3.693	4.162	4.417	4.631	4.907	5.224	5.419	5.483	-
WL Length m	123.380	123.368	123.388	122.890	123.388	123.367	123.380	123.396	119.390	111.658	115.574	118.181	120.324	121.815	122.768	123.447	123.950	124.304	124.426	123.988	123.743	123.667	123.667
Beam max extents on WL m	20.317	19.965	19.192	18.939	19.192	19.965	20.317	19.371	16.254	14.378	13.250	12.643	12.452	12.644	13.250	14.378	16.112	18.285	21.266	20.113	19.192	18.903	18.903

Εικόνα 90: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
Wetted Area m ²	2524.073	2526.552	2557.675	2554.225	2557.682	2526.444	2524.851	2554.190	2592.972	2596.046	2607.763	2622.783	2626.737	2645.987	2671.124	2714.753	2779.117	2879.042	3010.676	3141.749	3260.077	3217.215	3217.215
Waterpl. Area m ²	1508.581	1498.697	1500.069	1484.449	1500.096	1498.755	1508.606	1496.451	1380.081	1217.586	1098.970	1032.823	1002.932	1001.416	1028.031	1088.279	1183.114	1316.989	1493.744	1656.087	1805.607	1828.209	1828.209
Prismatic coeff. (Cp)	0.479	0.474	0.471	0.473	0.471	0.474	0.479	0.482	0.503	0.538	0.517	0.502	0.490	0.480	0.471	0.460	0.442	0.422	0.396	0.381	0.368	0.361	0.361
Block coeff. (Cb)	0.287	0.321	0.381	0.391	0.381	0.322	0.287	0.285	0.342	0.410	0.405	0.396	0.384	0.345	0.304	0.268	0.237	0.214	0.197	0.235	0.289	0.360	0.360
LCB from zero pt. (+ve fwd) m	50.621	50.627	50.635	50.641	50.638	50.632	50.623	50.611	50.597	50.574	50.552	50.511	50.500	50.490	50.498	50.523	50.559	50.606	50.642	50.680	50.699	50.703	50.703
LCF from zero pt. (+ve fwd) m	55.416	54.242	52.816	52.817	52.817	54.243	55.417	57.286	59.411	58.755	58.042	57.607	57.255	56.991	56.773	56.473	56.172	55.895	56.082	58.306	61.725	61.119	61.119
Max deck inclination deg	30.0412	20.0595	10.1138	1.4824	10.1137	20.0594	30.0411	40.0305	50.0249	60.0212	70.0179	80.0115	90.0000	99.9829	109.9603	119.9329	129.9007	139.8630	149.8160	159.7350	169.4759	176.6859	176.6859
Trim angle (+ve by stern) deg	1.9062	1.6776	1.5441	1.4824	1.5434	1.6759	1.9053	2.2359	2.8652	4.0955	6.9155	15.3900	n/a	18.5641	10.2389	7.2698	5.7198	4.7384	4.0333	3.5489	3.3473	3.3141	3.3141

Εικόνα 91: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion position = - 0.124 m)		31.6	n/a	5.848	4.097	2.212	0.287	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion position = - 0.124 m)		31.9	n/a	5.924	4.170	2.281	0.349	1.474	3.257	5.053	6.836	8.488	9.909	11.050	11.861	12.312	12.386	12.049	11.245	10.024	8.582	6.999
Ventilation	Downflooding point	55.3	0	9.858	8.149	6.304	4.415	2.576	0.860	0.761	2.188	3.438	4.527	5.428	6.126	6.597	6.812	6.738	6.319	5.475	4.161	2.568

Εικόνα 92: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Fore PS																						
Ventilation Fore SB	Downflooding point	165	0	9.858	11.404	12.714	13.786	14.623	15.216	15.467	15.417	15.006	14.196	13.006	11.459	9.608	7.522	5.290	3.038	0.927	0.911	2.568
Ventilation Mid PS	Downflooding point	51.6	0	9.984	8.222	6.279	4.248	2.248	0.302	1.621	3.441	5.118	6.615	7.887	8.898	9.613	10.001	10.021	9.611	8.732	7.431	5.855
Ventilation Mid SB	Downflooding point	149.2	0	9.984	11.500	12.736	13.688	14.383	14.763	14.726	14.292	13.462	12.246	10.682	8.817	6.711	4.439	2.096	0.185	2.283	4.157	5.855
Ventilation Aft PS	Downflooding point	42.5	0	8.363	6.573	4.599	2.530	0.512	1.500	3.548	5.587	7.509	9.219	10.662	11.779	12.533	12.897	12.829	12.265	11.223	9.872	8.304
Ventilation Aft SB	Downflooding point	136.9	0	8.363	9.854	11.060	11.976	12.655	12.971	12.810	12.158	11.083	9.654	7.920	5.948	3.802	1.551	0.705	2.832	4.770	6.596	8.304

Εικόνα 93: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 2-3-4

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

AUX ER[] Fully flooded 85

ABV SLOPE[] Fully flooded 85

ABV AUX EQPMNT[] Fully flooded 85

ABV AUX ER (RO-RO)[] Fully flooded 95

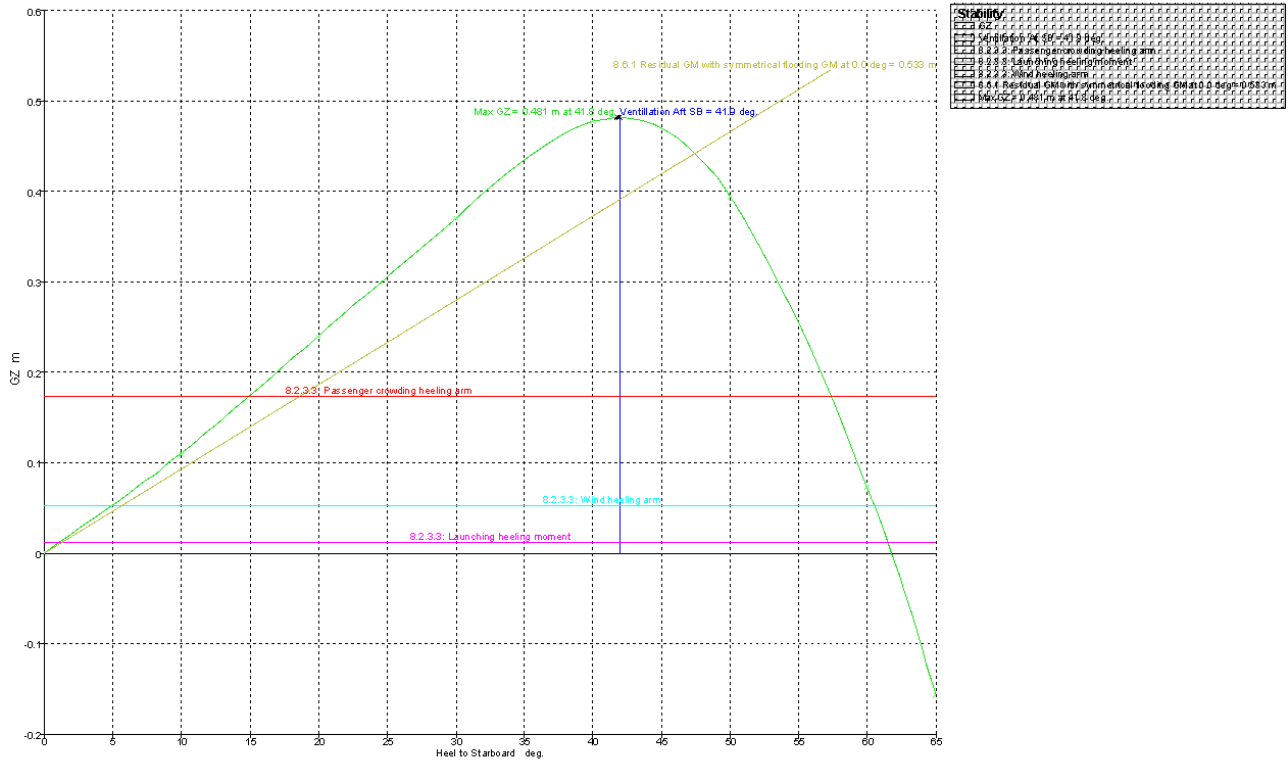
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.379	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.212	2.346	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.212	-2.346	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.660	-4.200	3.332	5.280	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.660	-1.500	3.332	10.313	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.642	4.200	5.233	4.580	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.928	-0.546	4.436	152.443	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	96.027	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.824	-5.600	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	58.947	8.475	2.871	2.489	Maximum
No 2 WBT	0%	120.288	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.685	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	55.998	3.150	2.320	4.314	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.391	3.150	2.480	8.628	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.580	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.580	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.554	5.223	0.883	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.554	2.173	0.883	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.554	-2.173	0.883	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.554	-5.213	0.883	1.510	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.196	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.168	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.896	0.000	0.520	39.972	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.032	1.381	1.639	61.371	

Εικόνα 94: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	91.939	0.000	0.339	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	48.993	-2.696	0.033	31.503	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	40.296	0.000	0.049	4.344	Maximum
No 1 FO DRAIN DεRTY OIL	5%	2.694	0.135	2.694	0.135	37.160	0.503	0.035	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.160	-0.503	0.035	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.577	0.000	0.030	84.009	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.749	-4.359	0.050	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	53.793	-2.548	0.033	1.853	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.240	-0.429	0.243	479.367	
Total Loadcase			6012.404	1583.013	926.838	50.787	0.000	8.622	1069.212	
FS correction								0.178		
VCG fluid								8.800		

Εικόνα 95: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 96: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-	-	-	0.000	0.111	0.241	0.371	0.477	0.394	0.073	0.425	1.023	1.637	2.220	2.739	3.131	3.329	3.273	2.902	2.185	1.140	-	0.000
Area under GZ curve	5.3234	2.2714	0.5334	0.0007	0.5407	2.2882	5.3399	9.6620	14.2189	16.7361	15.0939	7.8973	5.4187	24.7405	49.6071	79.0905	111.5741	144.8201	175.9713	201.7127	218.5203	224.2379	-

Εικόνα 97: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0		
from zero heel m.deg																								
Displacement t	6013	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	
Draft at FP m	3.134	3.461	3.663	3.737	3.665	3.460	3.131	2.466	1.223	-	-	-	n/a	-	-	-	-	-	-	-	-	-	-	
Draft at AP m	6.889	7.032	7.007	6.982	7.006	7.032	6.891	6.601	6.279	5.985	5.905	6.147	n/a	4.397	5.096	5.370	5.536	5.703	5.963	6.251	6.359	6.342	-	
WL Length m	123.377	123.380	123.446	122.587	123.445	123.380	123.377	123.385	120.427	114.599	117.226	120.001	121.754	122.757	123.446	123.930	124.250	124.322	123.815	123.220	123.047	123.063	122.863	
Beam max extents on WL m	20.572	20.040	19.192	18.919	19.192	20.040	20.573	19.365	16.254	14.944	13.250	12.643	12.451	12.643	13.250	14.378	16.078	18.040	20.645	20.113	19.192	18.960	18.960	
Wetted Area m ²	2604.826	2622.768	2638.462	2637.640	2638.503	2622.621	2604.395	2630.161	2664.932	2676.573	2675.038	2679.953	2690.841	2701.921	2723.591	2758.361	2810.507	2895.759	3021.242	3147.860	3205.453	3204.683	-	-
Waterpl. Area m ²	1462.878	1459.382	1466.437	1455.277	1466.523	1459.381	1462.791	1444.529	1338.553	1221.728	1107.767	1048.774	1024.655	997.392	1003.945	1059.938	1151.260	1279.504	1439.358	1633.229	1765.104	1763.656	-	-
Prismatic coeff. (Cp)	0.456	0.444	0.440	0.443	0.440	0.444	0.456	0.467	0.489	0.520	0.509	0.496	0.486	0.480	0.478	0.476	0.470	0.460	0.442	0.427	0.416	0.414	-	-
Block coeff. (Cb)	0.275	0.307	0.358	0.366	0.358	0.307	0.275	0.280	0.335	0.381	0.409	0.403	0.393	0.353	0.315	0.281	0.251	0.233	0.222	0.261	0.325	0.412	-	-
LCB from zero pt. (+ve fwd) m	50.622	50.623	50.618	50.621	50.625	50.613	50.614	50.621	50.610	50.587	50.577	50.573	50.552	50.547	50.558	50.578	50.605	50.634	50.665	50.699	50.717	50.711	-	-
LCF from zero pt. (+ve fwd) m	55.254	53.404	51.712	51.604	51.712	53.404	55.251	57.936	60.060	59.671	58.187	57.225	56.473	57.108	57.687	57.593	57.419	57.234	57.828	59.792	60.276	59.548	-	-
Max deck inclination deg	30.0419	20.0707	10.1399	1.6629	10.1396	20.0708	30.0420	40.0274	50.0203	60.0154	70.0122	80.0076	90.0000	99.9886	109.9746	119.9588	129.9415	139.9226	149.9012	159.8602	169.7036	177.4662	-	-
Trim angle (+ve by stern) deg	1.9235	1.8294	1.7132	1.6629	1.7114	1.8298	1.9264	2.1180	2.5894	3.4951	5.7081	12.5766	n/a	15.3253	8.2235	5.7081	4.3945	3.5610	2.9547	2.5741	2.5033	2.5338	-	-

Εικόνα 98: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Margin Line (immersion pos = - 0.124 m)		30.1	n/a	5.369	3.638	1.787	0.024	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion pos = - 0.124 m)		30.5	n/a	5.445	3.711	1.856	0.086	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore PS	Downflooding point	53.1	0	9.693	7.978	6.129	4.183	2.298	0.536	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore SB	Downflooding point	161.8	0	9.693	11.233	12.539	13.554	14.346	14.893	15.049	14.893	14.394	13.535	12.306	10.723	8.851	6.761	4.548	2.332	0.304	-	-
Ventilation Mid PS	Downflooding point	50.5	0	9.701	7.942	6.008	4.004	2.029	0.094	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Mid SB	Downflooding point	148.8	0	9.701	11.220	12.465	13.444	14.166	14.557	14.507	14.044	13.190	11.957	10.387	8.545	6.473	4.241	1.948	-	-	-	-
Ventilation Aft PS	Downflooding point	41.9	0	7.926	6.153	4.206	2.271	0.370	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Aft SB	Downflooding point	139.6	0	7.926	9.434	10.667	11.717	12.514	12.915	12.846	12.264	11.251	9.843	8.144	6.274	4.232	2.079	0.086	-	-	-	-

Εικόνα 99: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 3-4-5

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

No 4 LO Circ[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

AUX ER[] Fully flooded 85

ER[] Fully flooded 85

ABV AUX EQPMNT[] Fully flooded 85

ABV AUX ER (RO-RO)[] Fully flooded 95

ABV ER[] Fully flooded 95

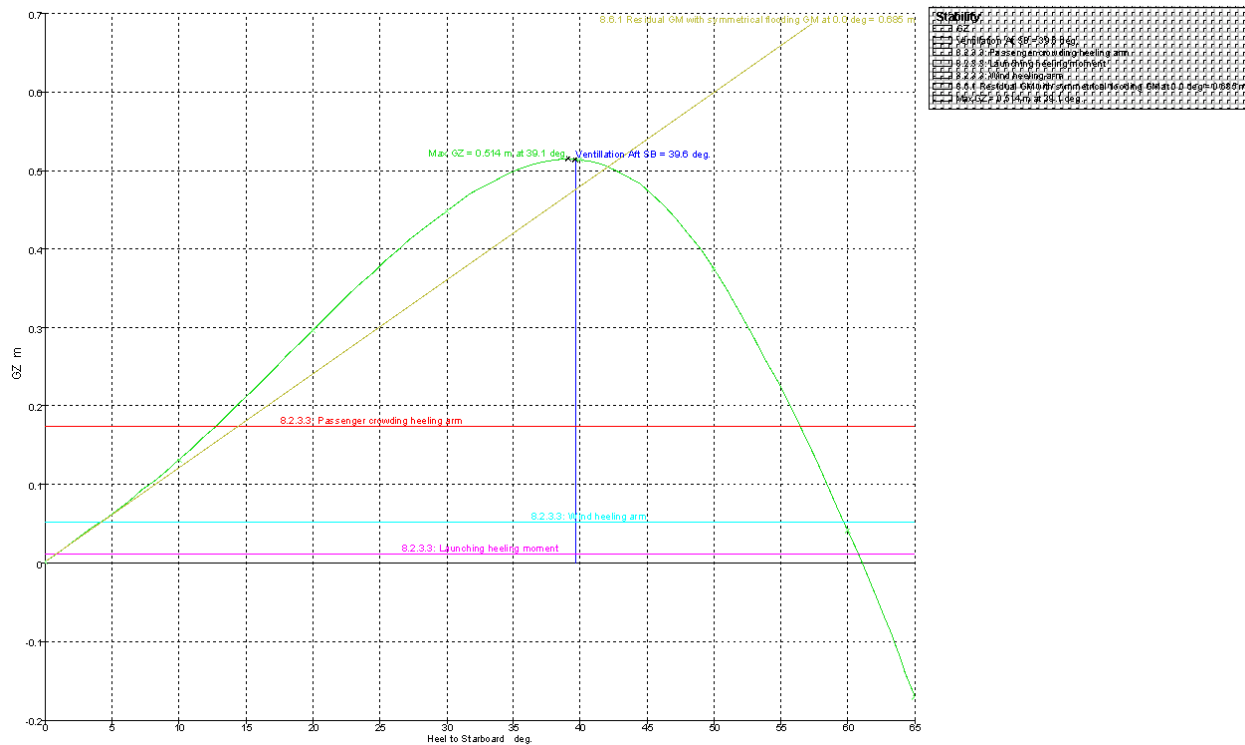
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.354	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.209	2.346	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.209	-2.346	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.662	-4.200	3.336	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.662	-1.500	3.336	10.314	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.643	4.200	5.235	4.580	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.927	-0.546	4.438	152.444	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	96.027	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum

Εικόνα 100: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Heeling Port	0%	50.570	0.000	49.337	0.000	55.821	-5.600	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	58.939	8.475	2.871	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.685	0.346	5.117	365.231	
LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	55.997	3.150	2.320	4.314	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.390	3.150	2.480	8.629	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.578	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.578	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.524	5.223	0.884	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.524	2.173	0.884	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.524	-2.173	0.884	1.444	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.195	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.164	0.900	1.986	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.895	0.000	0.520	39.975	Maximum
TOTAL LUBE OIL	70.37%	97.234	68.426	111.414	78.730	47.518	1.883	1.696	59.866	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	91.901	0.000	0.340	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	48.967	-2.696	0.033	31.506	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	40.190	0.000	0.052	4.344	Maximum
No 1 FO DRAIN D&RTY OIL	5%	2.694	0.135	2.694	0.135	37.141	0.503	0.035	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.141	-0.503	0.035	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.574	0.000	0.030	84.016	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.725	-4.361	0.050	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	53.767	-2.548	0.033	1.853	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.200	-0.429	0.244	479.377	
Total Loadcase			6007.195	1575.778	921.050	50.795	0.005	8.629	1067.719	
FS correction								0.178		
VCG fluid								8.806		

Εικόνα 101: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 102: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-	-	-	0.001	0.128	0.294	0.445	0.514	0.383	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-
Area under GZ curve from zero heel m.deg	6.4938	2.7577	0.6341	0.0027	0.6061	2.6962	6.4244	11.3396	16.0062	18.3038	16.6136	9.9011	2.3571	20.0665	42.8269	69.9428	100.0802	131.2081	160.6321	185.0004	200.6974	205.9441	-
Displacement	6007	6007	6007	6007	6007	6008	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6008	6008	6007	6007	-
Draft at FP m	3.698	4.034	4.247	4.316	4.249	4.032	3.698	3.045	1.933	0.191	-	-	n/a	30.252	18.849	14.931	12.919	11.706	10.969	10.687	10.747	10.791	-
Draft at AP m	7.409	7.517	7.456	7.430	7.454	7.519	7.409	7.182	6.984	6.833	6.939	7.995	n/a	2.771	4.347	5.071	5.509	5.864	6.235	6.502	6.554	6.532	-
WL Length m	123.364	123.380	123.272	122.301	123.273	123.381	123.364	123.376	121.546	119.124	119.023	121.480	122.668	123.369	123.854	124.179	124.323	124.044	123.178	122.685	122.579	122.224	-
Beam max extents on WL m	21.002	20.107	19.192	18.904	19.192	20.107	21.002	19.305	16.254	15.108	13.250	12.643	12.452	12.644	13.250	14.378	16.153	18.167	20.592	20.113	19.192	18.950	-

Εικόνα 103: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
Wetted Area m ²	2758.991	2776.737	2778.822	2773.466	2778.952	2777.100	2759.456	2792.323	2821.955	2842.179	2831.702	2839.006	2837.118	2855.289	2866.754	2890.652	2927.916	2994.818	3104.077	3221.817	3243.372	3246.178	-
Waterpl. Area m ²	1372.507	1385.982	1377.040	1365.457	1377.117	1385.978	1372.490	1336.037	1221.563	1154.701	1062.752	1004.176	985.324	977.780	952.733	991.768	1072.406	1193.392	1360.478	1558.954	1634.941	1612.339	-
Prismatic coeff. (Cp)	0.417	0.407	0.406	0.409	0.406	0.407	0.417	0.430	0.451	0.469	0.473	0.464	0.458	0.453	0.453	0.457	0.460	0.460	0.457	0.442	0.430	0.429	-
Block coeff. (Cb)	0.255	0.287	0.336	0.344	0.336	0.287	0.255	0.267	0.315	0.345	0.388	0.386	0.379	0.342	0.307	0.277	0.250	0.234	0.229	0.269	0.334	0.427	-
LCB from zero pt. (+ve fwd) m	50.643	50.650	50.647	50.642	50.655	50.641	50.641	50.634	50.645	50.639	50.622	50.608	50.601	50.594	50.597	50.615	50.640	50.677	50.705	50.725	50.732	50.742	-
LCF from zero pt. (+ve fwd) m	55.630	52.733	51.512	51.504	51.512	52.730	55.630	59.511	61.767	61.995	59.920	58.553	57.040	56.948	58.528	58.862	58.859	58.655	58.723	60.085	59.443	59.285	-
Max deck inclination deg	30.0409	20.0673	10.1289	1.5953	10.1286	20.0675	30.0410	40.0274	50.0203	60.0146	70.0103	80.0062	90.0000	99.9908	109.9795	119.9679	129.9564	139.9454	149.9334	159.9029	169.7810	177.8186	-
Trim angle (+ve by stern) deg	1.9009	1.7843	1.6439	1.5953	1.6420	1.7866	1.9013	2.1190	2.5866	3.4003	5.2647	11.3737	n/a	13.8095	7.3910	5.0400	3.7924	2.9916	2.4244	2.1438	2.1478	2.1814	-

Εικόνα 104: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Margin Line (immersion position = - 0.124 m)		27.6	n/a	4.925	3.198	1.329	-	0.424	2.094	3.770	5.408	7.015	8.538	9.888	10.963	11.614	11.824	11.642	11.054	10.037	8.748	7.381	5.866
Deck Edge (immersion position = - 0.124 m)		27.9	n/a	5.001	3.270	1.398	-	0.362	2.041	3.727	5.376	6.995	8.532	9.895	10.983	11.646	11.868	11.696	11.117	10.106	8.822	7.458	5.942
Ventilation	Downflooding point	50.5	0	9.127	7.419	5.601	3.697	1.854	0.080	-	1.688	3.335	4.756	5.950	6.907	7.634	8.101	8.277	8.128	7.596	6.571	5.097	3.487

Εικόνα 105: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Fore PS																							
Ventilation Fore SB	Downflooding point	159.2	0	9.127	10.674	12.011	13.069	13.902	14.438	14.543	14.275	13.697	12.786	11.541	9.968	8.121	6.073	3.915	1.772	0.162	1.843	3.487	-
Ventilation Mid PS	Downflooding point	48.1	0	9.181	7.427	5.507	3.533	1.585	-	0.360	2.318	4.213	5.952	7.491	8.778	9.751	10.377	10.647	10.529	9.971	8.960	7.590	6.028
Ventilation Mid SB	Downflooding point	147.5	0	9.181	10.706	11.964	12.973	13.721	14.103	14.032	13.527	12.638	11.383	9.806	7.981	5.964	3.809	1.602	0.533	2.504	4.312	6.028	-
Ventilation Aft PS	Downflooding point	39.6	0	7.466	5.697	3.739	1.818	0.075	2.009	3.949	5.874	7.719	9.392	10.795	11.788	12.344	12.489	12.200	11.442	10.331	9.029	7.517	-
Ventilation Aft SB	Downflooding point	139.7	0	7.466	8.977	10.200	11.264	12.069	12.463	12.412	11.877	10.883	9.494	7.801	5.955	4.008	1.976	0.061	1.998	3.870	5.749	7.517	-

Εικόνα 106: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 4-5-6

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

CW DRAIN[] Fully flooded 95
 No 4 LO Circ[] Fully flooded 95
 AUX ER[] Fully flooded 85
 ER[] Fully flooded 85
 WORKSHOP[] Fully flooded 95
 ABV AUX ER (RO-RO)[] Fully flooded 95
 ABV ER[] Fully flooded 95
 ABV WORKSHOP[] Fully flooded 95

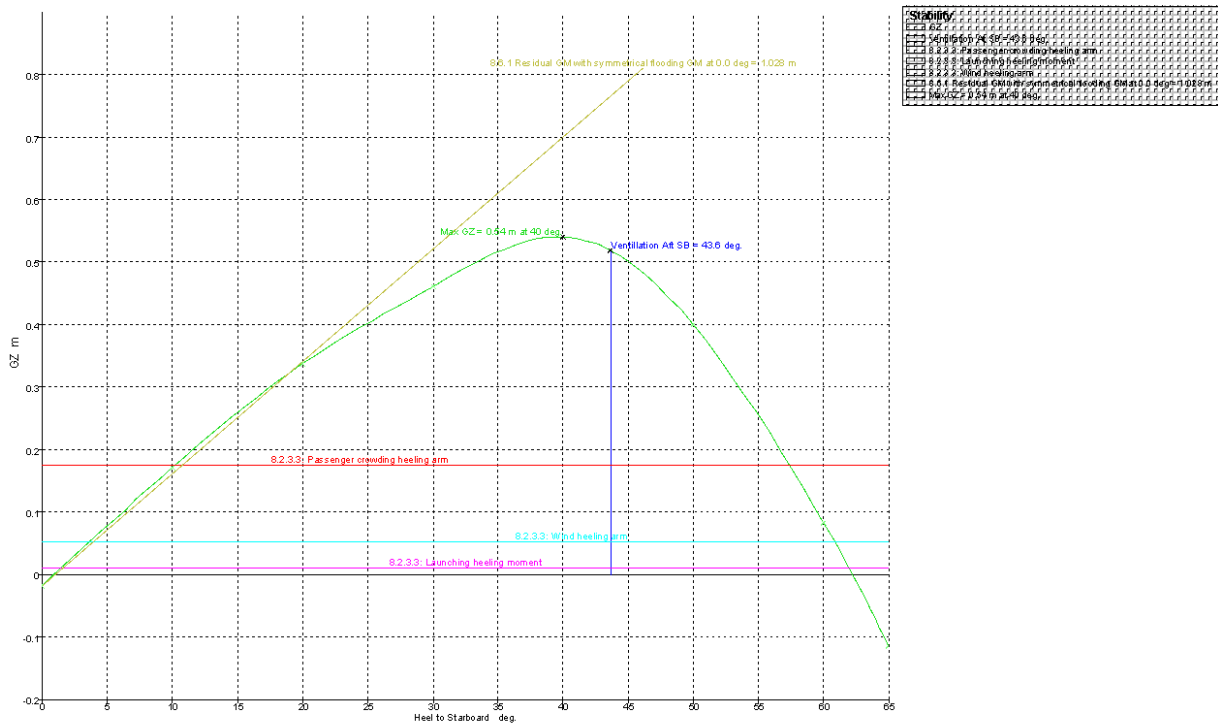
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.363	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.210	2.346	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.210	-2.346	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.670	-4.200	3.345	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.670	-1.500	3.345	10.314	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.652	4.200	5.238	4.580	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.930	-0.546	4.440	152.444	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	96.027	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified

Εικόνα 107: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.815	-5.600	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	58.942	8.475	2.871	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.685	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	55.997	3.150	2.320	4.314	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.391	3.150	2.480	8.628	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.579	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.579	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.535	5.223	0.884	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.535	2.173	0.884	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.535	-2.173	0.884	1.444	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.196	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.165	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.895	0.000	0.520	39.974	Maximum
TOTAL LUBE OIL	70.37%	97.234	68.426	111.414	78.730	47.521	1.883	1.696	59.864	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	91.915	0.000	0.340	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	48.977	-2.696	0.033	31.505	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	40.222	0.000	0.051	4.344	Maximum
No 1 FO DRAIN DêRTY OIL	5%	2.694	0.135	2.694	0.135	37.148	0.503	0.035	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.148	-0.503	0.035	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.734	-4.360	0.050	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	53.777	-2.548	0.033	1.853	Maximum
TOTAL MISC	5%	166.475	8.324	166.475	8.324	78.968	-0.454	0.256	395.360	
Total Loadcase			6006.703	1565.929	920.558	50.796	0.005	8.629	983.699	
FS correction								0.164		
VCG fluid								8.793		

Εικόνα 108: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 109: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	0.461	0.337	0.170	0.018	0.207	0.371	0.493	0.572	0.408	0.072	0.348	0.825	1.362	1.908	2.410	2.810	3.060	3.086	2.784	2.017	0.991	0.005	-
Area under GZ curve from zero heel m.deg	7.3512	3.3366	0.7677	0.0333	1.1319	4.0575	8.3927	13.8391	18.9424	21.4380	20.1044	14.2886	3.3878	12.9799	34.6325	60.8330	90.3323	121.2749	150.9741	175.3270	190.4312	195.3546	-
Displacement t	6007	6007	6006	6006	6007	6007	6007	6007	6007	6006	6007	6007	6006	6006	6007	6007	6007	6006	6007	6007	6007	6007	6007
Draft at FP m	4.898	5.199	5.383	5.457	5.386	5.200	4.896	4.329	3.445	2.162	0.199	7.563	n/a	22.661	15.030	12.471	11.203	10.486	10.102	10.027	10.168	10.228	-
Draft at AP m	6.405	6.651	6.673	6.646	6.673	6.651	6.405	5.911	5.330	4.609	3.514	1.112	n/a	10.560	8.453	7.772	7.470	7.319	7.296	7.348	7.289	7.257	-
WL Length m	123.333	123.344	123.382	122.846	123.382	123.344	123.333	123.320	123.328	123.348	121.518	122.880	123.538	123.938	124.170	124.210	123.958	123.236	122.345	122.002	122.028	121.097	-
Beam max extents on WL m	20.800	20.090	19.192	18.935	19.192	20.090	20.799	19.344	16.254	14.378	13.981	12.644	12.451	12.643	13.250	14.378	16.012	17.684	19.690	20.113	19.192	18.917	-

Εικόνα 110: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
Wetted Area m ²	2784.639	2805.537	2832.444	2829.503	2832.762	2805.119	2784.976	2802.694	2838.282	2863.268	2878.304	2849.164	2828.582	2840.947	2855.721	2873.890	2901.414	2956.535	3066.178	3200.903	3222.678	3224.840	-
Waterpl. Area m ²	1357.791	1363.392	1392.838	1387.623	1392.950	1363.409	1357.741	1336.918	1226.157	1180.688	1145.137	1065.295	980.160	936.188	941.840	983.837	1061.900	1189.388	1383.899	1589.353	1596.917	1570.508	-
Prismatic coeff. (Cp)	0.441	0.425	0.419	0.420	0.419	0.425	0.441	0.461	0.477	0.485	0.494	0.487	0.483	0.485	0.492	0.504	0.518	0.530	0.529	0.506	0.493	0.494	-
Block coeff. (Cb)	0.264	0.293	0.343	0.380	0.343	0.293	0.264	0.276	0.325	0.369	0.391	0.439	0.434	0.388	0.348	0.312	0.283	0.269	0.265	0.297	0.372	0.492	-
LCB from zero pt. (+ve fwd) m	50.739	50.733	50.733	50.737	50.741	50.734	50.733	50.735	50.733	50.742	50.740	50.727	50.717	50.711	50.709	50.711	50.726	50.733	50.740	50.750	50.752	50.751	-
LCF from zero pt. (+ve fwd) m	53.901	51.031	48.533	48.424	48.536	51.031	53.898	57.526	59.612	60.285	59.789	56.879	57.523	58.301	58.316	57.996	57.505	56.781	55.546	56.151	55.949	56.101	-
Max deck inclination deg	30.0068	20.0117	10.0210	0.6093	10.0208	20.0117	30.0068	40.0040	50.0028	60.0020	70.0013	80.0009	90.0000	99.9982	109.9958	119.9927	129.9889	139.9839	149.9766	159.9602	169.9961	178.4816	-
Trim angle (+ve by stern) deg	0.7723	0.7438	0.6611	0.6093	0.6594	0.7437	0.7737	0.8106	0.9661	1.2537	1.9022	4.4370	n/a	6.1777	3.3665	2.4066	1.9123	1.6226	1.4377	1.3725	1.4750	1.5184	-

Εικόνα 111: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Marginal Line (immersion position = - 0.124 m)		32.9	n/a	5.721	3.975	2.148	0.447	-	1.119	2.706	4.296	5.844	7.345	8.656	9.616	10.216	10.480	10.387	9.944	9.121	7.955	6.651	5.136
Deck Edge (immersion position = - 0.124 m)		33.2	n/a	5.797	4.048	2.217	0.509	-	1.065	2.663	4.264	5.825	7.338	8.662	9.636	10.248	10.524	10.441	10.007	9.190	8.028	6.728	5.212
Ventilation Fore PS	Downflooding point	46.2	0	8.207	6.515	4.721	2.876	1.092	-	0.662	2.438	4.165	5.692	6.936	7.929	8.641	9.046	9.120	8.836	8.162	7.034	5.523	3.912
Ventilation Fore SB	Downflooding point	156.6	0	8.207	9.771	11.134	12.251	13.144	13.701	13.791	13.459	12.771	11.811	10.533	8.975	7.188	5.240	3.213	1.211	-	0.623	2.268	3.912
Ventilation Mid PS	Downflooding point	47.8	0	8.910	7.162	5.274	3.356	1.484	-	0.415	2.359	4.281	6.078	7.633	8.899	9.843	10.452	10.693	10.546	9.974	8.945	7.579	6.017
Ventilation Mid SB	Downflooding point	147.5	0	8.910	10.442	11.734	12.799	13.624	14.053	13.997	13.467	12.522	11.252	9.699	7.902	5.902	3.773	1.592	-	0.532	2.487	4.301	6.017
Ventilation Aft PS	Downflooding point	43.6	0	8.030	6.252	4.338	2.470	0.675	-	1.180	3.078	4.963	6.802	8.448	9.756	10.703	11.297	11.508	11.327	10.719	9.701	8.456	6.943
Ventilation Aft SB	Downflooding point	143.9	0	8.030	9.534	10.801	11.919	12.823	13.298	13.289	12.796	11.809	10.449	8.854	7.054	5.067	2.967	0.819	-	1.271	3.239	5.175	6.943

Εικόνα 112: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 5-6-7

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[] Fully flooded 95

CW DRAIN[] Fully flooded 95

No 4 LO Circ[] Fully flooded 95

ER[] Fully flooded 85

WORKSHOP[] Fully flooded 95

HEELING[] Fully flooded 95

ABV ER[] Fully flooded 95

ABV WORKSHOP[] Fully flooded 95

ABV HEELING[] Fully flooded 95

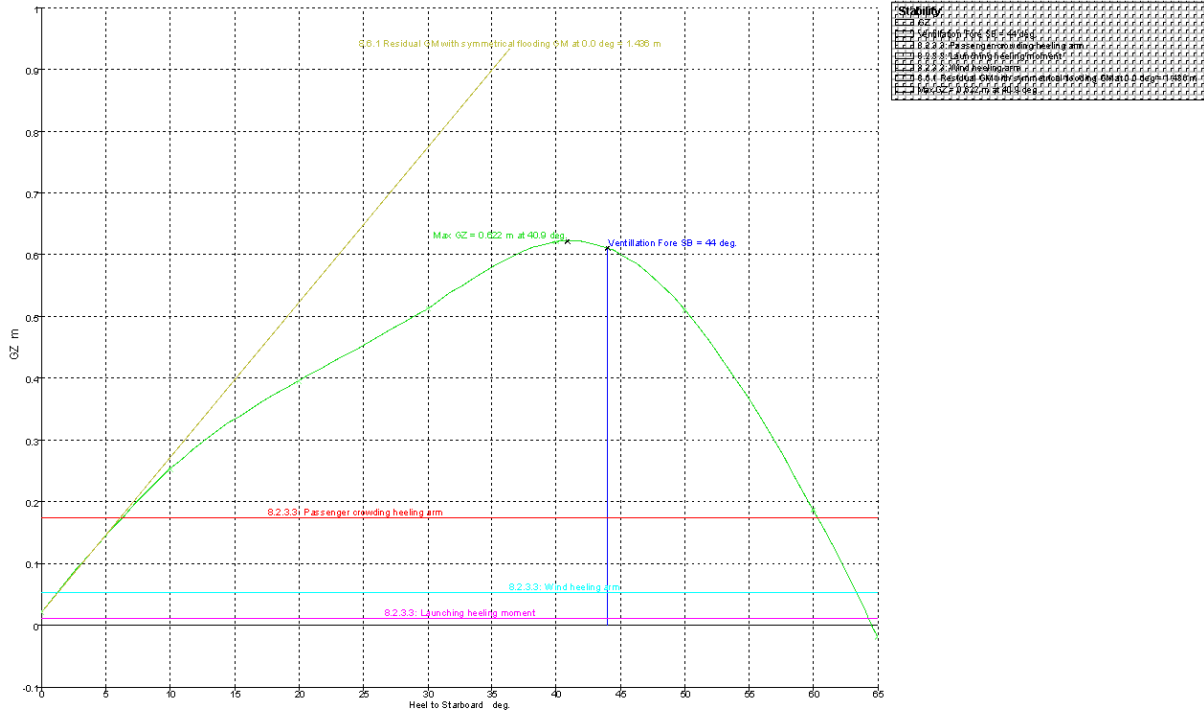
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.501	-2.612	0.032	30.865	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.238	2.345	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.238	-2.345	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.681	-4.200	3.349	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.681	-1.500	3.349	10.311	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.674	4.200	5.239	4.579	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.954	-0.546	4.441	152.439	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	96.027	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum

Εικόνα 113: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	25%	50.570	12.643	49.337	12.334	58.988	8.474	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	45.92%	674.879	309.909	658.418	302.351	11.687	0.346	5.117	365.231	
LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	55.999	3.150	2.320	4.313	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.396	3.150	2.480	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.592	-0.750	1.515	0.608	Maximum
LO RNVD	35%	5.540	1.939	6.156	2.155	51.592	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.699	5.223	0.881	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.699	2.173	0.881	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.699	-2.173	0.881	1.444	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.198	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.187	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.904	0.000	0.520	39.961	Maximum
TOTAL LUBE OIL	70.37%	97.234	68.426	111.414	78.730	47.562	1.883	1.695	59.845	
MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.120	0.000	0.336	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.115	-2.696	0.031	31.495	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	41.042	0.000	0.035	4.344	Maximum
No 1 FO DRAIN DERTY OIL	5%	2.694	0.135	2.694	0.135	37.252	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.252	-0.503	0.033	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.867	-4.355	0.047	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	53.915	-2.548	0.031	1.852	Maximum
TOTAL MISC	5%	166.475	8.324	166.475	8.324	79.218	-0.454	0.251	395.349	
Total Loadcase			6006.702	1516.592	920.558	50.798	0.005	8.629	983.664	
FS correction								0.164		
VCG fluid								8.793		

Εικόνα 114: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 115: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-	-	-	-	0.217	0.388	0.512	0.623	0.487	0.143	-	-	-	-	-	-	-	-	-	-	-	-	-
	0.513	0.396	0.252	0.021							0.282	0.768	1.343	1.914	2.430	2.839	3.096	3.128	2.834	2.028	0.985	0.005	
Area under GZ curve from zero heel m.deg	9.2612	4.7147	1.4186	0.0378	1.0175	4.1044	8.5995	14.3847	20.1622	23.4255	22.7740	17.5913	7.0761	9.2406	31.0242	57.4729	87.3038	118.6330	148.8207	173.4910	188.5866	193.4694	
Displacement t	6007	6007	6007	6006	6007	6007	6006	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007	6007
Draft at FP m	5.566	5.829	5.949	6.015	5.975	5.863	5.596	5.073	4.339	3.310	1.507	-	n/a	17.895	12.669	10.955	10.153	9.743	9.578	9.627	9.799	9.856	
Draft at AP m	5.408	5.750	5.898	5.911	5.905	5.764	5.423	4.792	3.891	2.621	0.450	-	n/a	18.824	12.498	10.325	9.218	8.553	8.172	8.055	7.975	7.951	
WL Length m	123.352	123.362	118.134	118.199	118.155	123.363	123.353	123.335	123.310	123.316	122.951	123.399	123.889	124.133	124.191	124.007	123.542	122.447	121.787	121.577	121.270	120.218	
Beam max extents on WL m	20.473	20.031	19.192	18.975	19.192	20.035	20.490	19.369	16.254	14.378	13.746	12.728	12.451	12.643	13.250	14.366	15.785	17.147	18.746	20.113	19.216	18.903	

Εικόνα 116: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
Wetted Area m ²	2745.552	2745.142	2775.649	2801.567	2780.595	2751.887	2751.542	2765.841	2801.405	2821.078	2826.592	2797.270	2759.466	2770.557	2782.392	2801.354	2829.837	2885.758	2993.119	3161.040	3180.260	3182.273	
Waterpl. Area m ²	1405.737	1404.615	1438.541	1494.750	1448.126	1406.767	1404.050	1413.898	1290.785	1220.789	1199.432	1095.858	1005.531	981.937	997.833	1038.911	1117.649	1243.665	1430.380	1644.765	1615.931	1595.982	
Prismatic coeff. (Cp)	0.473	0.452	0.461	0.458	0.460	0.451	0.472	0.495	0.511	0.519	0.522	0.522	0.525	0.532	0.543	0.559	0.583	0.608	0.610	0.583	0.573	0.575	
Block coeff. (Cb)	0.280	0.306	0.373	0.435	0.373	0.306	0.279	0.287	0.340	0.387	0.416	0.468	0.502	0.447	0.402	0.356	0.323	0.308	0.304	0.325	0.416	0.573	
LCB from zero pt. (+ve fwd) m	50.810	50.804	50.807	50.802	50.810	50.797	50.805	50.809	50.807	50.810	50.815	50.817	50.817	50.817	50.808	50.798	50.789	50.781	50.774	50.770	50.769	50.765	50.766
LCF from zero pt. (+ve fwd) m	51.968	49.882	47.373	45.964	47.465	49.922	51.983	54.082	56.319	57.661	58.175	59.229	57.223	56.703	56.154	55.611	54.882	53.998	52.760	52.567	52.879	52.947	
Max deck inclination deg	30.0001	20.0000	10.0000	0.0533	10.0001	20.0001	30.0001	40.0001	50.0002	60.0002	70.0001	80.0001	90.0000	100.0000	110.0000	119.9999	129.9993	139.9977	149.9941	159.9863	169.9581	179.0236	
Trim angle (+ve by stern) deg	0.0809	0.0407	0.0260	0.0533	0.0356	0.0505	0.0886	0.1438	0.2297	0.3529	0.5417	1.1658	n/a	0.4760	0.0873	0.3226	0.4794	0.6098	0.7202	0.8054	0.9350	0.9764	

Εικόνα 117: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Margin Line (immersion pos = 92.958 m)		37.2	n/a	6.367	4.671	2.898	1.164	-	0.454	2.037	3.607	5.117	6.488	7.564	8.336	8.837	9.204	9.265	8.999	8.363	7.291	5.975	4.436
Deck Edge (immersion pos = 92.958 m)		37.5	n/a	6.442	4.745	2.967	1.226	-	0.400	1.993	3.574	5.097	6.481	7.571	8.355	8.864	9.247	9.318	9.062	8.432	7.364	6.051	4.512

Εικόνα 118: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Ventilation Fore PS	Downflooding point	43.9	0	7.796	6.086	4.263	2.435	0.683	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore SB	Downflooding point	155	0	7.796	9.342	10.676	11.809	12.736	13.295	13.403	13.055	12.291	11.257	9.962	8.416	6.661	4.770	2.815	0.894	0.882	-	-
Ventilation Mid PS	Downflooding point	48.3	0	8.936	7.185	5.308	3.407	1.557	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Mid SB	Downflooding point	148	0	8.936	10.464	11.768	12.851	13.698	14.155	14.131	13.619	12.684	11.440	9.893	8.084	6.062	3.910	1.706	-	-	-	-
Ventilation Aft PS	Downflooding point	47.6	0	8.618	6.856	5.005	3.154	1.369	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Aft SB	Downflooding point	147.1	0	8.618	10.138	11.469	12.604	13.518	14.052	14.104	13.658	12.799	11.592	10.032	8.188	6.112	3.886	1.591	-	-	-	-

Εικόνα 119: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 6-7-8

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[] Fully flooded 95
 CW DRAIN[] Fully flooded 95
 WORKSHOP[] Fully flooded 95
 HEELING[] Fully flooded 95
 HFO STORAGE[] Fully flooded 95
 ABV WORKSHOP[] Fully flooded 95
 ABV HEELING[] Fully flooded 95
 ABV HFO STORAGE[] Fully flooded 95

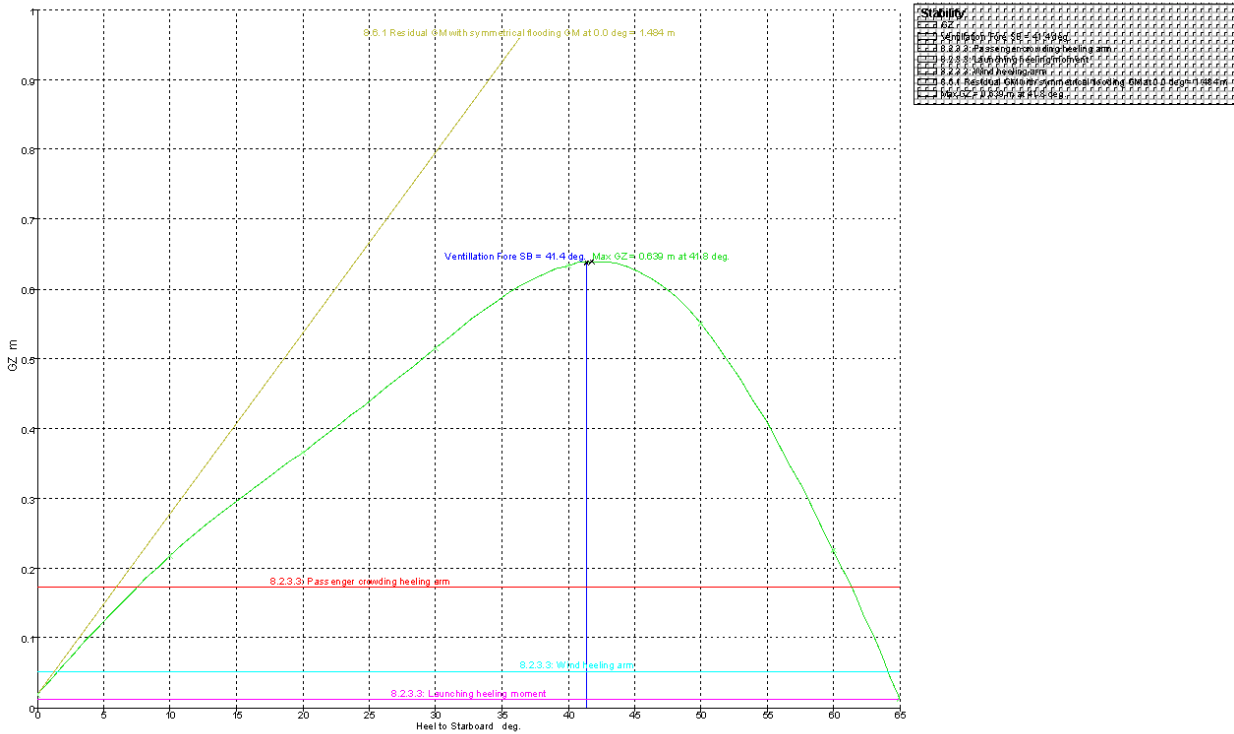
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.593	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.292	2.344	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.292	-2.344	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.684	-4.200	3.347	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.684	-1.500	3.347	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.685	4.200	5.238	4.578	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	64.993	-0.546	4.440	152.436	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	107.783	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	108.591	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.019	8.473	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	45.92%	674.879	309.909	658.418	302.351	11.688	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.000	3.150	2.320	4.312	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.400	3.150	2.480	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.601	-0.750	1.515	0.607	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.601	0.750	1.515	0.607	Maximum

Εικόνα 120: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.809	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.809	2.173	0.880	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.809	-2.173	0.880	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.809	-5.213	0.880	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.201	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.911	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.111	1.381	1.638	61.351	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.258	0.000	0.335	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.207	-2.696	0.030	31.493	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	41.649	0.000	0.033	4.344	Maximum
No 1 FO DRAIN DéRTY OIL	5%	2.694	0.135	2.694	0.135	37.322	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.322	-0.503	0.033	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	5%	4.842	0.242	4.842	0.242	53.960	-4.354	0.047	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.007	-2.548	0.030	1.852	Maximum
TOTAL MISC	5%	166.475	8.324	166.475	8.324	79.392	-0.454	0.250	395.347	
Total Loadcase			6011.912	1523.827	926.346	50.793	0.000	8.623	985.164	
FS correction									0.164	
VCG fluid									8.786	

Εικόνα 121: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 122: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0		
GZ m	-	-	-	-	0.187	0.361	0.516	0.627	0.514	0.172	-	-	-	-	-	-	-	-	-	-	-	-	0.000	
Area under GZ curve from zero heel m.deg	8.5416	4.1506	1.2103	0.0328	0.8603	3.6233	8.0146	13.8374	19.7574	23.3285	22.8359	17.3887	6.4434	10.2260	32.3657	59.1036	89.0709	120.3061	150.2981	174.8664	189.9180	194.7446	-	
Displacement t	6012	6012	6012	6012	6012	6012	6012	6011	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	
Draft at FP m	6.305	6.508	6.551	6.535	6.575	6.540	6.335	5.880	5.301	4.522	3.312	0.295	n/a	-	13.209	10.333	9.450	9.086	8.966	9.018	9.210	9.411	9.475	
Draft at AP m	4.409	4.806	5.041	5.161	5.052	4.820	4.421	3.705	2.508	0.757	-	-	n/a	25.558	12.519	25.988	15.957	12.484	10.677	9.575	8.905	8.632	8.550	8.522
WL Length m	118.447	118.611	118.654	118.626	118.673	118.638	118.471	118.099	123.361	123.339	123.331	123.788	124.138	124.227	124.066	123.698	122.944	121.630	121.154	121.141	120.421	119.440	-	
Beam max extents on WL m	20.178	19.963	19.192	18.900	19.192	19.971	20.198	19.371	16.254	14.378	13.250	13.368	12.451	12.643	13.250	14.338	15.579	16.776	17.940	20.113	19.192	18.900	18.900	18.900
Wetted Area m ²	2707.926	2692.858	2697.341	2746.909	2702.128	2699.106	2713.942	2741.161	2778.573	2783.007	2759.315	2759.294	2742.313	2722.858	2734.606	2754.655	2787.757	2847.544	2952.437	3149.578	3155.074	3155.074	3155.250	-
Waterpl. Area m ²	1482.694	1476.321	1483.156	1585.058	1492.881	1479.089	1483.161	1470.599	1348.956	1281.246	1208.202	1150.579	1086.117	1041.545	1060.363	1106.751	1186.135	1298.216	1457.872	1686.554	1634.646	1616.083	-	
Prismatic coeff. (Cp)	0.515	0.493	0.480	0.475	0.478	0.491	0.513	0.536	0.530	0.540	0.544	0.546	0.549	0.558	0.573	0.593	0.621	0.660	0.693	0.673	0.663	0.663	0.663	-
Block coeff. (Cb)	0.306	0.332	0.386	0.402	0.385	0.331	0.305	0.309	0.351	0.402	0.449	0.465	0.473	0.423	0.383	0.350	0.331	0.331	0.346	0.353	0.463	0.661	-	-
LCB from zero pt. (+ve fwd) m	50.871	50.881	50.872	50.859	50.856	50.867	50.865	50.874	50.884	50.884	50.893	50.898	50.906	50.896	50.875	50.852	50.829	50.812	50.791	50.783	50.787	50.779	50.779	-
LCF from zero pt. (+ve fwd) m	50.840	49.192	47.424	45.862	47.497	49.226	50.850	51.644	52.831	54.513	57.363	58.500	57.035	54.780	53.952	53.219	52.350	51.268	50.002	49.237	49.505	49.575	-	
Max deck inclination deg	30.0107	20.0161	10.0287	0.7041	10.0292	20.0164	30.0109	40.0076	50.0062	60.0047	70.0034	80.0020	90.0000	99.9980	109.9969	119.9970	129.9980	139.9994	150.0000	159.9981	169.9907	179.5118	-	
Trim angle (+ve by stern) deg	-	-	-	-	-	-	-	-	-	-	-	-	n/a	-	-	-	-	-	0.0579	0.2959	0.4412	0.4882	-	
	0.9720	0.8722	0.7738	0.7041	0.7805	0.8813	0.9805	1.1145	1.4311	1.9292	3.0029	6.5387	-	6.5207	2.8803	1.5546	0.8156	0.3120	-	-	-	-	-	

Εικόνα 123: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion position = 94.208 m)		34.8	n/a	5.977	4.297	2.507	0.770	0.833	2.406	3.958	5.461	6.854	8.007	8.807	9.272	9.406	9.193	8.617	7.729	6.748	5.408	3.859
Deck Edge (immersion position = 94.208 m)		35.2	n/a	6.053	4.369	2.575	0.832	0.780	2.363	3.926	5.442	6.848	8.014	8.827	9.305	9.450	9.248	8.679	7.797	6.821	5.484	3.935
Ventilation Fore PS	Downflooding point	41.3	0	7.420	5.656	3.798	1.964	0.228	1.516	3.268	4.996	6.635	8.041	9.083	9.777	10.122	10.096	9.677	8.840	7.581	6.046	4.432
Ventilation Fore SB	Downflooding point	153.1	0	7.420	8.912	10.210	11.338	12.279	12.845	12.968	12.621	11.826	10.705	9.378	7.839	6.114	4.266	2.376	0.535	1.168	2.790	4.432
Ventilation Mid PS	Downflooding point	48.6	0	8.988	7.238	5.358	3.446	1.593	0.253	2.139	4.005	5.760	7.316	8.593	9.570	10.221	10.513	10.409	9.864	8.825	7.432	5.858
Ventilation Mid SB	Downflooding point	148	0	8.988	10.518	11.817	12.889	13.732	14.214	14.216	13.741	12.838	11.568	10.004	8.177	6.135	3.955	1.732	0.420	2.365	4.152	5.858
Ventilation Aft PS	Downflooding point	51.6	0	9.222	7.532	5.718	3.849	2.036	0.290	1.507	3.262	4.861	6.300	7.571	8.614	9.385	9.839	9.932	9.595	8.722	7.444	5.910
Ventilation Aft SB	Downflooding point	149.4	0	9.222	10.814	12.181	13.298	14.183	14.766	14.859	14.495	13.748	12.596	11.038	9.143	6.982	4.638	2.217	0.145	2.258	4.162	5.910

Εικόνα 124: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 7-8-9

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[] Fully flooded 95
 HEELING[] Fully flooded 95
 HFO STORAGE[] Fully flooded 95
 FW ROOM 1,2[] Fully flooded 95
 ABV HEELING[] Fully flooded 95
 ABV HFO STORAGE[] Fully flooded 95
 ABV FW ROOM 1,2[] Fully flooded 95

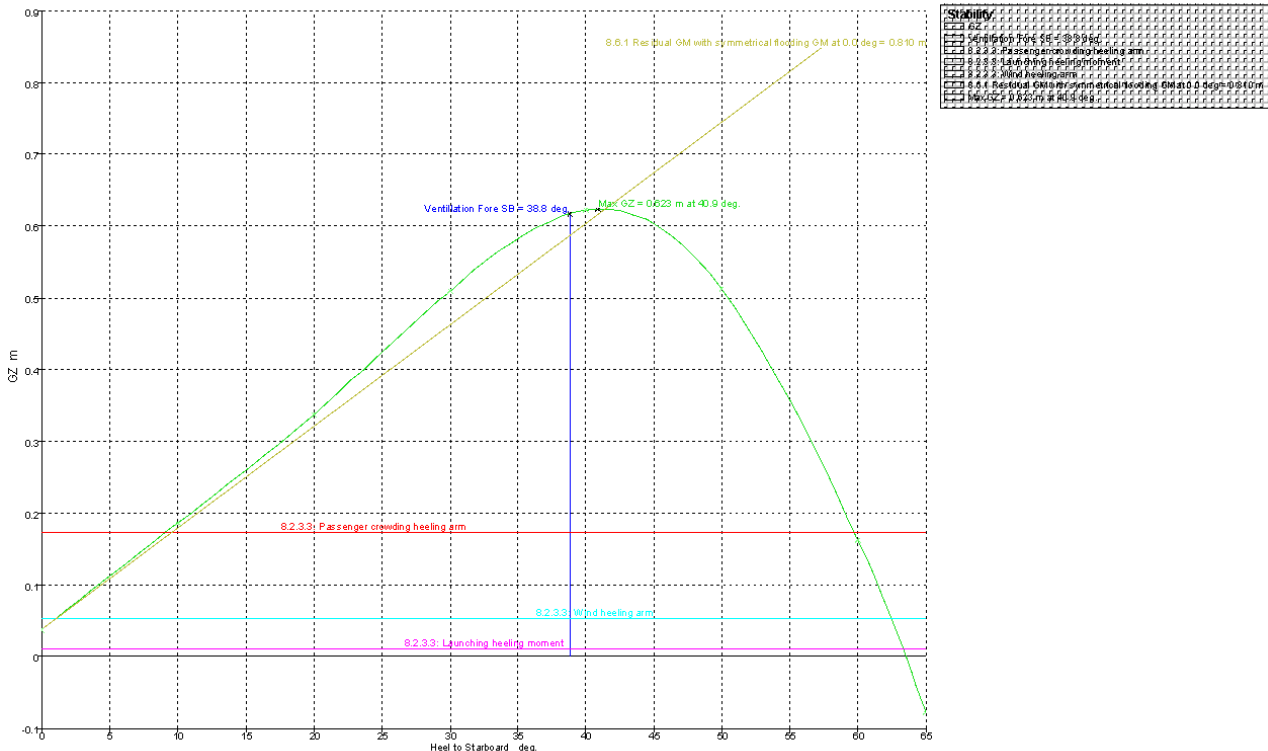
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long- Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.684	-2.612	0.033	30.865	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.342	2.343	4.825	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.342	-2.343	4.825	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.688	-4.200	3.345	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.688	-1.500	3.345	10.311	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.696	4.200	5.237	4.579	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	65.028	-0.546	4.440	152.440	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum

Εικόνα 125: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m^3	Total Volume m^3	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	107.983	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.050	8.473	2.870	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	45.92%	674.879	309.909	658.418	302.351	11.689	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.001	3.150	2.320	4.313	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.404	3.150	2.480	8.626	Maximum
LO RNV'TG	35%	5.540	1.939	6.156	2.155	51.609	-0.750	1.515	0.608	Maximum
LO RNV'TD	35%	5.540	1.939	6.156	2.155	51.609	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.917	5.223	0.881	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.917	2.173	0.881	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	40.917	-2.173	0.881	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	40.917	-5.213	0.881	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.202	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.215	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.917	0.000	0.520	39.961	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.144	1.381	1.638	61.355	
.MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.393	0.000	0.336	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.298	-2.696	0.031	31.495	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	42.245	0.000	0.036	4.344	Maximum
No 1 FO DRAIN D'RTY OIL	5%	2.694	0.135	2.694	0.135	37.390	0.503	0.033	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.390	-0.503	0.033	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.611	0.000	0.030	83.987	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	54.053	-4.354	0.048	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.098	-2.548	0.031	1.852	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.777	-0.428	0.239	479.337	
Total Loadcase			6012.404	1533.676	926.838	50.795	0.000	8.622	1069.163	
FS correction									0.178	
VCG fluid									8.800	

Εικόνα 126: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 127: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.509	-0.338	0.185	0.037	0.116	0.295	0.476	0.591	0.484	0.136	0.365	0.924	1.489	2.041	2.538	2.916	3.113	3.083	2.763	1.981	0.955	-0.000
Area under GZ curve from zero heel m.deg	7.9391	3.7171	1.1132	0.0677	0.3786	2.4189	6.2892	11.7431	17.3315	20.6042	19.5467	13.1225	1.0500	16.6262	39.5939	66.9906	97.3084	128.4816	158.0423	182.1097	196.8313	201.5379
Displacement t	6012	6013	6012	6012	6012	6012	6012	6012	6012	6012	6012	6013	6013	6013	6012	6012	6013	6012	6012	6012	6012	6012
Draft at FP m	6.961	7.088	7.078	7.044	7.102	7.121	6.990	6.657	6.261	5.742	5.098	3.806	n/a	8.907	8.097	7.963	7.994	8.130	8.368	8.700	8.931	9.005
Draft at AP m	3.652	4.089	4.356	4.480	4.366	4.100	3.664	2.889	1.527	0.572	4.709	16.987	n/a	30.789	18.327	13.975	11.688	10.284	9.417	9.023	8.929	8.899
WL Length m	119.034	119.145	119.198	113.067	119.220	119.173	119.059	118.784	119.788	122.486	123.533	124.060	124.281	124.174	123.850	123.250	122.040	120.546	120.367	120.577	119.661	118.688
Beam max extents on WL m	20.040	19.889	19.192	18.900	19.192	19.896	20.059	19.366	16.254	14.378	13.250	13.056	12.870	12.643	13.250	14.306	15.510	16.706	17.981	20.113	19.192	18.903

Εικόνα 128: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
Wetted Area m ²	2689.103	2658.670	2639.615	2617.727	2644.742	2664.499	2695.394	2739.975	2783.597	2780.638	2757.999	2758.038	2758.674	2744.135	2732.874	2753.340	2791.626	2858.203	2967.992	3167.397	3167.541	3168.365	
Waterpl. Area m ²	1531.160	1513.699	1494.553	1504.697	1502.404	1516.321	1531.681	1502.665	1383.270	1276.472	1202.941	1171.523	1139.652	1103.221	1101.484	1155.095	1233.647	1332.642	1464.809	1672.088	1610.987	1595.099	
Prismatic coeff. (Cp)	0.518	0.501	0.489	0.511	0.488	0.498	0.516	0.535	0.546	0.546	0.548	0.551	0.554	0.561	0.574	0.592	0.618	0.650	0.681	0.709	0.736	0.737	
Block coeff. (Cb)	0.311	0.338	0.371	0.393	0.370	0.337	0.310	0.311	0.366	0.410	0.456	0.479	0.435	0.401	0.364	0.334	0.319	0.319	0.331	0.349	0.463	0.590	
LCB from zero pt. (+ve fwd) m	50.936	50.936	50.937	50.928	50.918	50.929	50.929	50.941	50.949	50.949	50.959	50.968	50.975	50.979	50.972	50.946	50.916	50.877	50.847	50.825	50.811	50.800	50.795
LCF from zero pt. (+ve fwd) m	50.402	48.980	47.795	47.972	47.849	49.009	50.414	50.490	50.311	52.347	55.316	56.929	56.797	54.793	52.697	51.702	50.659	49.306	47.760	46.075	46.301	46.326	
Max deck inclination deg	30.0326	20.0499	10.0930	1.3136	10.0939	20.0507	30.0329	40.0227	50.0178	60.0132	70.0094	80.0053	90.0000	99.9942	109.9898	119.9880	129.9892	139.9926	149.9967	159.9994	170.0000	179.9457	
Trim angle (+ve by stern) deg	-1.6952	-1.5368	-1.3949	-1.3136	-1.4016	-1.5482	-1.7043	-1.9303	-2.4251	-3.2326	-5.0134	-10.5359	n/a	-11.0742	-5.2284	-3.0782	-1.8921	-1.1038	-0.5374	-0.1654	-0.0010	0.0543	

Εικόνα 129: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Margin Line (immersion pos = 94.832 m)		32.4	n/a	5.590	3.911	2.139	0.392	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion pos = 94.832 m)		32.8	n/a	5.665	3.981	2.205	0.453	1.182	2.782	4.332	5.836	7.234	8.436	9.320	9.815	9.952	9.729	9.125	8.196	6.940	5.515	4.435

Εικόνα 130: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Ventilation Fore PS	Downflooding point	38.7	0	7.045	5.270	3.388	1.534	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Fore SB	Downflooding point	150.5	0	7.045	8.525	9.799	10.906	11.820	12.366	12.499	12.158	11.369	10.209	8.806	7.250	5.537	3.717	1.869	0.086	-	-	-
Ventilation Mid PS	Downflooding point	48.3	0	9.013	7.256	5.361	3.429	1.548	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Mid SB	Downflooding point	147.5	0	9.013	10.535	11.819	12.869	13.685	14.156	14.177	13.734	12.848	11.566	9.966	8.119	6.061	3.862	1.625	-	-	-	-
Ventilation Aft PS	Downflooding point	54.4	0	9.764	8.069	6.253	4.364	2.521	0.778	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation Aft SB	Downflooding point	150.8	0	9.764	11.350	12.715	13.811	14.666	15.251	15.374	15.074	14.361	13.230	11.687	9.770	7.555	5.132	2.625	0.184	-	-	-

Εικόνα 131: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 8-9-10

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

HFO STORAGE[] Fully flooded 95

FW ROOM 1,2[] Fully flooded 95

AC PLANT ROOM[] Fully flooded 95

ABV HFO STORAGE[] Fully flooded 95

ABV FW ROOM 1,2[] Fully flooded 95

ABV AC PLANT ROOM[] Fully flooded 95

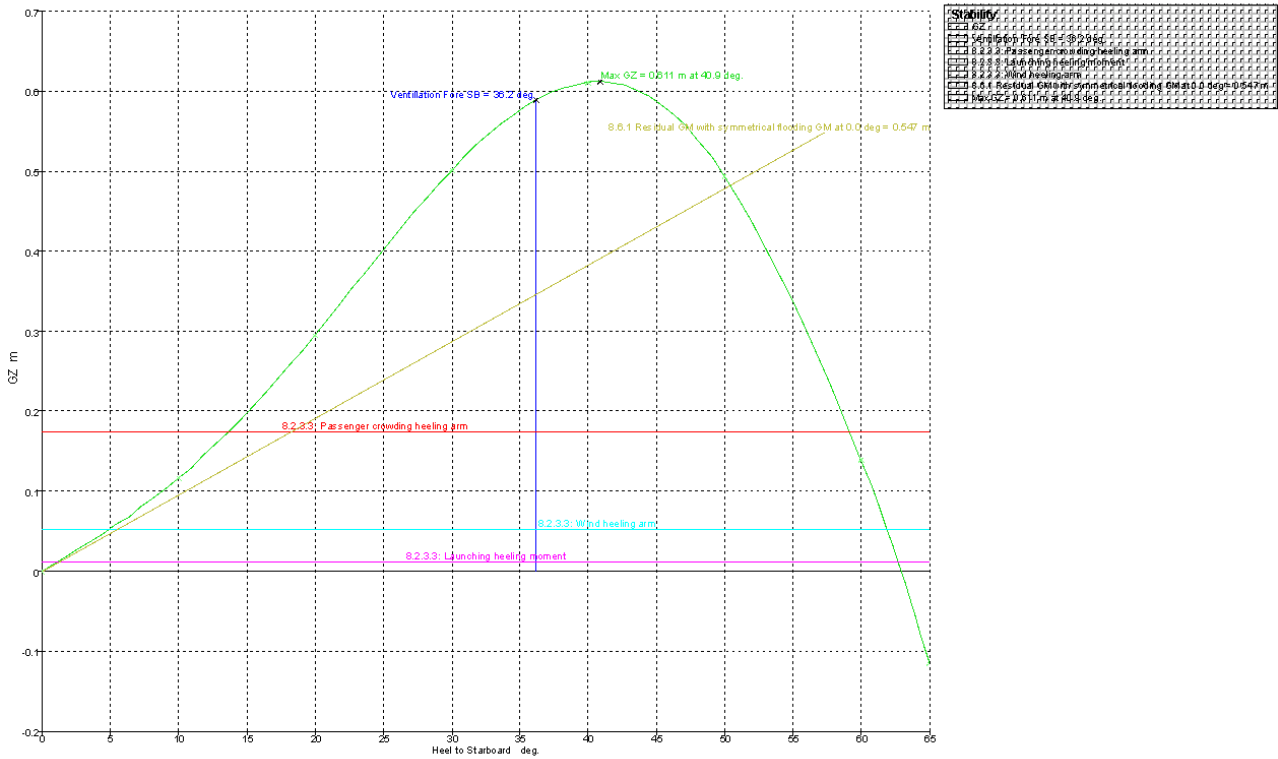
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.770	-2.612	0.034	30.871	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.359	2.343	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.359	-2.343	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.691	-4.200	3.343	5.280	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.691	-1.500	3.343	10.313	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.706	4.200	5.237	4.580	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	65.042	-0.546	4.439	152.449	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	107.983	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.079	8.472	2.871	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.690	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.002	3.150	2.320	4.314	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.408	3.150	2.480	8.627	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.617	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.617	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.018	5.223	0.883	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.018	2.173	0.883	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	41.018	-2.173	0.883	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	41.018	-5.213	0.883	1.510	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.204	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.229	0.900	1.985	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.923	0.000	0.520	39.969	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.175	1.381	1.638	61.367	

Εικόνα 132: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
MISC										
GREY WATER TANK	5%	119.826	5.991	119.826	5.991	92.520	0.000	0.338	356.124	Maximum
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.383	-2.696	0.032	31.501	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	42.791	0.000	0.046	4.344	Maximum
No 1 FO DRAIN DêRTY OIL	5%	2.694	0.135	2.694	0.135	37.454	0.503	0.034	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.454	-0.503	0.034	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.620	0.000	0.030	84.003	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	54.140	-4.354	0.049	1.167	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.183	-2.548	0.032	1.853	Maximum
TOTAL MISC	5%	176.325	8.816	176.325	8.816	77.927	-0.428	0.242	479.359	
Total Loadcase			6012.404	1583.013	926.838	50.797	0.000	8.622	1069.206	
FS correction								0.178		
VCG fluid								8.800		

Εικόνα 133: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 134: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.501	-0.294	-0.116	0.000	0.117	0.295	0.501	0.611	0.494	0.139	-0.396	-0.986	-1.565	-2.109	-2.590	-2.958	-3.138	-3.083	-2.742	-1.971	-0.945	-0.000
Area under GZ curve	6.5145	2.5467	0.5408	0.0007	0.5501	2.5572	6.5595	12.2669	17.9983	21.3427	20.1530	13.2530	0.4801	17.9288	41.4932	69.3550	100.0114	131.3121	160.7466	184.6492	199.2696	203.9118
Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
from zero heel m.deg																						
Displacement t	6012	6012	6013	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6012	6013	6012	6012	6012	6012	6012	6012
Draft at FP m	7.632	7.725	7.685	7.643	7.681	7.720	7.631	7.388	7.139	6.887	6.683	6.707	n/a	5.884	6.416	6.843	7.172	7.483	7.843	8.246	8.482	8.560
Draft at AP m	3.170	3.633	3.922	4.031	3.924	3.637	3.171	2.338	0.874	-1.486	-6.144	-19.891	n/a	33.839	19.909	15.001	12.414	10.816	9.814	9.334	9.231	9.196
WL Length m	119.734	119.757	119.682	112.923	119.679	119.752	119.733	119.784	121.518	123.150	123.867	124.231	124.316	124.086	123.610	122.776	120.995	119.673	119.807	119.899	119.020	117.977
Beam max extents on WL m	20.079	19.888	19.192	18.900	19.192	19.888	20.079	19.366	16.254	14.378	13.250	12.643	13.165	12.643	13.250	14.289	15.479	16.706	18.108	20.113	19.192	18.903
Wetted Area m ²	2712.199	2674.760	2642.642	2616.124	2642.510	2674.815	2711.908	2764.129	2802.017	2795.599	2779.976	2773.594	2771.286	2768.760	2756.923	2760.441	2799.710	2870.462	2984.418	3176.286	3187.578	3186.973
Waterpl. Area m ²	1528.327	1500.520	1461.773	1402.722	1461.842	1500.587	1528.323	1481.645	1373.270	1232.799	1156.047	1133.996	1126.822	1115.130	1114.043	1154.320	1240.738	1340.269	1464.508	1646.819	1594.918	1574.906
Prismatic coeff. (Cp)	0.505	0.490	0.480	0.505	0.480	0.490	0.505	0.518	0.527	0.533	0.541	0.546	0.551	0.558	0.568	0.585	0.609	0.635	0.656	0.676	0.696	0.706
Block coeff. (Cb)	0.307	0.335	0.341	0.364	0.342	0.335	0.307	0.307	0.359	0.407	0.453	0.486	0.409	0.386	0.351	0.323	0.310	0.308	0.314	0.332	0.434	0.534
LCB from zero pt. (+ve fwd) m	50.987	50.995	50.982	50.985	50.971	50.978	50.984	50.994	50.997	51.012	51.024	51.031	51.032	51.015	50.998	50.955	50.915	50.880	50.843	50.828	50.820	50.812
LCF from zero pt. (+ve fwd) m	49.761	48.383	47.447	47.003	47.439	48.372	49.759	49.233	48.429	50.072	52.498	54.428	55.326	54.416	52.217	50.356	49.272	47.841	46.198	44.147	43.888	43.892
Max deck inclination deg	30.0592	20.0928	10.1768	1.8506	10.1763	20.0924	30.0591	40.0408	50.0312	60.0232	70.0160	80.0086	90.0000	99.9905	109.9823	119.9780	129.9782	139.9822	149.9884	159.9934	169.9929	179.6739
Trim angle (+ve by stern) deg	-2.2851	-2.0963	-1.9276	-1.8506	-1.9247	-2.0917	-2.2842	-2.5861	-3.2076	-4.2832	-6.5448	-13.3824	n/a	14.0390	6.8816	4.1736	2.6843	1.7080	1.0100	0.5578	0.3834	0.3261

Εικόνα 135: Μογλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Marginal Line (immersion position = 96,081 m)		29.9	n/a	5.097	3.442	1.699	-	0.019	1.645	3.235	4.772	6.231	7.582	8.759	9.654	10.177	10.295	10.043	9.436	8.521	7.242	5.838	4.849
Deck Edge (immersion position = 96,081 m)		30.2	n/a	5.172	3.512	1.763	0.040	-	1.593	3.193	4.742	6.214	7.577	8.768	9.677	10.212	10.340	10.098	9.507	8.605	7.326	5.919	4.925
Ventilation Fore PS	Downflooding point	36.2	0	6.563	4.812	2.938	1.090	-	0.678	2.445	4.188	5.876	7.474	8.906	10.051	10.806	11.130	11.057	10.575	9.653	8.310	6.782	5.168
Ventilation Fore SB	Downflooding point	148.4	0	6.563	8.066	9.347	10.459	11.367	11.909	12.039	11.729	10.975	9.826	8.397	6.799	5.097	3.300	1.474	-	0.279	1.897	3.526	5.168
Ventilation Mid PS	Downflooding point	47.7	0	8.885	7.137	5.247	3.315	1.430	-	0.428	2.282	4.082	5.791	7.348	8.671	9.689	10.364	10.681	10.602	10.067	9.025	7.632	6.057
Ventilation Mid SB	Downflooding point	147.1	0	8.885	10.415	11.703	12.754	13.563	14.032	14.064	13.653	12.795	11.523	9.913	8.044	5.983	3.782	1.536	-	0.624	2.566	4.352	6.057
Ventilation Aft PS	Downflooding point	56.3	0	10.091	8.387	6.572	4.677	2.830	1.085	-	0.648	2.305	3.852	5.259	6.504	7.565	8.414	8.987	9.217	9.013	8.241	6.955	5.417
Ventilation Aft SB	Downflooding point	152	0	10.091	11.667	13.033	14.122	14.971	15.554	15.708	15.442	14.745	13.624	12.091	10.180	7.943	5.484	2.928	0.436	-	1.778	3.673	5.417

Εικόνα 136: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 9-10-11

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
GREY WATER TANK[]	Fully flooded		95	
FW ROOM 1,2[]	Fully flooded		95	
AC PLANT ROOM[]	Fully flooded		95	
SEWAGE TRMNT[]	Fully flooded		95	
ABV FW ROOM 1,2[]	Fully flooded		95	
ABV AC PLANT ROOM[]	Fully flooded		95	
ABV SEWAGE TRMNT[]	Fully flooded		95	

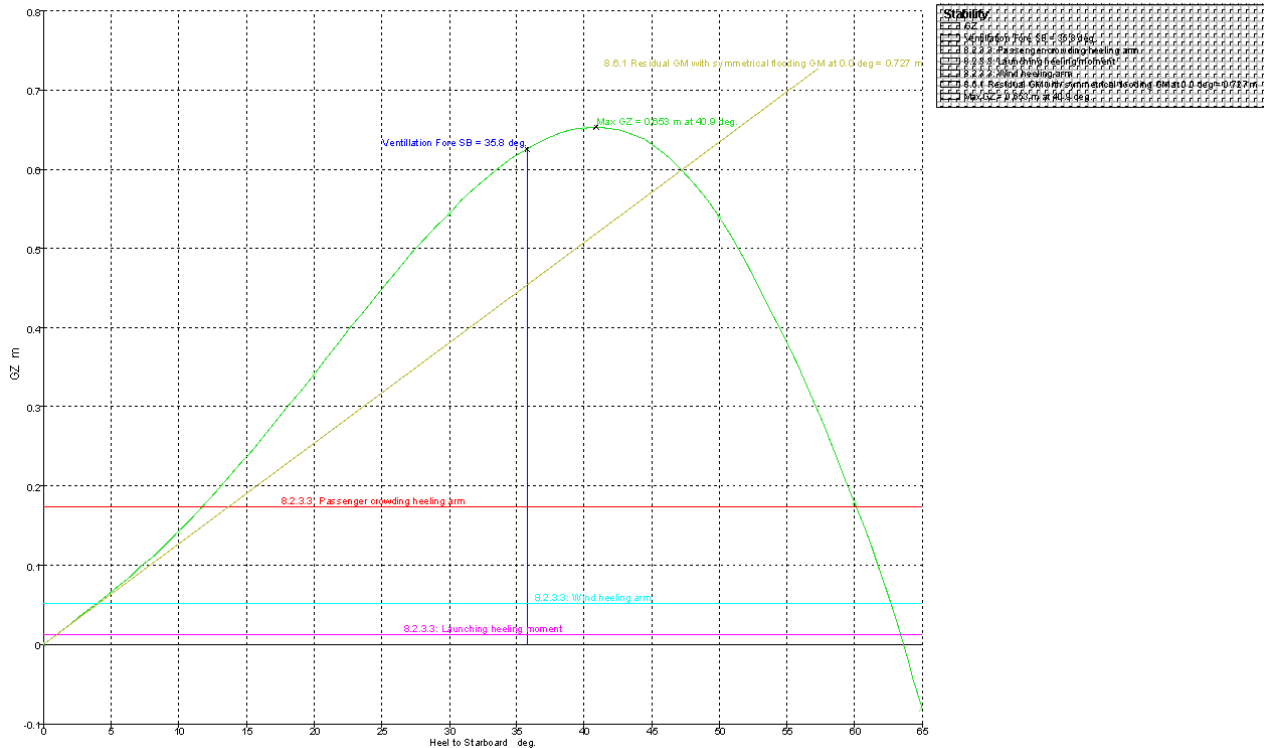
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.845	-2.612	0.036	30.879	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.367	2.343	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.367	-2.343	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.696	-4.200	3.345	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.696	-1.500	3.345	10.315	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.718	4.200	5.238	4.581	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	65.049	-0.546	4.440	152.463	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1	0%	119.245	0.000	116.337	0.000	107.983	0.000	0.000	0.000	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum

Εικόνα 137: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.104	8.472	2.872	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	42.72%	725.449	309.909	707.755	302.351	11.691	0.346	5.117	365.231	
LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.003	3.150	2.320	4.315	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.411	3.150	2.480	8.629	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.625	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.625	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.108	5.223	0.885	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.108	2.173	0.885	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	41.108	-2.173	0.885	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	41.108	-5.213	0.885	1.510	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.205	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.241	0.900	1.986	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.928	0.000	0.520	39.979	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.203	1.381	1.639	61.383	
MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.458	-2.696	0.034	31.509	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	43.098	0.000	0.054	4.344	Maximum
No 1 FO DRAIN DêRTY OIL	5%	2.694	0.135	2.694	0.135	37.511	0.503	0.036	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.511	-0.503	0.036	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.629	0.000	0.031	84.025	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	54.216	-4.354	0.051	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.258	-2.548	0.034	1.853	Maximum
TOTAL MISC	5%	56.499	2.825	56.499	2.825	47.106	-1.337	0.041	123.265	
Total Loadcase			6006.413	1463.188	920.847	50.756	0.000	8.630	713.142	
FS correction									0.119	
VCG fluid									8.749	

Εικόνα 138: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 139: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0		
GZ m	-	-	-	0.000	0.143	0.341	0.545	0.653	0.539	0.180	-	-	-	-	-	-	-	-	-	-	-	-	0.000	
Area under GZ curve from zero heel m.deg	7.4824	3.0525	0.6712	0.0007	0.6805	3.0639	7.5262	13.6503	19.8127	23.6007	22.7462	15.9603	3.0374	15.7585	39.8684	68.3671	99.7284	131.8119	162.0829	186.9529	202.3475	207.2211	-	
Displacement	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	
Draft at FP m	7.773	7.808	7.720	7.677	7.715	7.804	7.772	7.562	7.343	7.192	7.125	7.504	n/a	-	-	-	-	-	-	-	-	-	-	-
Draft at AP m	2.698	3.224	3.550	3.659	3.553	3.228	2.699	1.795	0.218	-	-	-	n/a	5.132	5.990	6.533	6.937	7.289	7.651	8.032	8.235	8.297	-	-
WL Length m	119.935	119.892	117.627	112.668	117.898	119.887	119.933	120.090	121.863	123.333	123.980	124.304	124.340	124.082	123.554	122.628	120.617	119.430	119.628	119.449	118.578	117.420	-	-
Beam max extents on WL m	19.881	19.811	19.192	18.900	19.192	19.811	19.881	19.305	16.254	14.378	13.250	12.643	13.122	12.643	13.250	14.237	15.358	16.491	17.961	20.113	19.192	18.906	-	-

Εικόνα 140: Μοχλοβραχίονας GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0		
Wetted Area m ²	2663.269	2623.722	2577.473	2550.243	2577.537	2623.792	2663.413	2712.028	2745.050	2737.420	2733.380	2725.443	2721.037	2721.096	2713.030	2712.467	2753.205	2825.465	2944.967	3142.470	3176.976	3176.946	-	-
Waterpl. Area m ²	1522.663	1499.559	1462.224	1426.684	1462.441	1499.622	1522.678	1489.201	1388.831	1237.682	1158.153	1133.050	1129.323	1126.381	1135.298	1170.221	1253.566	1361.243	1490.167	1673.399	1641.339	1617.343	-	-
Prismatic coeff. (Cp)	0.516	0.504	0.503	0.522	0.502	0.504	0.516	0.528	0.535	0.543	0.552	0.559	0.564	0.570	0.579	0.595	0.619	0.641	0.657	0.669	0.680	0.688	-	-
Block coeff. (Cb)	0.316	0.341	0.346	0.363	0.345	0.341	0.316	0.314	0.366	0.415	0.464	0.488	0.409	0.385	0.349	0.323	0.312	0.309	0.312	0.325	0.420	0.505	-	-
LCB from zero pt. (+ve fwd) m	50.980	50.985	50.970	50.969	50.955	50.971	50.976	50.983	50.999	51.015	51.021	51.031	51.033	51.014	50.997	50.950	50.905	50.854	50.821	50.792	50.783	50.783	-	-
LCF from zero pt. (+ve fwd) m	48.839	47.590	47.108	47.100	47.090	47.580	48.837	48.626	47.479	48.845	50.597	52.397	53.453	52.903	51.166	49.068	48.025	46.917	45.562	43.681	42.871	42.830	-	-
Max deck inclination deg	30.0765	20.1164	10.2167	2.0582	10.2158	20.1160	30.0765	40.0532	50.0403	60.0307	70.0214	80.0114	90.0000	99.9876	109.9766	119.9703	129.9696	139.9737	149.9803	159.9852	169.9781	179.3723	-	-
Trim angle (+ve by stern) deg	-	-	-	-	-	-	-	-	-	-	-	-	n/a	-	-	-	-	-	-	-	-	-	-	-
	2.5991	2.3480	2.1364	2.0582	2.1318	2.3438	2.5982	2.9531	3.6465	4.9308	7.5450	15.2812	-	15.9159	7.8857	4.8445	3.1683	2.0772	1.3187	0.8373	0.6755	0.6277	-	-

Εικόνα 141: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Marginal Line (immersion position = 97.331 m)		29.6	n/a	5.103	3.449	1.671	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion position = 97.331 m)		29.9	n/a	5.179	3.519	1.734	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ventilation	Downflooding point	35.8	0	6.574	4.823	2.911	1.027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
								0.749	2.513	4.268	5.950	7.533	8.954	10.101	10.872	11.209	11.138	10.660	9.760	8.453	6.961	5.365

Εικόνα 142: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Fore PS																							
Ventilation Fore SB	Downflooding point	147.8	0	6.574	8.077	9.319	10.395	11.293	11.839	11.955	11.651	10.911	9.773	8.341	6.728	5.015	3.216	1.388	-	0.386	2.041	3.706	5.365
Ventilation Mid PS	Downflooding point	48.3	0	9.033	7.282	5.376	3.432	1.543	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ventilation Mid SB	Downflooding point	147.5	0	9.033	10.560	11.831	12.869	13.675	14.147	14.195	13.803	12.961	11.700	10.086	8.203	6.123	3.904	1.637	-	0.555	2.536	4.342	6.054
Ventilation Aft PS	Downflooding point	58.6	0	10.415	8.706	6.903	5.025	3.182	1.443	-	0.238	1.856	3.383	4.781	6.030	7.106	7.985	8.598	8.875	8.716	7.988	6.701	5.159
Ventilation Aft SB	Downflooding point	153.2	0	10.415	11.985	13.362	14.467	15.321	15.909	16.115	15.886	15.209	14.097	12.561	10.635	8.369	5.871	3.269	0.732	-	1.525	3.419	5.159

Εικόνα 143: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 10-11-12

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

WBT No1[] Fully flooded 95
 GREY WATER TANK[] Fully flooded 95
 AC PLANT ROOM[] Fully flooded 95
 SEWAGE TRMNT[] Fully flooded 95
 BOW THRUSTER[] Fully flooded 95
 ABV AC PLANT ROOM[] Fully flooded 95
 ABV SEWAGE TRMNT[] Fully flooded 95
 ABV BOW THRUSTER[] Fully flooded 95

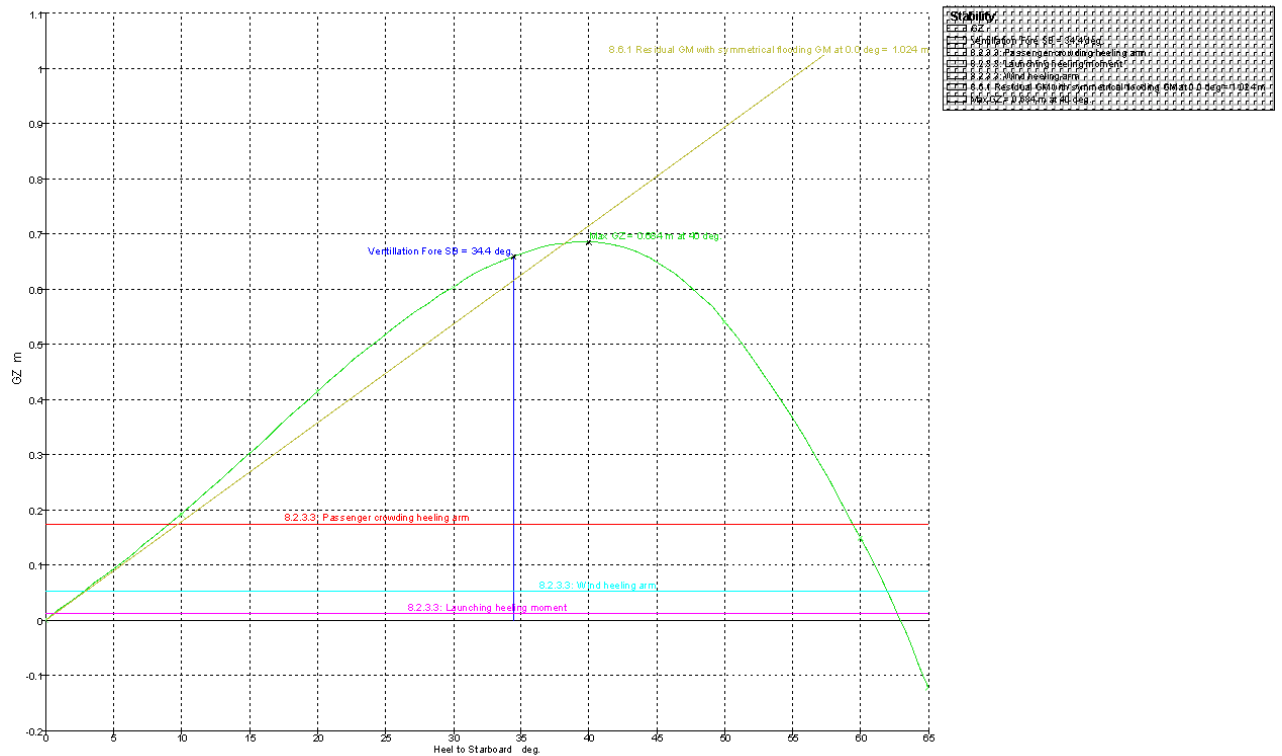
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.874	-2.612	0.037	30.883	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.369	2.343	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.369	-2.343	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.695	-4.200	3.342	5.282	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.695	-1.500	3.342	10.317	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.720	4.200	5.237	4.581	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	65.050	-0.546	4.439	152.469	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.114	8.472	2.872	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.12%	606.204	309.909	591.418	302.351	11.692	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.003	3.150	2.320	4.315	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.412	3.150	2.480	8.630	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.627	-0.750	1.515	0.608	Maximum
LO RNVD	35%	5.540	1.939	6.156	2.155	51.627	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	5.223	0.886	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	2.173	0.886	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	-2.173	0.886	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	41.141	-5.213	0.886	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.206	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.245	0.900	1.986	0.700	Maximum

Εικόνα 144: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	5.223	0.886	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	2.173	0.886	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	41.141	-2.173	0.886	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	41.141	-5.213	0.886	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.206	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.245	0.900	1.986	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.930	0.000	0.520	39.984	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.213	1.381	1.639	61.386	
.MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.487	-2.696	0.035	31.513	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	43.195	0.000	0.058	4.344	Maximum
No 1 FO DRAIN DêRTY OIL	5%	2.694	0.135	2.694	0.135	37.533	0.503	0.036	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.533	-0.503	0.036	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.632	0.000	0.031	84.035	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	54.245	-4.354	0.052	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.287	-2.548	0.035	1.853	Maximum
TOTAL MISC	5%	56.499	2.825	56.499	2.825	47.149	-1.337	0.042	123.280	
Total Loadcase			6006.413	1346.851	920.847	50.756	0.000	8.630	713.166	
FS correction								0.119		
VCG fluid								8.749		

Εικόνα 145: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 146: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0		
GZ m	-0.603	-0.413	-0.191	0.000	0.192	0.414	0.604	0.685	0.541	0.149	-	-	-	-	-	-	-	-	-	-	-	-	0.000	
Area under GZ curve from zero heel m.deg	9.0605	3.9536	0.9305	0.0007	0.9400	3.9658	9.1083	15.6932	22.0320	25.6684	24.3898	16.8967	2.8260	17.5587	43.5050	73.8807	107.0693	140.9579	173.0120	199.4557	216.0753	221.4760	-	
Displacement t	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006
Draft at FP m	8.091	7.930	7.721	7.643	7.715	7.923	8.090	8.068	8.109	8.482	9.374	12.014	n/a	0.938	3.686	4.734	5.353	5.813	6.210	6.667	6.840	6.877	-	-
Draft at AP m	2.202	2.855	3.249	3.376	3.254	2.859	2.202	1.164	-	-	-	-	n/a	41.142	23.592	17.493	14.298	12.329	11.100	10.436	10.292	10.267	-	-
WL Length m	120.371	120.052	113.480	112.502	113.514	120.045	120.370	120.965	122.761	123.862	124.329	124.467	124.300	123.877	123.611	123.565	123.559	123.553	118.253	117.800	116.941	115.663	-	-
Beam max extents on WL m	19.751	19.750	19.192	18.900	19.192	19.750	19.751	19.266	16.254	14.378	13.250	12.643	12.691	13.221	13.250	14.218	15.387	16.719	18.653	20.113	19.192	18.900	-	-
Wetted Area m ²	2634.495	2583.852	2522.498	2493.629	2522.352	2583.661	2634.167	2689.729	2723.908	2736.465	2754.385	2759.394	2743.820	2746.665	2751.760	2769.945	2809.007	2888.839	3024.851	3185.266	3261.680	3265.213	-	-
Waterpl. Area m ²	1479.737	1475.109	1447.626	1427.176	1447.800	1475.156	1479.739	1444.874	1344.217	1204.138	1107.859	1056.953	1053.750	1070.755	1103.324	1156.571	1227.611	1318.000	1448.700	1619.517	1639.626	1619.661	-	-
Prismatic coeff. (Cp)	0.518	0.513	0.537	0.539	0.537	0.513	0.518	0.520	0.523	0.529	0.536	0.544	0.552	0.557	0.560	0.562	0.563	0.560	0.575	0.569	0.565	0.566	-	-
Block coeff. (Cb)	0.322	0.337	0.359	0.365	0.359	0.337	0.322	0.316	0.365	0.413	0.458	0.456	0.399	0.351	0.331	0.302	0.279	0.267	0.269	0.285	0.350	0.396	-	-
LCB from zero pt. (+ve fwd) m	51.023	51.013	50.992	50.984	50.978	50.998	51.022	51.036	51.092	51.090	51.115	51.117	51.115	51.092	51.067	51.016	50.968	50.913	50.870	50.838	50.828	50.819	-	-
LCF from zero pt. (+ve fwd) m	46.791	45.987	46.067	46.320	46.054	45.972	46.791	46.725	45.521	45.766	46.190	46.529	47.705	48.242	47.804	46.732	45.150	43.620	43.370	42.460	41.143	41.123	-	-
Max deck inclination deg	30.1029	20.1425	10.2488	2.1856	10.2475	20.1419	30.1029	40.0762	50.0600	60.0490	70.0357	80.0188	90.0000	99.9804	109.9614	119.9463	129.9366	139.9321	149.9290	159.9212	169.9111	178.2631	-	-
Trim angle (+ve by stern) deg	3.0151	2.5992	2.2907	2.1856	2.2848	2.5935	3.0147	3.5339	4.4510	6.2220	9.7182	19.3713	n/a	19.7792	10.0960	6.5106	4.5745	3.3354	2.5040	1.9310	1.7681	1.7369	-	-

Εικόνα 147: Μοχλοβραχίονας GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Margin Line (immersion pos = 97.331 m)		29.6	n/a	5.103	3.449	1.671	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deck Edge (immersion pos = 97.331 m)		29.9	n/a	5.179	3.519	1.734	0.011	1.646	3.239	4.797	6.261	7.610	8.789	9.701	10.251	10.393	10.154	9.623	8.741	7.498	6.137	5.223	-
Ventilation	Downflooding point	35.8	0	6.574	4.823	2.911	1.027	0.749	2.513	4.268	5.950	7.533	8.954	10.101	10.872	11.209	11.138	10.660	9.760	8.453	6.961	5.365	-

Εικόνα 148: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immersion angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Marginal Line (immersion position = 98.58 m)		28.6	n/a	5.162	3.479	1.605	0.255	1.959	3.622	5.279	6.819	8.162	9.292	10.183	10.770	11.002	10.964	10.558	9.785	8.579	7.374	6.696	-
Deck Edge (immersion position = 99.204 m)		28.9	n/a	5.238	3.549	1.668	0.199	1.910	3.582	5.250	6.804	8.159	9.303	10.207	10.806	11.040	11.029	10.639	9.869	8.663	7.458	6.772	-
Ventilation Fore PS	Downflooding point	34.4	0	6.636	4.856	2.849	0.831	1.038	2.889	4.766	6.547	8.138	9.520	10.658	11.480	11.914	11.948	11.570	10.775	9.506	8.095	6.538	-
Ventilation Fore SB	Downflooding point	142.5	0	6.636	8.110	9.256	10.196	11.001	11.456	11.448	11.042	10.293	9.193	7.771	6.106	4.298	2.397	0.470	1.407	3.096	4.841	6.538	-
Ventilation Mid PS	Downflooding point	48.2	0	9.178	7.414	5.469	3.473	1.548	0.345	2.218	4.025	5.712	7.239	8.563	9.625	10.372	10.768	10.774	10.335	9.369	8.046	6.496	-
Ventilation Mid SB	Downflooding point	146	0	9.178	10.692	11.923	12.907	13.675	14.106	14.115	13.694	12.855	11.613	10.002	8.091	5.959	3.681	1.355	0.898	2.913	4.767	6.496	-
Ventilation Aft PS	Downflooding point	61.6	0	10.668	8.966	7.195	5.372	3.565	1.848	0.243	1.311	2.817	4.219	5.474	6.550	7.425	8.042	8.331	8.183	7.490	6.211	4.659	-
Ventilation Aft SB	Downflooding point	155.5	0	10.668	12.245	13.653	14.812	15.700	16.308	16.586	16.419	15.762	14.644	13.102	11.177	8.916	6.417	3.806	1.260	1.029	2.931	4.659	-

Εικόνα 149: Προσδιορισμός της θέσης των Key Points

Loadcase - Departure 100%

Damage Case - 11-12-13

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

WBT No1[] Fully flooded 95

FPT[] Fully flooded 95

GREY WATER TANK[] Fully flooded 95

SEWAGE TRMNT[] Fully flooded 95

BOW THRUSTER[] Fully flooded 95

FORE[] Fully flooded 95

ABV SEWAGE TRMNT[] Fully flooded 95

ABV BOW THRUSTER[] Fully flooded 95

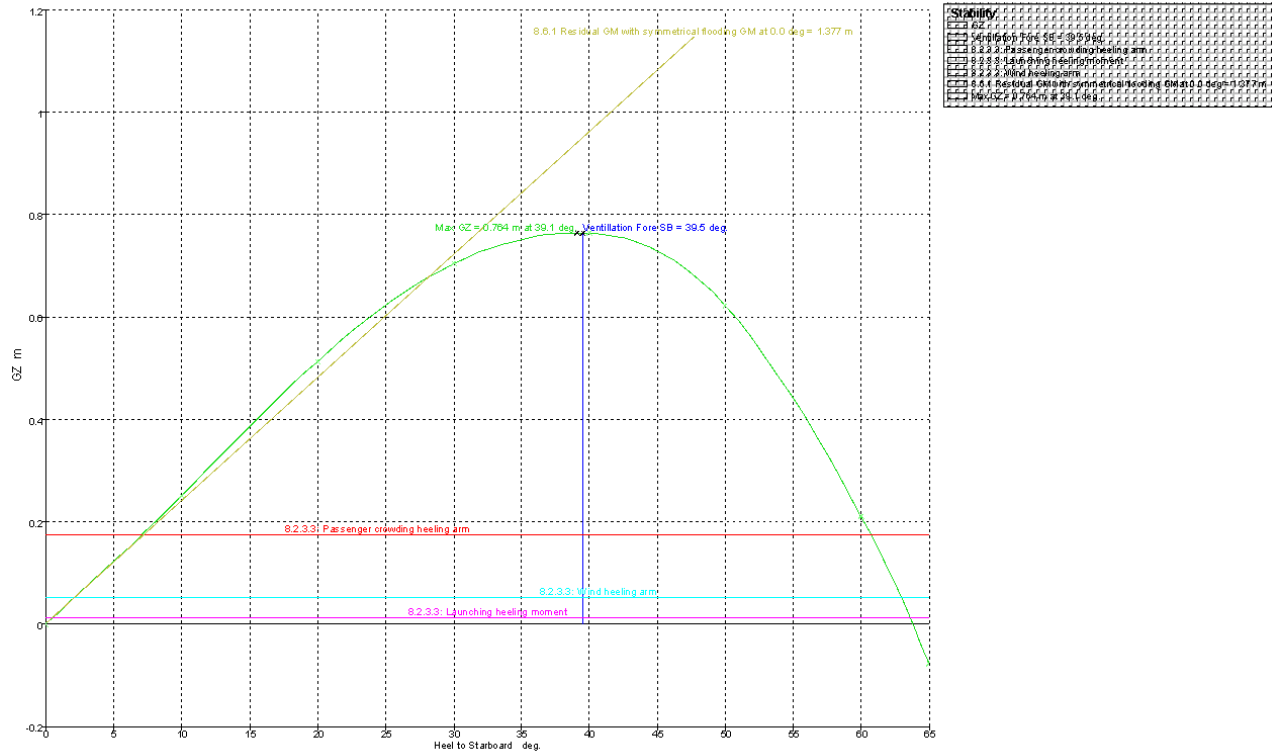
Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	1	15.000	15.000			54.350	0.000	15.200	0.000	User Specified
TOTAL			5098.910			51.891	0.000	9.349	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.892	-2.612	0.038	30.885	Maximum
No 1 HFO STOR SB	98%	130.737	128.122	133.405	130.737	68.370	2.343	4.826	101.406	User Specified
No 2 HFO STOR PS	98%	130.737	128.122	133.405	130.737	68.370	-2.343	4.826	0.000	Maximum
HFO Settling	80%	54.849	43.879	55.968	44.775	57.694	-4.200	3.339	5.283	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.694	-1.500	3.339	10.317	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.720	4.200	5.236	4.582	Maximum
TOTAL FUEL	88.65%	418.888	371.338	430.488	381.357	65.051	-0.546	4.439	152.473	
.FRESH WATER TANKS										
No 1 FWT	100%	49.932	49.932	49.932	49.932	79.200	-1.500	5.425	10.800	User Specified
No 2 FWT	100%	49.932	49.932	49.932	49.932	79.200	1.500	5.425	0.000	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	100%	149.796	149.796	149.796	149.796	59.333	0.000	5.425	10.800	
.WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	362.742	User Specified

Εικόνα 150: Κατάσταση φόρτωσης, πληρότητα 100%

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
FPT (Damaged)	Damaged									
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	25%	50.570	12.643	49.337	12.334	59.120	8.472	2.873	2.489	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	59.75%	518.676	309.909	506.025	302.351	11.692	0.346	5.117	365.231	
.LUBRICATING OIL										
CPP&RG LO STOR	70%	14.446	10.112	16.051	11.236	56.004	3.150	2.320	4.316	Maximum
ME&AE LO STORAGE	80%	28.892	23.114	32.102	25.682	58.413	3.150	2.480	8.631	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.629	-0.750	1.516	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.629	0.750	1.516	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.160	5.223	0.887	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.160	2.173	0.887	1.444	Maximum
No 3 LO Circ	80%	6.416	5.133	7.129	5.703	41.160	-2.173	0.887	1.444	Maximum
No 4 LO Circ	80%	6.512	5.209	7.235	5.788	41.160	-5.213	0.887	1.509	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.206	-0.900	2.580	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.248	0.900	1.986	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.931	0.000	0.520	39.987	Maximum
TOTAL LUBE OIL	70.98%	103.745	73.635	118.649	84.518	47.219	1.381	1.640	61.391	
.MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	5%	14.773	0.739	14.773	0.739	49.505	-2.696	0.036	31.516	Maximum
DIRTY OIL	5%	15.903	0.795	15.903	0.795	43.235	0.000	0.059	4.344	Maximum
No 1 FO DRAIN DérTY OIL	5%	2.694	0.135	2.694	0.135	37.546	0.503	0.037	0.184	Maximum
No2 FO DRAIN CLEAN OIL	5%	2.694	0.135	2.694	0.135	37.546	-0.503	0.037	0.184	Maximum
CW DRAIN	5%	9.849	0.492	9.849	0.492	47.634	0.000	0.031	84.042	Maximum
Bilge Dirty	5%	4.842	0.242	4.842	0.242	54.263	-4.354	0.053	1.166	Maximum
Bilge Clean	5%	5.745	0.287	5.745	0.287	54.305	-2.548	0.036	1.854	Maximum
TOTAL MISC	5%	56.499	2.825	56.499	2.825	47.170	-1.337	0.043	123.290	
Total Loadcase			6006.413	1261.457	920.847	50.756	0.000	8.630	713.185	
FS correction									0.119	
VCG fluid									8.749	

Εικόνα 151: Κατάσταση φόρτωσης, πληρότητα 100%



Εικόνα 152: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.703	-0.513	-0.250	0.000	0.251	0.514	0.704	0.764	0.622	0.212	-0.398	-1.083	-1.776	-2.424	-2.979	-3.391	-3.601	-3.559	-3.197	-2.374	-1.186	-0.000
Area under GZ curve from zero heel m.deg	11.2029	5.0708	1.2272	0.0007	1.2373	5.0819	11.2599	18.7301	25.8678	30.2497	29.4307	22.0574	7.7507	13.3073	40.4217	72.4165	107.5692	143.5926	177.7016	205.9510	223.8895	229.7771
Displacement t	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006	6006
Draft at FP m	6.760	6.701	6.559	6.493	6.553	6.691	6.764	6.622	6.500	6.726	7.383	9.363	n/a	1.814	3.869	4.692	5.216	5.669	6.153	6.676	6.891	6.937
Draft at AP m	2.635	3.274	3.665	3.802	3.669	3.280	2.633	1.591	0.201	3.403	9.656	27.732	n/a	42.434	24.346	18.054	14.751	12.698	11.378	10.638	10.458	10.431
WL Length m	118.920	118.889	118.685	111.714	118.680	118.880	118.923	118.815	120.435	123.174	124.081	124.432	124.357	123.955	123.629	123.593	123.585	123.571	123.114	117.681	116.827	115.580
Beam max extents on WL m	19.308	19.592	19.189	18.900	19.189	19.592	19.308	18.726	16.254	14.378	13.250	12.643	12.926	13.140	13.247	14.181	15.309	16.615	18.527	20.113	19.192	18.900

Εικόνα 153: Μοχλοβραχίονας επαναφοράς GZ

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
Wetted Area m ²	2517.266	2481.731	2441.249	2410.591	2441.225	2481.256	2517.745	2558.031	2606.470	2630.071	2657.013	2673.220	2680.411	2694.036	2707.878	2734.660	2783.254	2860.607	2986.647	3143.689	3232.719	3235.557
Waterpl. Area m ²	1531.716	1553.830	1552.489	1532.174	1552.728	1554.065	1531.660	1496.537	1396.738	1240.739	1144.008	1091.021	1067.349	1071.275	1105.009	1169.079	1260.698	1374.860	1519.347	1698.210	1740.506	1720.511
Prismatic coeff. (Cp)	0.580	0.565	0.554	0.584	0.554	0.565	0.580	0.590	0.586	0.575	0.571	0.570	0.570	0.571	0.571	0.569	0.566	0.561	0.555	0.576	0.574	0.576
Block coeff. (Cb)	0.348	0.373	0.403	0.432	0.403	0.373	0.348	0.344	0.389	0.435	0.480	0.479	0.403	0.358	0.334	0.302	0.279	0.266	0.259	0.286	0.353	0.399
LCB from zero pt. (+ve fwd) m	50.941	50.940	50.917	50.902	50.903	50.918	50.949	50.961	50.992	51.043	51.086	51.108	51.120	51.105	51.089	51.039	50.986	50.931	50.880	50.836	50.828	50.822
LCF from zero pt. (+ve fwd) m	46.941	46.655	46.618	47.083	46.607	46.643	46.945	46.684	45.212	45.704	46.240	46.545	46.580	46.403	46.134	45.881	45.673	45.667	46.156	45.174	43.623	43.667
Max deck inclination deg	30.0506	20.0652	10.1050	1.3787	10.1043	20.0646	30.0507	40.0405	50.0356	60.0339	70.0283	80.0167	90.0000	99.9800	109.9592	119.9411	129.9280	139.9210	149.9189	159.9130	169.8410	178.2095
Trim angle (+ve by stern) deg	-2.1129	-1.7558	-1.4830	-1.3787	-1.4780	-1.7475	-2.1160	-2.5769	-3.4301	-5.1765	-8.6659	-18.3560	n/a	-19.9674	-10.3789	-6.8156	-4.8745	-3.5976	-2.6759	-2.0296	-1.8275	-1.7905

Εικόνα 154: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m
Margin Line (immersion pos = 95.457 m)		33.9	n/a	6.153	4.466	2.591	0.691	1.061	2.782	4.557	6.248	7.760	9.038	10.020	10.678	11.001	11.026	10.644	9.818	8.561	7.325	6.643
Deck Edge (immersion pos = 95.457 m)		34.3	n/a	6.229	4.536	2.656	0.751	1.009	2.740	4.527	6.231	7.758	9.049	10.044	10.714	11.040	11.093	10.726	9.902	8.645	7.409	6.718
Ventilation	Downflooding point	39.5	0	7.610	5.827	3.833	1.808	0.093	2.003	4.007	5.950	7.723	9.263	10.498	11.394	11.899	11.990	11.634	10.791	9.476	8.032	6.466

Εικόνα 155: Προσδιορισμός της θέσης των Key Points

Key point	Type	Immerision angle deg	Emergency angle deg	Free board at 0.0 deg m	Free board at 10.0 deg m	Free board at 20.0 deg m	Free board at 30.0 deg m	Free board at 40.0 deg m	Free board at 50.0 deg m	Free board at 60.0 deg m	Free board at 70.0 deg m	Free board at 80.0 deg m	Free board at 90.0 deg m	Free board at 100.0 deg m	Free board at 110.0 deg m	Free board at 120.0 deg m	Free board at 130.0 deg m	Free board at 140.0 deg m	Free board at 150.0 deg m	Free board at 160.0 deg m	Free board at 170.0 deg m	Free board at 180.0 deg m	
Fore PS																							
Ventilation Fore SB	Downflooding point	142.2	0	7.610	9.082	10.243	11.179	11.952	12.350	12.214	11.645	10.711	9.452	7.930	6.190	4.310	2.351	0.404	-	1.424	3.066	4.778	6.466
Ventilation Mid PS	Downflooding point	50.6	0	9.621	7.862	5.930	3.938	2.009	0.108	-	1.805	3.671	5.426	7.015	8.378	9.474	10.255	10.684	10.706	10.253	9.279	7.944	6.389
Ventilation Mid SB	Downflooding point	146.4	0	9.621	11.140	12.387	13.377	14.143	14.567	14.535	14.054	13.144	11.838	10.186	8.241	6.073	3.764	1.421	-	0.817	2.822	4.666	6.389
Ventilation Aft PS	Downflooding point	61.4	0	10.427	8.739	6.980	5.176	3.404	1.743	0.209	-	1.268	2.697	4.038	5.259	6.315	7.178	7.793	8.092	7.975	7.321	6.060	4.507
Ventilation Aft SB	Downflooding point	156.3	0	10.427	12.019	13.442	14.622	15.545	16.211	16.560	16.468	15.885	14.826	13.317	11.411	9.161	6.664	4.043	1.467	-	0.860	2.780	4.507

Εικόνα 156: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 1-2-3

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

STEERING GEAR ROOM[] Fully flooded 95

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

ABV STEERING GEAR ROOM[] Fully flooded 95

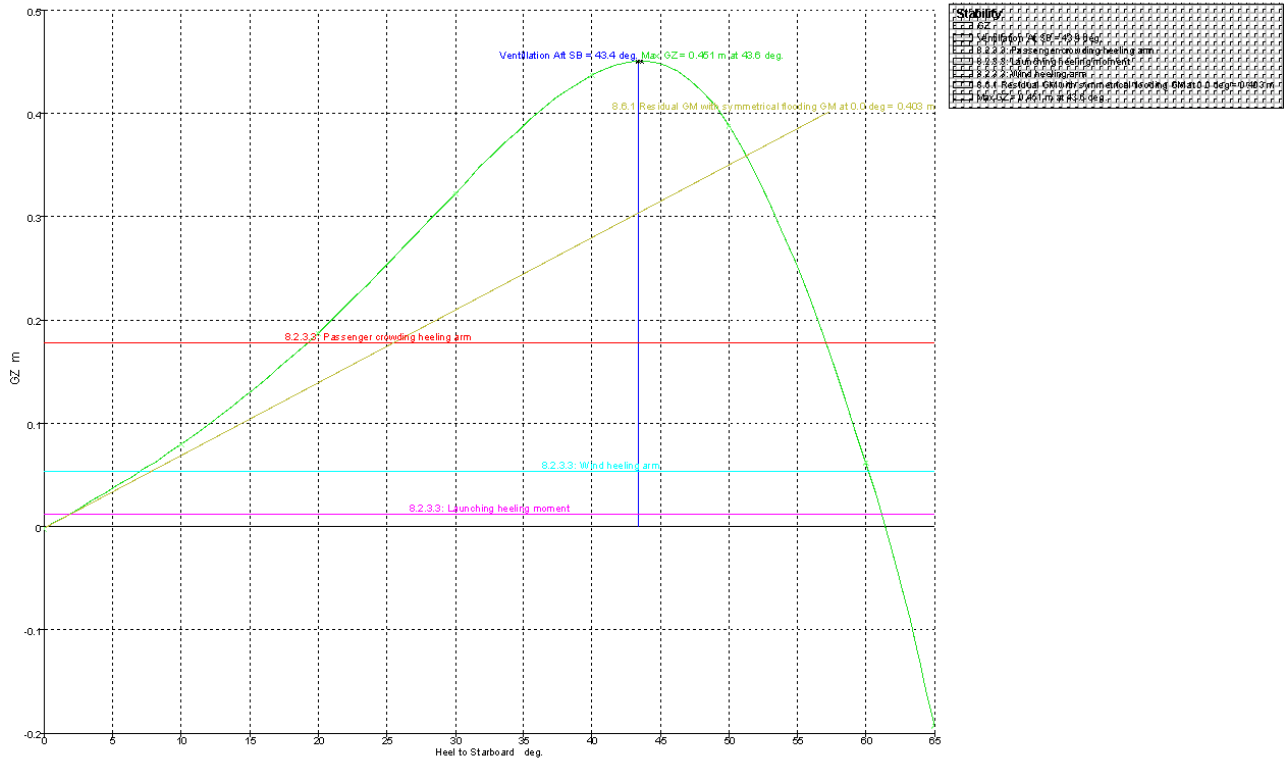
ABV SLOPE[] Fully flooded 85

ABV AUX EQPMNT[] Fully flooded 85

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.460	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.260	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.760	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.288	2.344	4.226	101.406	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.288	-2.344	4.226	101.406	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.670	-4.200	1.732	5.279	Maximum
HFO SVCE	80%	88.561	54.849	89.980	55.988	57.670	-1.500	3.329	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.670	4.200	5.231	4.578	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.708	64.169	-0.303	3.926	253.842	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	79.200	-1.500	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.200	1.500	4.512	10.800	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.467	0.500	5.121	10.800	
.WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.506	0.000	1.521	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	58.941	-8.375	2.348	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	58.985	8.294	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	29.129	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.766	27.831	-0.091	4.473	97.287	
.LUBRICATING OIL										
OPP&RG LO STOR	40%	14.448	5.778	16.051	6.420	56.000	3.150	1.840	4.312	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.400	3.150	2.000	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.800	-0.750	1.515	0.807	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.800	0.750	1.515	0.807	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.800	2.173	0.880	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	-2.173	0.800	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	40.800	-5.213	0.600	0.000	Maximum
ST LO STOR	80%	4.188	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.188	2.093	4.651	2.328	23.200	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.910	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.968	118.649	60.441	44.988	1.935	1.429	58.398	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.170	0.000	1.278	366.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.200	-2.699	0.240	31.493	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.800	0.000	0.260	4.344	Maximum
No 1 FO DRAIN D&RTY OIL	40%	2.694	1.077	2.694	1.077	37.316	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.316	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.800	0.000	0.120	83.981	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.962	-4.476	0.197	1.166	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.000	-2.550	0.180	1.852	Maximum
TOTAL MISC	38.28%	176.325	67.501	176.325	67.501	78.795	-0.398	0.972	479.328	
Total Loadcase			5871.556	1583.013	788.314	50.895	0.002	8.615	899.654	
FS correction									0.153	
VCG fluid									8.768	

Εικόνα 157: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 158: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.322	-0.187	-0.079	0.002	0.083	0.191	0.328	0.440	0.591	0.694	-0.485	-1.133	-1.798	-2.420	-2.956	-3.355	-3.552	-3.483	-3.095	-2.271	-1.212	-0.002
Area under GZ curve from zero heel m.deg	4.2108	1.6774	0.3718	0.0039	0.4147	1.7629	4.3340	8.2315	12.5878	15.0872	13.1123	5.0855	-9.5898	-30.7268	-57.7016	-89.3998	-124.1274	-169.5556	-192.6102	-219.5833	-237.1481	-243.2833
Displacement t	5872	5872	5872	5872	5872	5872	5872	5872	5871	5871	5871	5871	5872	5872	5872	5872	5872	5872	5872	5872	5872	5872
Draft at FP m	2.845	3.274	3.484	3.566	3.485	3.275	2.843	2.083	0.657	-1.817	-7.098	-23.073	n/a	-39.991	-23.947	-18.472	-15.856	-13.936	-12.819	-12.177	-11.969	-11.974
Draft at AP m	6.402	6.422	6.408	6.373	6.408	6.421	6.403	6.210	5.823	5.713	5.730	6.236	n/a	-3.847	-4.426	-4.623	-4.738	-4.885	-5.092	-5.388	-5.577	-5.628
WL Length m	123.377	123.364	123.378	122.975	123.378	123.364	123.377	123.391	119.395	111.592	115.539	118.148	120.294	121.788	122.745	123.424	123.930	124.287	124.414	123.988	123.732	123.686
Beam max extents on WL m	20.170	19.916	19.192	18.948	19.192	19.916	20.171	19.371	18.254	14.378	13.250	12.844	12.451	12.843	13.250	14.378	16.072	18.183	21.163	20.113	19.192	18.903
Wetted Area m ²	2494.408	2496.840	2531.836	2528.448	2531.836	2496.772	2494.877	2520.821	2559.763	2559.891	2571.012	2579.098	2590.332	2603.705	2634.127	2678.986	2743.813	2844.028	2977.390	3110.311	3230.322	3197.117
Waterpl. Area m ²	1500.189	1494.874	1498.944	1485.679	1498.960	1494.720	1500.148	1490.989	1380.772	1218.176	1097.835	1031.693	1001.081	999.039	1024.708	1083.903	1176.874	1307.087	1481.274	1648.822	1808.038	1832.051
Prismatic coeff. (Cp)	0.480	0.474	0.469	0.471	0.469	0.474	0.480	0.483	0.504	0.540	0.519	0.503	0.491	0.481	0.472	0.460	0.443	0.422	0.394	0.378	0.368	0.380
Block coeff. (Cb)	0.287	0.319	0.378	0.390	0.378	0.319	0.287	0.263	0.340	0.408	0.407	0.398	0.385	0.345	0.303	0.287	0.236	0.214	0.190	0.233	0.287	0.359
LCB from zero pt. (+ve fwd) m	50.735	50.736	50.742	50.748	50.744	50.740	50.732	50.720	50.709	50.687	50.665	50.624	50.611	50.600	50.608	50.627	50.662	50.705	50.752	50.780	50.799	50.802
LCF from zero pt. (+ve fwd) m	55.372	54.142	52.723	52.666	52.723	54.143	55.371	57.196	59.372	68.669	67.982	67.513	67.190	66.847	66.744	66.446	66.153	65.889	66.061	68.210	61.550	61.041
Max deck inclination deg	30.0376	20.0560	10.1070	1.4384	10.1069	20.0549	30.0377	40.0275	50.0220	60.0187	70.0160	80.0106	90.0000	99.9841	109.9828	119.9368	129.9056	139.8687	149.8232	159.7459	169.4988	176.7510
Trim angle (+ve by stern) deg	1.8223	1.6129	1.4971	1.4384	1.4965	1.6116	1.8237	2.1239	2.6965	3.8530	6.5490	14.8602	n/a	17.9157	9.9047	7.0913	5.5780	4.6388	3.9537	3.4751	3.2720	3.2490

Εικόνα 159: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = -0.124 m)		32.5	n/a	5.682	4.222	2.381	0.447	-1.350	-3.099	-4.849	-6.801	-8.221	-9.807	-10.771	-11.679	-12.039	-12.127	-11.808	-11.017	-9.794	-8.349	-6.778
Deck Edge (immersion pos = -0.124 m)		32.8	n/a	6.989	4.305	2.430	0.509	-1.298	-3.045	-4.818	-6.581	-8.224	-9.844	-10.781	-11.612	-12.082	-12.181	-11.871	-11.098	-9.870	-8.428	-6.854
Ventilation Fore PS	Downflooding point	55.5	0	9.914	8.204	6.345	4.482	2.806	0.894	-0.734	-2.165	-3.400	-4.485	-5.383	-6.081	-6.551	-6.788	-6.692	-6.280	-5.442	-4.134	-2.537
Ventilation Fore SB	Downflooding point	165.2	0	9.914	11.458	12.759	13.824	14.653	15.241	15.494	15.461	15.046	14.241	13.063	11.607	9.659	7.969	5.337	3.073	0.991	-0.883	-2.537
Ventilation Mid PS	Downflooding point	52.1	0	10.070	8.307	6.383	4.332	2.334	0.399	-1.514	-3.324	-4.994	-6.488	-7.781	-8.775	-9.497	-9.895	-9.924	-9.528	-8.694	-7.389	-5.781
Ventilation Mid SB	Downflooding point	149.8	0	10.070	11.585	12.821	13.772	14.470	14.880	14.834	14.411	13.587	12.375	10.811	8.942	6.829	4.548	2.193	-0.099	-2.204	-4.081	-5.781
Ventilation Aft PS	Downflooding point	43.4	0	8.488	6.867	4.734	2.674	0.871	-1.312	-3.338	-5.381	-7.275	-8.864	-10.430	-11.596	-12.328	-12.714	-12.688	-12.121	-11.089	-9.734	-8.175
Ventilation Aft SB	Downflooding point	137.8	0	8.488	9.978	11.195	12.120	12.814	13.180	13.021	12.385	11.318	9.882	8.154	6.173	4.009	1.738	-0.543	-2.888	-4.832	-6.467	-8.175

Εικόνα 160: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 2-3-4

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

AUX ER[] Fully flooded 85

ABV SLOPE[] Fully flooded 85

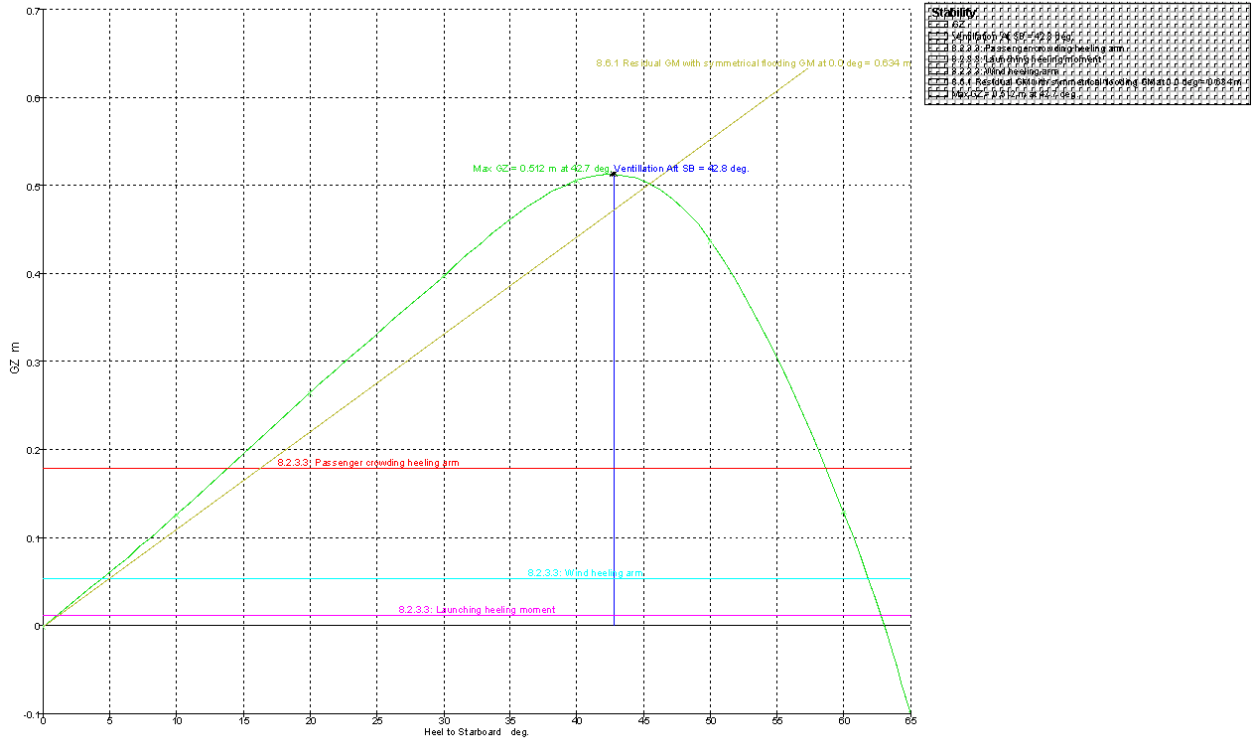
ABV AUX EQPMNT[] Fully flooded 85

ABV AUX ER (RO-RO)[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.460	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.461	0.723	14.745	0.737	51.385	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.051	2.349	4.228	101.438	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.051	-2.349	4.228	101.438	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.626	-4.200	1.733	5.280	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.659	-1.500	3.330	10.313	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.642	4.200	5.232	4.580	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.708	64.016	-0.303	3.928	253.912	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	76.827	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.174	1.500	4.513	10.803	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.458	0.500	5.121	10.803	
.WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.331	0.000	1.523	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	58.771	-8.381	2.350	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	55.825	5.600	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.765	27.795	-0.091	4.473	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	55.996	3.150	1.840	4.314	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.387	3.150	2.000	8.628	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.581	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.581	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.418	5.133	7.129	5.703	40.561	5.223	0.883	1.444	Maximum
No 2 LO Circ	80%	6.418	5.133	7.129	5.703	40.561	2.173	0.883	1.444	Maximum
No 3 LO Circ	0%	6.418	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	36.989	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.188	3.349	4.651	3.721	23.196	-0.900	2.560	0.700	Maximum
ST LO DRAIN	50%	4.188	2.093	4.651	2.326	23.194	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.897	0.000	0.520	39.971	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.966	118.649	60.441	44.911	1.935	1.430	58.416	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.086	0.000	1.277	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.175	-2.899	0.240	31.503	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.435	0.000	0.262	4.345	Maximum
No 1 FO DRAIN D'RTY OIL	40%	2.694	1.077	2.694	1.077	37.297	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.297	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.594	0.000	0.120	84.007	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.958	-4.476	0.167	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	53.966	-2.550	0.181	1.853	Maximum
TOTAL MISC	38.28%	176.325	67.501	176.325	67.501	78.715	-0.398	0.973	479.366	
Total Loadcase			5871.556	1583.013	786.314	50.885	0.002	8.615	899.785	
FS correction								0.153		
VCG fluid								8.768		

Εικόνα 161: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 162: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-0.396	-0.284	-0.125	0.002	0.129	0.268	0.400	0.508	0.440	0.130	-0.397	-0.988	-1.588	-2.185	-2.717	-3.121	-3.330	-3.290	-2.937	-2.230	-1.165	-0.002	
Area under GZ curve from zero heel m.deg	5.8533	2.5472	0.6050	0.0039	0.8478	2.8337	5.9728	10.5900	15.5244	18.5809	17.5024	10.8779	-1.9101	-20.8123	-45.4010	-74.7250	-107.1638	-140.4671	-171.9053	-198.0680	-215.2389	-221.0886	
Displacement t	5872	5872	5872	5872	5872	5872	5872	5872	5872	5872	5871	5871	5871	5872	5872	5872	5872	5872	5872	5872	5872	5872	5871
Draft at FP m	3.091	3.409	3.602	3.675	3.603	3.408	3.088	2.441	1.199	-0.881	-5.353	-19.031	n/a	-35.267	-21.363	-16.620	-14.185	-12.710	-11.772	-11.304	-11.273	-11.319	
Draft at AP m	6.715	6.868	6.884	6.880	6.882	6.888	6.718	6.369	5.963	5.547	5.239	4.857	n/a	-6.704	-6.808	-6.828	-6.857	-6.940	-6.150	-6.414	-6.499	-6.475	
WL Length m	123.374	123.375	123.431	122.868	123.430	123.375	123.374	123.381	120.395	114.153	117.141	119.609	121.684	122.721	123.419	123.909	124.238	124.322	123.830	123.227	123.093	122.785	
Beam max extents on WL m	20.457	20.020	19.182	18.823	18.192	20.020	20.458	19.371	16.254	14.929	13.250	12.644	12.452	12.843	13.250	14.378	16.012	17.905	20.429	20.113	19.192	18.953	
Wetted Area m ²	2574.256	2591.615	2613.542	2613.851	2613.575	2573.996	2565.590	2630.480	2640.168	2638.017	2639.419	2655.180	2661.143	2686.202	2721.307	2774.711	2858.996	2984.700	3114.736	3180.661	3182.571		
Waterpl. Area m ²	1463.466	1460.467	1465.664	1463.193	1465.750	1450.462	1453.380	1440.463	1342.709	1223.770	1107.503	1052.224	1021.846	992.090	969.053	1053.715	1143.520	1268.785	1427.460	1628.095	1764.645	1760.591	
Prismatic coeff. (Cp)	0.455	0.443	0.438	0.441	0.438	0.443	0.455	0.467	0.490	0.522	0.509	0.498	0.480	0.479	0.477	0.471	0.461	0.442	0.426	0.415	0.414		
Block coeff. (Cb)	0.274	0.304	0.356	0.364	0.356	0.304	0.274	0.277	0.333	0.361	0.410	0.404	0.393	0.363	0.314	0.280	0.251	0.233	0.222	0.280	0.323	0.412	
LCS from zero pt. (+ve fwd) m	50.728	50.727	50.720	50.721	50.728	50.722	50.714	50.728	50.728	50.716	50.694	50.676	50.651	50.652	50.661	50.679	50.704	50.733	50.762	50.797	50.813	50.808	
LCF from zero pt. (+ve fwd) m	55.246	53.466	51.535	51.463	51.538	53.463	55.242	57.800	59.021	59.416	57.951	56.812	56.373	57.519	57.721	57.839	57.448	57.258	57.756	59.588	60.316	59.710	
Max deck inclination deg	30.0391	20.0871	10.1348	1.8319	10.1348	20.0872	30.0392	40.0247	50.0180	60.0137	70.0109	80.0099	90.0000	99.9994	109.9794	119.9615	129.9450	139.9287	149.9082	159.8876	169.7170	177.5194	
Trim angle (+ve by stern) deg	1.8585	1.7815	1.6816	1.6319	1.6002	1.7828	1.8600	2.0122	2.4397	3.2903	5.4122	12.0608	n/a	14.7681	7.9207	5.5134	4.2601	3.4653	2.8769	2.5043	2.4450	2.4806	

Εικόνα 163: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margn Line (immersion pos + -0.124 m)		31.1	n/a	5.492	3.760	1.923	0.174	-1.472	-3.114	-4.795	-6.433	-7.993	-9.374	-10.437	-11.113	-11.444	-11.418	-10.994	-10.108	-8.929	-7.437	-5.626
Deck Edge (immersion pos + -0.124 m)		31.4	n/a	5.588	3.833	1.992	0.236	-1.418	-3.071	-4.733	-6.414	-7.987	-9.381	-10.457	-11.145	-11.488	-11.470	-11.069	-10.178	-8.963	-7.514	-6.002
Ventilation Fore PS	Downflooding point	53.3	0	9.702	8.047	6.188	4.233	2.335	0.572	-1.140	-2.668	-3.989	-5.129	-6.075	-6.815	-7.309	-7.520	-7.438	-6.889	-6.065	-4.942	-3.024
Ventilation Fore SB	Downflooding point	162	0	9.702	11.301	12.590	13.605	14.383	14.930	15.091	14.944	14.496	13.804	12.970	10.784	8.910	6.918	4.602	2.381	0.343	-1.369	-3.024
Ventilation Mid PS	Downflooding point	51	0	9.700	8.051	6.097	4.092	2.120	0.166	-1.734	-3.577	-5.274	-6.787	-8.083	-9.053	-9.741	-10.097	-10.078	-9.619	-8.077	-7.323	-5.793
Ventilation Mid SB	Downflooding point	149.2	0	9.700	11.300	12.584	13.533	14.298	14.698	14.817	14.163	13.315	12.094	10.519	8.676	6.697	4.355	2.060	-0.184	-2.222	-4.051	-5.793
Ventilation Aft PS	Downflooding point	42.8	0	8.042	6.289	4.332	2.498	0.829	-1.375	-3.318	-5.282	-7.146	-8.838	-10.230	-11.240	-11.910	-12.195	-12.097	-11.424	-10.395	-9.015	-7.505
Ventilation Aft SB	Downflooding point	140.4	0	8.042	9.548	10.793	11.854	12.674	13.098	13.043	12.496	11.454	10.045	8.364	6.494	4.439	2.297	0.078	-1.983	-3.879	-5.739	-7.505

Εικόνα 164: Προσδιορισμός της θέσης των Key Points

Damage Case - 3-4-5

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
No 4 LO Circ[]	Fully flooded	95		
AUX EQPMNT[]	Fully flooded	95		
AUX ER[]	Fully flooded	85		
ER[]	Fully flooded	85		
ABV AUX EQPMNT[]	Fully flooded	85		
ABV AUX ER (RO-RO)[]	Fully flooded	95		
ABV ER[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.460	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.260	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.358	-2.812	0.035	30.883	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.020	2.350	4.229	101.447	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.020	-2.350	4.229	101.447	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.624	-4.200	1.734	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	56.988	57.662	-1.500	3.335	10.314	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.642	4.200	5.234	4.580	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	63.997	-0.303	3.930	253.933	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	76.827	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.170	1.500	4.513	10.804	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.457	0.500	5.121	10.804	
.WATER BALLAST										
WBT No1	80%	119.245	71.547	116.337	69.802	101.307	0.000	1.524	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.878	104.878	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	58.748	-8.382	2.351	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	55.822	5.600	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.765	27.790	-0.091	4.473	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	40%	14.448	5.778	18.051	6.420	55.995	3.150	1.840	4.314	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.385	3.150	2.000	8.628	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.578	-0.750	1.515	0.808	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.578	0.750	1.515	0.808	Maximum
No 1 LO Circ	80%	6.418	5.133	7.129	5.703	40.529	5.223	0.884	1.444	Maximum
No 2 LO Circ	80%	6.418	5.133	7.129	5.703	40.529	2.173	0.884	1.444	Maximum
No 3 LO Circ	0%	6.418	0.000	7.129	0.000	36.989	-1.448	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.188	3.349	4.651	3.721	23.196	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.188	2.093	4.651	2.326	23.193	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.158	20.260	16.208	34.895	0.000	0.520	39.974	Maximum
TOTAL LUBE OIL	53.44%	97.234	51.986	111.414	60.441	44.904	1.935	1.430	58.421	
MISC										
GREY WATER TANK	40%	119.828	47.930	119.828	47.930	92.075	0.000	1.277	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.171	-2.899	0.240	31.508	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.413	0.000	0.263	4.348	Maximum
No 1 FO DRAIN DeRTY OIL	40%	2.694	1.077	2.694	1.077	37.295	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.295	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.594	0.000	0.120	84.015	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.954	-4.476	0.167	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	53.962	-2.550	0.181	1.853	Maximum
TOTAL MISC	38.28%	178.325	67.501	178.325	67.501	78.705	-0.398	0.973	479.378	
Total Loadcase			5871.556	1575.778	786.314	50.884	0.002	8.615	899.822	
FS correction								0.153		
VCG fluid								8.768		

Εικόνα 165: Κατάσταση φόρτωσης, πληρότητα 50%

Loadcase - Half Load 50%

Damage Case - 4-5-6

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

CW DRAIN[] Fully flooded 95
 No 4 LO Circ[] Fully flooded 95
 AUX ER[] Fully flooded 85
 ER[] Fully flooded 85
 WORKSHOP[] Fully flooded 95
 ABV AUX ER (RO-RO)[] Fully flooded 95
 ABV ER[] Fully flooded 95
 ABV WORKSHOP[] Fully flooded 95

Fluid analysis method: Use corrected VCG

		tonne	tonne	Volume m ³	Volume m ³	Arm m	Arm m	m	tonne.m	
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.366	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.030	2.350	4.229	101.444	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.030	-2.350	4.229	101.444	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.633	-4.200	1.736	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.669	-1.500	3.343	10.314	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.651	4.200	5.237	4.580	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.708	64.006	-0.303	3.932	253.926	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	76.827	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.171	1.500	4.513	10.804	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.457	0.500	5.121	10.804	
.WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.314	0.000	1.524	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	58.755	-8.381	2.351	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	55.816	5.600	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.766	27.792	-0.091	4.473	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	55.995	3.150	1.840	4.314	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.385	3.150	2.000	8.628	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.579	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.579	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.539	5.223	0.884	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.539	2.173	0.884	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.198	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.193	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.280	16.208	34.895	0.000	0.520	39.973	Maximum
TOTAL LUBE OIL	53.44%	97.234	51.966	111.414	60.441	44.906	1.935	1.430	58.420	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.079	0.000	1.277	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.173	-2.699	0.240	31.505	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.420	0.000	0.262	4.346	Maximum
No 1 FO DRAIN DeRTY OIL	40%	2.694	1.077	2.694	1.077	37.295	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.295	-0.503	0.260	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.955	-4.476	0.197	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	53.963	-2.550	0.181	1.853	Maximum
TOTAL MISC	39.36%	166.475	65.532	166.475	65.532	79.643	-0.410	0.999	395.362	
Total Loadcase			5869.586	1565.929	784.344	50.886	0.002	8.618	815.798	
FS correction								0.139		
VCG fluid								8.757		

Εικόνα 169: Κατάσταση φόρτωσης, πληρότητα 50%

Loadcase - Half Load 50%

Damage Case - 5-6-7

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

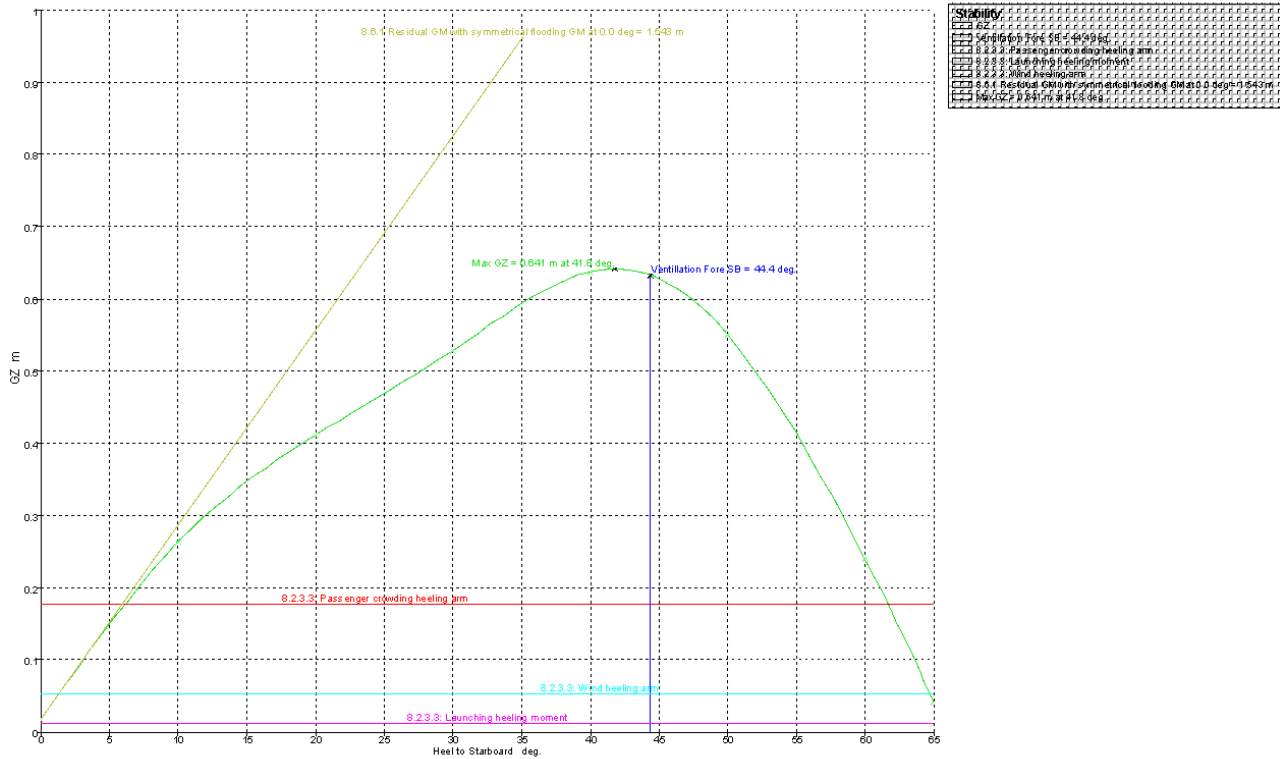
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
Heeling Port[]	Fully flooded	95		
CW DRAIN[]	Fully flooded	95		
No 4 LO Circ[]	Fully flooded	95		
ER[]	Fully flooded	85		
WORKSHOP[]	Fully flooded	95		
HEELING[]	Fully flooded	95		
ABV ER[]	Fully flooded	95		
ABV WORKSHOP[]	Fully flooded		95	
ABV HEELING[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	0.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	0.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	0.340	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.501	-2.612	0.032	30.865	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.189	2.346	4.226	101.412	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.189	-2.346	4.226	101.412	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.666	-4.200	1.737	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.679	-1.500	3.347	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.672	4.200	5.238	4.579	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.110	-0.303	3.931	253.856	
FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	76.827	-1.000	3.800	0.000	Maximum
No 2 FWT	80%	49.932	24.966	49.932	24.966	79.169	1.500	4.513	10.801	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.463	0.500	5.121	10.801	
WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.433	0.000	1.522	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.628	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	0%	50.670	0.000	49.337	0.000	55.814	5.600	2.050	0.000	Maximum
No 2 WBT	0%	120.288	0.000	117.335	0.000	24.083	0.000	0.000	0.000	Maximum
TOTAL BALLAST	54.65%	674.679	368.814	658.418	359.819	27.475	0.000	4.496	94.797	
LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	55.998	3.150	1.840	4.313	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.394	3.150	2.000	8.625	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.592	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.592	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.700	5.223	0.881	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.700	2.173	0.881	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.198	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.197	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.905	0.000	0.520	39.980	Maximum
TOTAL LUBE OIL	53.44%	97.234	51.966	111.414	60.441	44.944	1.935	1.429	58.401	
MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	62.135	0.000	1.276	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.189	-2.699	0.240	31.495	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.531	0.000	0.260	4.344	Maximum
No 1 FO DRAIN D&RTY OIL	40%	2.694	1.077	2.694	1.077	37.308	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.308	-0.503	0.260	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.978	-4.476	0.197	1.166	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	53.986	-2.550	0.180	1.852	Maximum
TOTAL MISC	39.36%	166.475	65.532	166.475	65.532	79.668	-0.410	0.998	395.349	
Total Loadcase			5865.540	1516.592	780.397	50.888	0.008	8.622	813.204	
FS correction									0.139	
VCG fluid									8.781	

Εικόνα 173: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 174: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.528	-0.411	-0.282	-0.017	0.233	0.409	0.532	0.644	0.627	0.198	-0.216	-0.710	-1.295	-1.877	-2.404	-2.827	-3.097	-3.144	-2.987	-2.072	-1.008	-0.008
Area under GZ curve from zero heel m deg	9.5866	4.8860	1.4552	-0.0313	1.1190	4.3972	9.0997	15.0965	21.1451	24.8885	24.8498	20.3005	10.3156	-5.5778	-27.0501	-53.3069	-83.0879	-114.5015	-144.9293	-170.0033	-185.4498	-190.4584
Displacement t	5886	5886	5886	5886	5886	5886	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885	5885
Draft at FP m	5.461	5.740	5.852	5.917	5.881	5.773	5.511	4.989	4.240	3.183	1.922	-3.921	n/a	-18.358	-12.908	-11.119	-10.279	-9.344	-8.881	-8.685	-8.884	-9.920
Draft at AP m	5.271	5.832	5.801	5.823	5.808	5.647	5.284	4.625	3.658	2.262	-0.052	-8.973	n/a	-19.994	-13.069	-10.862	-9.474	-8.739	-8.308	-8.163	-8.081	-8.057
WL Length m	123.348	123.358	123.361	118.178	123.361	123.359	123.349	123.332	123.308	123.319	122.312	123.370	123.867	124.121	124.197	124.027	123.588	122.530	121.869	121.850	121.254	120.208
Bearn max extents on WL m	20.386	20.014	19.192	18.979	19.192	20.016	20.389	19.371	16.254	14.378	13.786	12.843	12.451	12.843	13.250	14.359	15.068	16.997	18.534	20.113	19.230	18.903
Wetted Area m ²	2716.053	2716.507	2743.267	2777.671	2748.438	2722.114	2720.888	2726.967	2765.841	2783.484	2788.129	2756.501	2722.367	2733.218	2745.660	2764.541	2793.404	2847.962	2953.966	3132.716	3157.393	3159.288
Waterpl. Area m ²	1393.383	1382.448	1428.971	1489.898	1439.003	1395.898	1393.890	1415.936	1296.378	1227.552	1106.488	1080.224	998.487	976.893	993.372	1032.885	1110.821	1235.162	1419.133	1639.810	1616.621	1597.418
Prismatic coeff. (Cp)	0.472	0.450	0.439	0.455	0.437	0.448	0.470	0.494	0.509	0.517	0.522	0.520	0.524	0.531	0.543	0.560	0.585	0.610	0.610	0.583	0.573	0.575
Block coeff. (Cb)	0.278	0.303	0.354	0.431	0.353	0.303	0.277	0.284	0.336	0.384	0.414	0.469	0.496	0.442	0.398	0.355	0.322	0.308	0.305	0.322	0.413	0.573
LCB from zero pt. (+ve fwd) m	50.896	50.894	50.890	50.890	50.895	50.881	50.895	50.900	50.896	50.902	50.908	50.910	50.913	50.902	50.881	50.881	50.871	50.883	50.858	50.857	50.853	50.853
LCF from zero pt. (+ve fwd) m	51.950	49.898	47.484	45.738	47.580	49.829	51.978	54.038	56.242	57.500	58.291	59.184	57.125	56.644	56.077	55.520	54.789	53.908	52.748	52.478	53.027	53.080
Max deck inclination deg	30.0001	20.0001	10.0000	0.0461	10.0001	20.0001	30.0002	40.0002	50.0003	60.0003	70.0002	80.0001	90.0000	100.0000	110.0000	119.9999	129.9995	139.9980	149.9946	159.9870	169.9800	179.0450
Trim angle (+ve by stern) deg	-0.1075	-0.0554	-0.0264	-0.0481	-0.0373	-0.0641	-0.1161	-0.1862	-0.2983	-0.4665	-0.7043	-1.0637	n/a	-0.8392	-0.0828	0.2182	0.4125	0.5682	0.6933	0.7849	0.9138	0.9550

Εικόνα 175: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 92.958 m)		37.7	n/a	6.494	4.794	2.897	1.249	-0.379	-1.899	-3.628	-5.035	-6.403	-7.488	-8.235	-8.703	-9.021	-9.100	-8.899	-8.244	-7.189	-5.870	-4.330
Deck Edge (immersion pos = 92.958 m)		39	n/a	6.540	4.830	3.089	1.300	-0.325	-1.915	-3.494	-5.015	-6.198	-7.474	-8.254	-8.738	-9.084	-9.153	-8.919	-8.314	-7.283	-5.946	-4.408
Ventilation Fore PS	Downflooding point	44.3	0	7.894	6.179	4.350	2.913	0.765	-0.894	-2.780	-4.489	-6.098	-7.403	-8.409	-9.109	-9.493	-9.603	-9.182	-8.403	-7.228	-5.701	-4.089
Ventilation Fore SB	Downflooding point	155.4	0	7.894	6.435	10.783	11.888	12.807	13.369	13.473	13.130	12.386	11.947	10.050	8.511	6.795	4.880	2.900	0.971	-0.814	-2.448	-4.089
Ventilation Mid PS	Downflooding point	48.9	0	9.029	7.279	5.404	3.801	1.651	-0.211	-2.117	-4.017	-5.793	-7.315	-8.573	-9.532	-10.167	-10.441	-10.328	-9.790	-8.773	-7.394	-5.823
Ventilation Mid SB	Downflooding point	148.4	0	9.029	10.593	11.884	12.945	13.781	14.289	14.240	13.732	12.808	11.872	10.028	8.217	6.190	4.028	1.812	-0.346	-2.314	-4.114	-5.823
Ventilation Aft PS	Downflooding point	49.4	0	8.707	6.851	5.112	3.289	1.480	-0.289	-2.110	-3.943	-5.631	-7.119	-8.382	-9.380	-10.084	-10.437	-10.422	-9.888	-8.980	-7.801	-6.270
Ventilation Aft SB	Downflooding point	147.6	0	8.707	10.233	11.576	12.719	13.638	14.192	14.257	13.819	12.882	11.780	10.221	8.370	6.284	4.041	1.728	-0.559	-2.587	-4.520	-6.270

Εικόνα 176: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 6-7-8

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

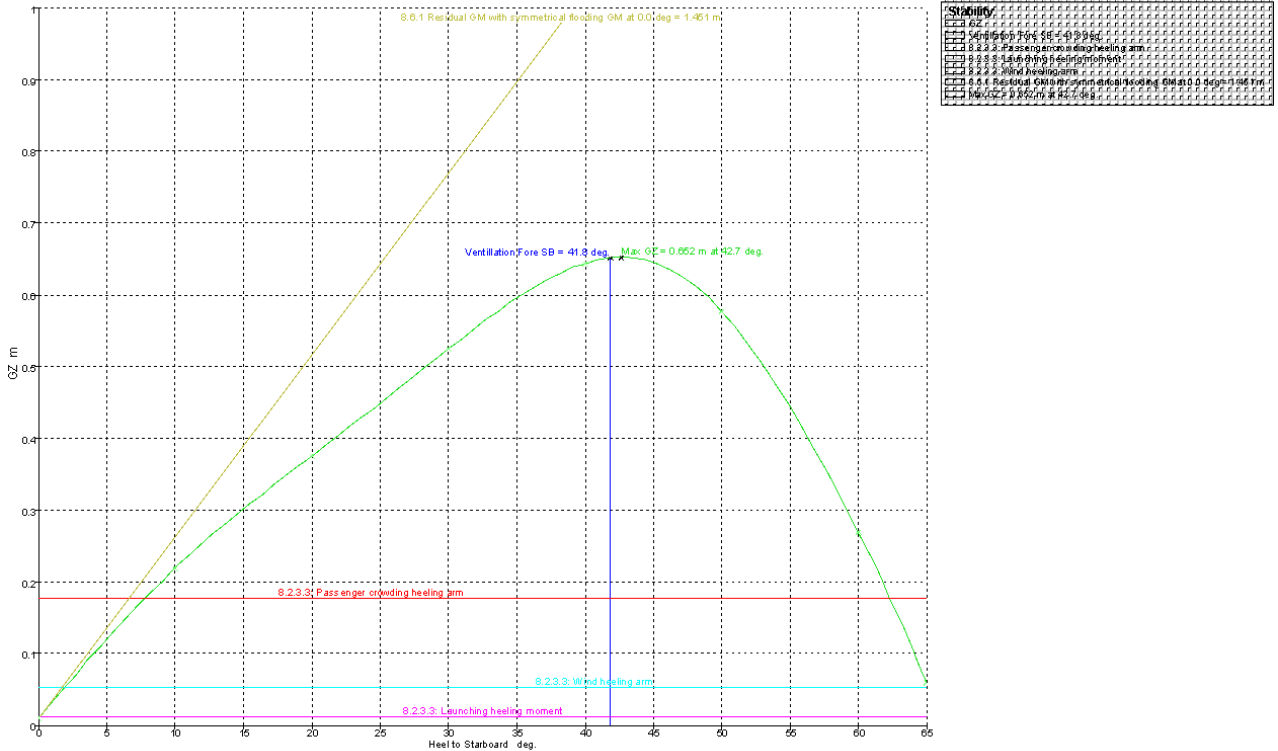
Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[] Fully flooded 95
 CW DRAIN[] Fully flooded 95
 WORKSHOP[] Fully flooded 95
 HEELING[] Fully flooded 95
 HFO STORAGE[] Fully flooded 95
 ABV WORKSHOP[] Fully flooded 95
 ABV HEELING[] Fully flooded 95
 ABV HFO STORAGE[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.800	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.593	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.296	2.344	4.225	101.406	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.296	-2.344	4.225	101.406	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.684	-4.200	1.736	5.279	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.683	-1.500	3.345	10.310	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.663	4.200	5.238	4.578	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.708	64.179	-0.303	3.930	253.842	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.514	-1.294	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.201	1.500	4.513	10.800	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.467	0.500	5.121	10.800	
.WATER BALLAST										
WBT No1	80%	119.245	71.547	116.337	69.802	101.512	0.000	1.521	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.591	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	0%	50.570	0.000	49.337	0.000	62.184	5.886	2.050	0.000	Maximum
No 2 WBT	0%	120.288	0.000	117.335	0.000	33.396	0.000	0.000	0.000	Maximum
TOTAL BALLAST	54.66%	674.879	368.314	658.418	359.819	27.491	0.000	4.496	94.797	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.000	3.150	1.840	4.312	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.400	3.150	2.000	8.625	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.801	-0.750	1.515	0.807	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.801	0.750	1.515	0.807	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	40.808	5.223	0.880	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	40.808	2.173	0.880	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.446	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	44.613	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.188	3.349	4.651	3.721	23.200	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.188	2.093	4.651	2.326	23.200	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.911	0.000	0.520	39.958	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.966	118.649	60.441	44.970	1.935	1.429	58.398	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.173	0.000	1.276	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.201	-2.699	0.240	31.493	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.606	0.000	0.280	4.344	Maximum
No 1 FO DRAIN D'RTY OIL	40%	2.694	1.077	2.694	1.077	37.317	0.503	0.280	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.317	-0.503	0.280	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	30%	4.842	1.453	4.842	1.453	53.993	-4.476	0.197	1.166	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.001	-2.550	0.180	1.852	Maximum
TOTAL MISC	39.36%	166.475	65.532	166.475	65.532	79.735	-0.410	0.998	395.347	
Total Loadcase			5865.540	1523.827	780.397	50.891	0.008	8.622	813.184	
FS correction									0.139	
VCG fluid									8.761	

Εικόνα 177: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 178: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.524	-0.375	-0.219	-0.010	0.203	0.385	0.538	0.648	0.648	0.221	-0.233	-0.764	-1.337	-1.919	-2.441	-2.853	-3.101	-3.127	-2.854	-2.079	-1.010	-0.008
Area under GZ curve from zero heel m.deg	8.6849	4.1738	1.1751	-0.0178	0.9860	3.9594	8.5851	14.6048	20.7778	24.7717	24.7924	19.8567	9.3758	-6.9242	-26.9978	-55.3767	-85.3066	-116.6423	-146.9007	-171.9578	-187.4882	-192.4831
Displacement t	5886	5886	5886	5886	5886	5886	5885	5885	5885	5885	5885	5886	5886	5886	5886	5886	5886	5886	5886	5886	5886	5886
Draft at FP m	6.218	6.417	6.457	6.441	6.481	6.450	6.249	5.785	5.184	4.379	3.120	-0.080	n/a	-13.710	-10.595	-9.631	-9.225	-9.080	-9.114	-9.289	-9.488	-9.551
Draft at AP m	4.276	4.893	4.941	5.071	4.951	4.708	4.287	3.551	2.302	0.458	-3.082	-13.810	n/a	-27.058	-18.474	-12.814	-10.908	-8.744	-6.032	-8.731	-8.848	-8.820
WL Length m	118.376	118.538	118.584	117.823	118.803	118.566	118.402	122.072	123.356	123.337	123.338	123.786	124.131	124.237	124.068	123.738	123.028	121.750	121.264	121.231	120.432	119.446
Beam max extents on WL m	20.081	19.924	19.192	18.900	19.192	19.932	20.081	19.396	16.254	14.378	13.250	13.332	12.451	12.843	13.250	14.309	15.499	16.608	17.708	20.113	19.192	18.903
Wetted Area m ²	2678.257	2663.775	2665.458	2663.244	2670.797	2670.099	2663.881	2707.719	2740.170	2744.930	2721.811	2724.019	2702.838	2686.893	2699.271	2718.814	2751.851	2810.601	2913.418	3120.836	3131.469	3129.581
Waterpl. Area m ²	1496.163	1498.245	1479.560	1539.369	1486.012	1499.993	1471.361	1462.856	1355.405	1282.048	1204.588	1144.401	1077.458	1036.848	1058.165	1100.978	1177.428	1287.080	1445.132	1662.804	1636.805	1617.424
Prismatic coeff. (Cp)	0.813	0.491	0.477	0.474	0.478	0.488	0.511	0.517	0.527	0.536	0.541	0.543	0.547	0.558	0.571	0.591	0.620	0.660	0.694	0.673	0.683	0.684
Block coeff. (Cb)	0.304	0.329	0.383	0.401	0.382	0.328	0.303	0.295	0.347	0.398	0.445	0.463	0.467	0.418	0.378	0.348	0.328	0.330	0.347	0.340	0.460	0.660
LCB from zero pt. (+ve fwd) m	50.972	50.972	50.972	50.958	50.954	50.966	50.974	50.974	50.898	50.993	50.997	51.003	51.011	51.000	50.978	50.954	50.931	50.913	50.890	50.881	50.884	50.877
LCF from zero pt. (+ve fwd) m	50.848	49.231	47.814	46.944	47.853	49.276	50.881	51.770	52.875	54.627	57.532	58.428	56.735	54.649	53.841	53.116	52.237	51.200	50.053	49.239	49.879	49.819
Max deck inclination deg	30.0112	20.0165	10.0289	0.7018	10.0294	20.0169	30.0115	40.0080	50.0068	60.0051	70.0037	80.0022	90.0000	99.9978	109.9968	119.9968	129.9977	139.9993	150.0000	159.9983	169.9911	179.9230
Trim angle (+ve by stern) deg	-0.9851	-0.8831	-0.7771	-0.7018	-0.7838	-0.8842	-1.0055	-1.1448	-1.4766	-2.0087	-3.1651	-6.9008	n/a	-8.8077	-3.0104	-1.6307	-0.8827	-0.3405	0.0422	0.2884	0.4305	0.4770

Εικόνα 179: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = H4.208 m)		35.3	n/a	6.072	4.390	2.595	0.851	-0.793	-2.321	-3.874	-5.378	-6.768	-7.914	-8.704	-9.168	-9.304	-9.094	-8.523	-7.616	-6.655	-5.512	-3.783
Deck Edge (immersion pos = H4.208 m)		35.7	n/a	6.148	4.482	2.663	0.912	-0.700	-2.278	-3.842	-5.359	-6.762	-7.921	-8.724	-9.201	-9.348	-9.149	-8.585	-7.688	-6.729	-5.588	-3.839
Ventilation Fore PS	Downflooding point	41.5	0	7.514	5.749	3.894	2.043	0.308	-1.434	-3.187	-4.918	-6.666	-7.954	-8.965	-9.678	-10.023	-10.000	-9.584	-8.754	-7.594	-6.889	-4.394
Ventilation Fore SB	Downflooding point	153.0	0	7.514	9.005	10.290	11.417	12.387	12.927	13.043	12.989	11.905	10.792	9.478	7.959	6.213	4.382	2.469	0.621	-1.091	-3.712	-4.384
Ventilation Mid PS	Downflooding point	49.2	0	9.080	7.333	5.452	3.538	1.889	-0.182	-2.032	-3.891	-6.038	-7.189	-8.482	-9.440	-10.097	-10.387	-10.303	-9.768	-8.743	-7.347	-5.772
Ventilation Mid SB	Downflooding point	148.5	0	9.080	10.913	11.911	12.881	13.825	14.319	14.323	13.855	12.968	11.894	10.139	8.306	6.259	4.071	1.838	-0.324	-2.283	-4.087	-5.772
Ventilation Aft PS	Downflooding point	92.3	0	9.312	7.800	6.022	3.960	2.146	0.416	-1.369	-3.101	-4.888	-6.122	-7.399	-8.447	-9.229	-9.699	-9.807	-9.488	-8.632	-7.350	-5.614
Ventilation Aft SB	Downflooding point	149.0	0	9.312	10.912	12.289	13.409	14.299	14.992	14.999	14.696	13.923	12.773	11.212	9.310	7.138	4.780	2.342	-0.038	-2.189	-4.083	-5.814

Εικόνα 180: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 7-8-9

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

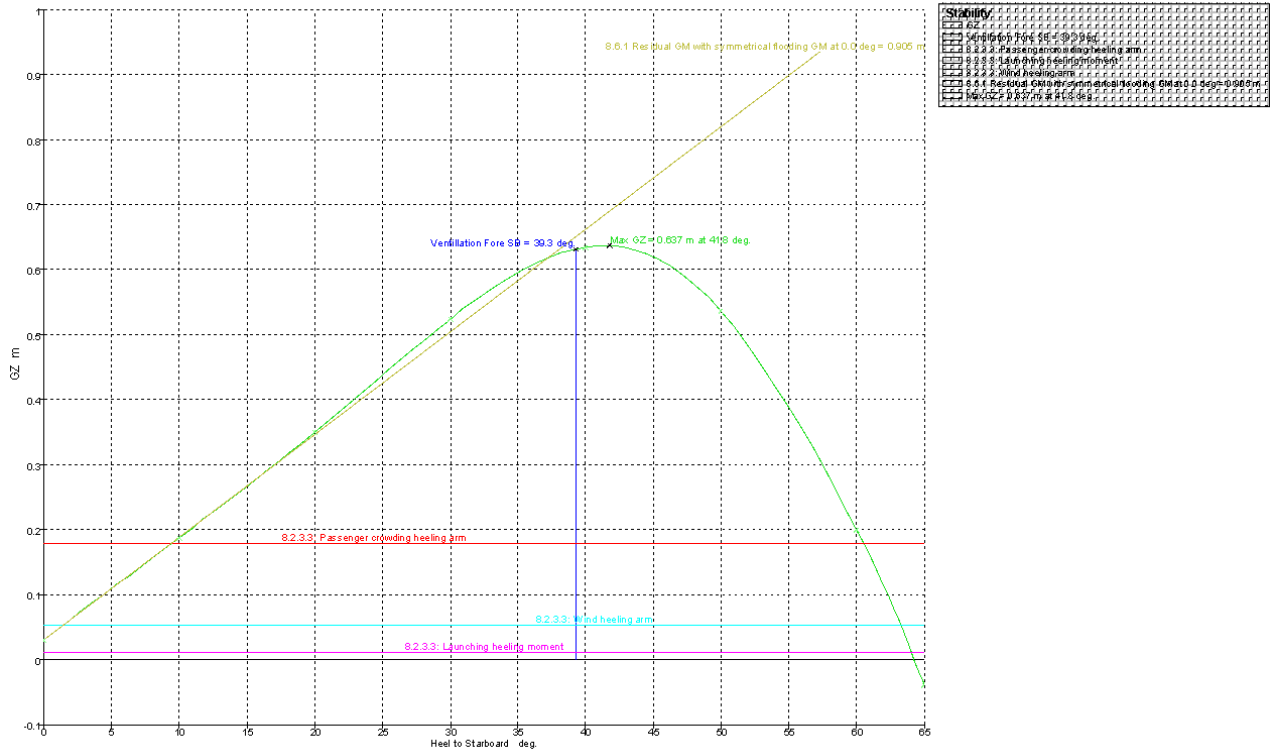
Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[] Fully flooded 95
 HEELING[] Fully flooded 95
 HFO STORAGE[] Fully flooded 95
 FW ROOM 1,2[] Fully flooded 95
 ABV HEELING[] Fully flooded 95
 ABV HFO STORAGE[] Fully flooded 95
 ABV FW ROOM 1,2[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.800	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5081.410			51.887	0.000	9.340	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.684	-2.612	0.033	30.865	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.403	2.342	4.226	101.414	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.403	-2.342	4.226	101.414	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.702	-4.200	1.798	5.279	Maximum
HFO SVCE	80%	68.661	54.849	69.960	55.968	57.686	-1.500	3.343	10.311	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.684	4.200	5.237	4.579	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.248	-0.303	3.930	253.961	
FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.573	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.213	1.500	4.513	10.801	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.471	0.500	5.121	10.801	
WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.591	0.000	1.522	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Stb	0%	50.570	0.000	49.337	0.000	62.384	5.422	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	54.65%	674.879	368.814	658.418	359.819	27.506	0.000	4.496	94.797	
LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.002	3.150	1.840	4.313	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.407	3.150	2.000	8.626	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.609	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.609	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.418	5.133	7.129	5.703	40.917	5.223	0.881	1.444	Maximum
No 2 LO Circ	80%	6.418	5.133	7.129	5.703	40.917	2.173	0.881	1.444	Maximum
No 3 LO Circ	0%	6.418	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	44.613	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.202	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.203	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.158	20.280	16.208	34.917	0.000	0.520	39.961	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.966	118.649	60.441	44.996	1.935	1.429	58.402	
MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.211	0.000	1.278	356.124	Maximum
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.212	-2.699	0.240	31.495	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.680	0.000	0.260	4.344	Maximum
No 1 FO DRAIN DeRTY OIL	40%	2.694	1.077	2.694	1.077	37.325	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.325	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.603	0.000	0.120	83.987	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	54.009	-4.476	0.197	1.166	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.016	-2.550	0.180	1.852	Maximum
TOTAL MISC	38.28%	176.325	67.501	176.325	67.501	78.834	-0.398	0.972	479.337	
Total Loadcase			5867.510	1533.676	782.367	50.894	0.008	8.619	897.198	
FS correction									0.153	
VCG fluid									8.772	

Εικόνα 181: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 182: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.523	-0.349	-0.187	-0.028	0.132	0.320	0.502	0.614	0.517	0.181	-0.316	-0.877	-1.448	-2.008	-2.613	-2.900	-3.108	-3.084	-2.785	-2.038	-0.988	-0.008
Area under GZ curve from zero heel m.deg	8.1083	3.7508	1.0784	-0.0538	0.4868	2.7442	6.8768	12.5715	18.4327	22.0862	21.4685	15.5488	3.8381	-13.3448	-38.0154	-63.2085	-83.4255	-124.8310	-154.3888	-178.9243	-194.0983	-198.8888
Displacement t	5888	5888	5888	5888	5888	5888	5887	5888	5888	5887	5887	5888	5888	5888	5888	5888	5888	5888	5888	5888	5888	5888
Draft at FP m	8.877	7.002	6.888	6.856	7.013	7.036	6.908	6.588	6.132	5.582	4.888	3.413	n/a	-8.372	-8.383	-8.147	-8.138	-8.252	-8.475	-8.783	-9.022	-9.088
Draft at AP m	3.527	3.978	4.285	4.381	4.286	3.880	3.538	2.748	1.344	-0.848	-5.183	-17.888	n/a	-31.788	-18.800	-14.272	-11.888	-10.437	-9.533	-9.111	-9.017	-8.887
WL Length m	118.887	119.079	119.110	112.788	119.132	119.107	118.884	118.704	119.547	123.185	123.488	124.048	124.283	124.183	123.888	123.315	122.178	120.719	120.487	120.842	119.882	118.881
Beam max extents on WL m	18.831	18.850	18.182	18.800	18.182	18.858	18.851	18.318	16.254	14.378	13.280	13.122	12.774	12.843	13.250	14.279	15.436	16.548	17.778	20.113	18.182	18.803
Wetted Area m ²	2881.028	2830.288	2808.000	2888.803	2813.305	2838.288	2888.380	2707.747	2748.888	2742.484	2722.788	2724.870	2723.788	2708.581	2688.181	2719.585	2787.312	2821.887	2831.041	3140.838	3143.888	3144.335
Waterpl. Area m ²	1518.332	1505.248	1492.887	1524.881	1497.238	1509.157	1520.575	1494.387	1386.783	1278.824	1204.881	1170.733	1134.581	1096.910	1087.583	1148.741	1223.775	1320.444	1448.138	1670.237	1613.818	1587.583
Prismatic coeff. (Cp)	0.518	0.488	0.487	0.508	0.488	0.488	0.514	0.532	0.544	0.538	0.545	0.547	0.551	0.558	0.571	0.580	0.618	0.647	0.679	0.709	0.737	0.737
Block coeff. (Cb)	0.308	0.335	0.387	0.388	0.388	0.334	0.308	0.308	0.382	0.403	0.482	0.472	0.432	0.388	0.358	0.330	0.315	0.317	0.330	0.344	0.458	0.587
LCB from zero pt. (+ve fwd) m	51.038	51.038	51.037	51.027	51.018	51.028	51.038	51.037	51.050	51.082	51.072	51.080	51.088	51.080	51.051	51.020	50.978	50.948	50.925	50.908	50.888	50.883
LCF from zero pt. (+ve fwd) m	50.451	49.080	48.010	48.808	48.038	49.100	50.478	50.802	50.354	52.813	55.480	58.887	58.832	54.503	52.578	51.587	50.552	49.271	47.803	48.387	48.485	48.517
Max deck inclination deg	30.0334	20.0508	10.0837	1.3212	10.0848	20.0515	30.0338	40.0233	50.0182	60.0137	70.0088	80.0058	90.0000	98.9838	108.8884	118.8878	128.8888	138.8823	148.8887	158.8884	170.0000	179.9441
Trim angle (+ve by stem) deg	-1.7182	-1.5488	-1.4004	-1.3212	-1.4075	-1.5807	-1.7278	-1.8528	-2.4521	-3.2813	-4.1478	-5.8403	n/a	-11.3374	-5.3333	-3.1380	-1.8248	-1.1189	-0.5423	-0.1828	0.0027	0.0559

Εικόνα 183: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 94.932 m)		32.9	na	5.678	4.000	2.222	0.465	-1.154	-2.735	-4.273	-5.768	-7.154	-8.539	-9.203	-9.676	-9.808	-9.575	-8.895	-8.020	-6.766	-5.245	-4.288
Deck Edge (immersion pos = 94.932 m)		33.2	na	5.732	4.070	2.286	0.530	-1.101	-2.663	-4.243	-5.750	-7.149	-8.347	-9.224	-9.713	-9.851	-9.558	-8.823	-8.103	-6.853	-5.428	-4.344
Ventilation Fore PS	Downflooding point	38.2	0	7.131	5.380	3.471	1.610	-0.149	-1.805	-3.046	-5.071	-7.008	-8.448	-9.657	-10.282	-10.586	-10.546	-10.087	-8.198	-7.077	-6.334	-4.717
Ventilation Fore SB	Downflooding point	51.1	0	7.131	8.614	9.882	10.681	11.669	12.453	13.065	12.240	11.449	10.282	8.887	7.346	5.638	3.814	1.864	0.179	-1.485	-3.078	-4.717
Ventilation Mid PS	Downflooding point	46.9	0	9.108	7.348	5.482	3.518	1.638	-0.200	-2.088	-3.865	-5.827	-7.191	-8.502	-9.488	-10.173	-10.463	-10.411	-9.877	-8.838	-7.438	-5.887
Ventilation Mid SB	Downflooding point	143	0	9.108	10.827	11.610	12.068	13.775	14.266	14.263	13.848	12.884	11.668	10.088	8.242	6.178	3.973	1.729	-0.433	-2.378	-4.166	-5.887
Ventilation AH PS	Downflooding point	55.1	0	9.882	8.167	6.364	4.470	2.827	0.882	-0.687	-2.628	-4.079	-5.493	-6.752	-7.627	-8.063	-8.214	-8.408	-8.167	-8.386	-7.081	-5.942
Ventilation AH SB	Downflooding point	151.3	0	9.882	11.448	12.818	13.617	14.771	15.384	15.835	15.225	14.923	13.368	11.848	9.824	7.687	5.281	2.738	0.283	-1.865	-3.789	-5.942

Εικόνα 184: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 8-9-10

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

HFO STORAGE[] Fully flooded 95

FW ROOM 1,2[] Fully flooded 95

AC PLANT ROOM[] Fully flooded 95

ABV HFO STORAGE[] Fully flooded 95

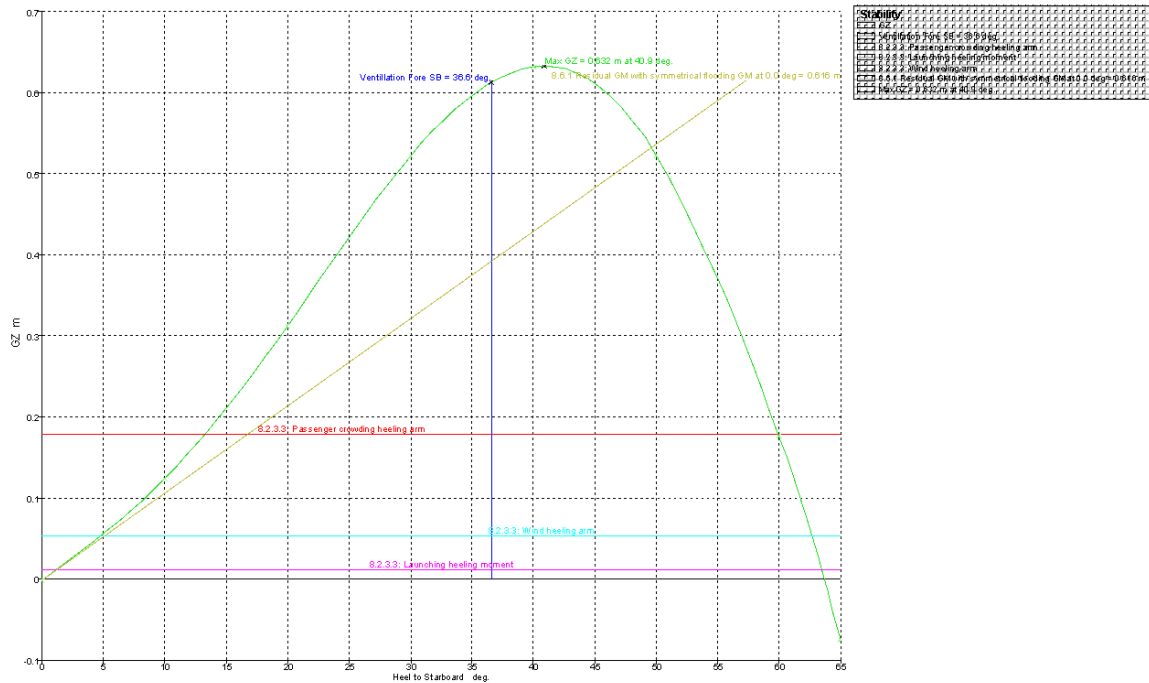
ABV FW ROOM 1,2[] Fully flooded 95

ABV AC PLANT ROOM[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.300			86.600	0.000	12.460	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.260	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.760	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.771	-2.612	0.034	30.871	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.505	2.339	4.228	101.433	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.505	-2.339	4.228	101.433	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.720	-4.200	1.736	5.280	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.690	-1.500	3.341	10.313	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.705	4.200	5.236	4.580	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.313	-0.303	3.931	253.910	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.573	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.224	1.500	4.513	10.803	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.798	74.998	149.798	74.998	39.475	0.500	5.121	10.803	
.WATER BALLAST										
WBT No1	60%	119.245	71.547	116.337	69.802	101.666	0.000	1.523	94.787	Maximum
No 4 WBT	100%	107.295	107.295	104.878	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.066	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	59.100	-8.370	2.350	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	62.384	5.422	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.765	27.863	-0.061	4.473	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.004	3.150	1.840	4.314	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.412	3.150	2.000	8.627	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.818	-0.750	1.515	0.808	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.818	0.750	1.515	0.808	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.020	5.223	0.883	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.020	2.173	0.883	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	44.613	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.188	3.349	4.651	3.721	23.204	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.188	2.093	4.651	2.326	23.206	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.923	0.000	0.520	39.969	Maximum
TOTAL LUBE OIL	50.06%	103.745	51.966	118.649	60.441	46.020	1.935	1.430	58.413	
.MISC										
GREY WATER TANK	40%	119.826	47.930	119.826	47.930	92.247	0.000	1.277	356.124	Maximum
SLUDGE TANK	40%	14.773	5.908	14.773	5.908	46.223	-2.669	0.240	31.501	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.751	0.000	0.262	4.345	Maximum
No 1 FO DRAIN D'ERTY OIL	40%	2.694	1.077	2.694	1.077	37.333	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.333	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.605	0.000	0.120	84.003	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	54.023	-4.476	0.197	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.031	-2.550	0.180	1.853	Maximum
TOTAL MISC	38.28%	178.325	67.501	178.325	67.501	78.888	-0.398	0.973	479.360	
Total Loadcase			5871.556	1583.013	786.314	50.903	0.002	8.615	899.773	
FS correction									0.153	
VCG fluid									8.768	

Εικόνα 185: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 186: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.621	-0.312	-0.123	0.002	0.127	0.316	0.525	0.834	0.932	0.179	-0.353	-0.940	-1.520	-2.070	-2.559	-2.835	-3.124	-3.083	-2.783	-2.014	-0.968	-0.002
Area under GZ curve from zero heel m.deg	6.8543	2.6622	0.5853	0.0040	0.6105	2.7758	7.0037	12.9391	18.9339	22.8355	21.8658	15.4151	3.1011	-14.8834	-38.0948	-65.8672	-98.1588	-127.3879	-158.9161	-181.1588	-198.1341	-200.8944
Displacement t	5872	5872	5872	5872	5872	5872	5872	5872	5872	5872	5872	5871	5871	5871	5872	5872	5872	5872	5872	5872	5872	5872
Draft at FP m	7.549	7.839	7.598	7.551	7.593	7.635	7.547	7.286	7.001	6.710	6.444	6.274	nia	-8.331	-8.872	-7.031	-7.318	-7.606	-7.953	-8.347	-8.584	-8.661
Draft at AP m	3.049	3.527	3.821	3.929	3.823	3.529	3.050	2.202	0.704	-1.746	-6.587	-20.838	nia	-34.801	-20.361	-15.281	-12.808	-10.959	-9.621	-8.415	-8.309	-8.275
WL Length m	119.649	119.667	119.597	112.745	119.594	119.663	119.846	119.638	121.313	123.081	123.838	124.225	124.329	124.113	123.861	122.871	121.209	119.839	119.924	119.938	119.080	117.961
Beam max extents on WL m	18.673	18.848	18.162	18.800	19.192	19.848	18.973	18.349	18.254	14.378	13.250	12.652	13.123	12.643	13.250	14.282	16.407	18.555	17.913	20.113	18.182	18.903
Wetted Area m ²	2684.479	2647.621	2612.109	2583.421	2611.672	2647.454	2684.868	2731.982	2787.868	2758.549	2748.386	2740.322	2738.700	2734.598	2719.907	2727.054	2787.102	2836.274	2948.025	3146.437	3163.789	3162.238
Waterpl. Area m ²	1516.424	1493.445	1455.128	1416.284	1455.206	1493.488	1516.428	1473.713	1373.148	1231.840	1158.890	1136.368	1126.842	1110.803	1108.882	1149.445	1232.605	1328.442	1449.058	1640.388	1598.022	1577.020
Prismatic coeff. (Cp)	0.502	0.487	0.477	0.503	0.477	0.487	0.502	0.518	0.524	0.530	0.538	0.543	0.547	0.554	0.565	0.581	0.605	0.632	0.667	0.697	0.708	0.708
Block coeff. (Cb)	0.305	0.332	0.338	0.360	0.338	0.332	0.305	0.304	0.366	0.404	0.450	0.461	0.404	0.381	0.348	0.319	0.307	0.307	0.313	0.328	0.431	0.533
LCB from zero pt. (+ve fwd) m	51.086	51.067	51.060	51.062	51.079	51.085	51.089	51.097	51.108	51.121	51.135	51.144	51.148	51.130	51.112	51.087	51.028	50.960	50.851	50.934	50.927	50.918
LCF from zero pt. (+ve fwd) m	48.800	48.462	47.818	47.469	47.810	48.455	49.798	49.413	46.510	50.289	52.715	54.800	55.398	54.282	51.915	50.280	48.191	47.803	46.291	44.478	44.077	44.114
Max deck inclination deg	30.0802	20.0937	10.1780	1.8555	10.1774	20.0935	30.0801	40.0414	50.0315	60.0236	70.0165	80.0089	90.0000	99.9901	109.9817	119.9775	129.9778	139.9820	149.9885	159.9937	169.9934	179.8852
Trim angle (+ve by stern) deg	-2.3053	-2.1055	-1.9340	-1.8555	-1.9311	-2.1033	-2.3038	-2.9038	-3.2239	-4.3253	-6.8477	-13.8312	nia	-14.2888	-8.9808	-4.2203	-2.7091	-1.7175	-1.0087	-0.5474	-0.3719	-0.3148

Εικόνα 187: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immerse angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 98.061 m)		30.4	nia	5.188	3.930	1.781	0.098	-1.953	-3.143	-4.677	-6.159	-7.492	-8.671	-9.693	-10.679	-11.644	-12.584	-13.491	-14.365	-15.207	-16.018	-16.797
Deck Edge (immersion pos = 98.061 m)		30.7	nia	5.285	3.981	1.845	0.117	-1.911	-3.102	-4.647	-6.121	-7.458	-8.691	-9.695	-10.614	-11.556	-12.420	-13.242	-14.031	-14.789	-15.518	-16.218
Ventilation Fore FS	Downflooding point	36.6	0	8.658	4.901	3.020	1.189	-0.597	-2.354	-4.066	-5.767	-7.386	-8.922	-10.383	-11.763	-13.060	-14.279	-15.429	-16.517	-17.543	-18.506	-19.407
Ventilation Fore SB	Downflooding point	149	0	8.658	8.155	6.453	4.835	3.402	2.119	0.930	-0.183	-1.269	-2.281	-3.213	-4.063	-4.830	-5.512	-6.109	-6.622	-7.052	-7.409	-7.693
Ventilation Mid FS	Downflooding point	48.2	0	8.881	7.229	5.338	3.402	1.919	0.530	-0.715	-2.069	-3.479	-4.838	-6.145	-7.401	-8.616	-9.690	-10.624	-11.429	-12.105	-12.654	-13.077
Ventilation Mid SB	Downflooding point	147.6	0	8.881	10.507	11.792	12.841	13.685	14.258	14.711	15.068	15.369	15.634	15.864	16.059	16.220	16.348	16.444	16.509	16.544	16.549	16.524
Ventilation Aft FS	Downflooding point	98.0	0	10.191	8.485	6.871	4.779	2.831	1.192	-0.203	-1.762	-3.380	-5.060	-6.794	-8.484	-10.131	-11.736	-13.301	-14.826	-16.312	-17.759	-19.168
Ventilation Aft SB	Downflooding point	182.4	0	10.191	11.785	13.151	14.233	15.072	15.890	16.633	17.344	18.004	18.614	19.174	19.684	20.144	20.554	20.914	21.224	21.484	21.694	21.864

Εικόνα 188: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 9-10-11

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

GREY WATER TANK[] Fully flooded 95

FW ROOM 1,2[] Fully flooded 95

AC PLANT ROOM[] Fully flooded 95

SEWAGE TRMNT[] Fully flooded 95

ABV FW ROOM 1,2[] Fully flooded 95

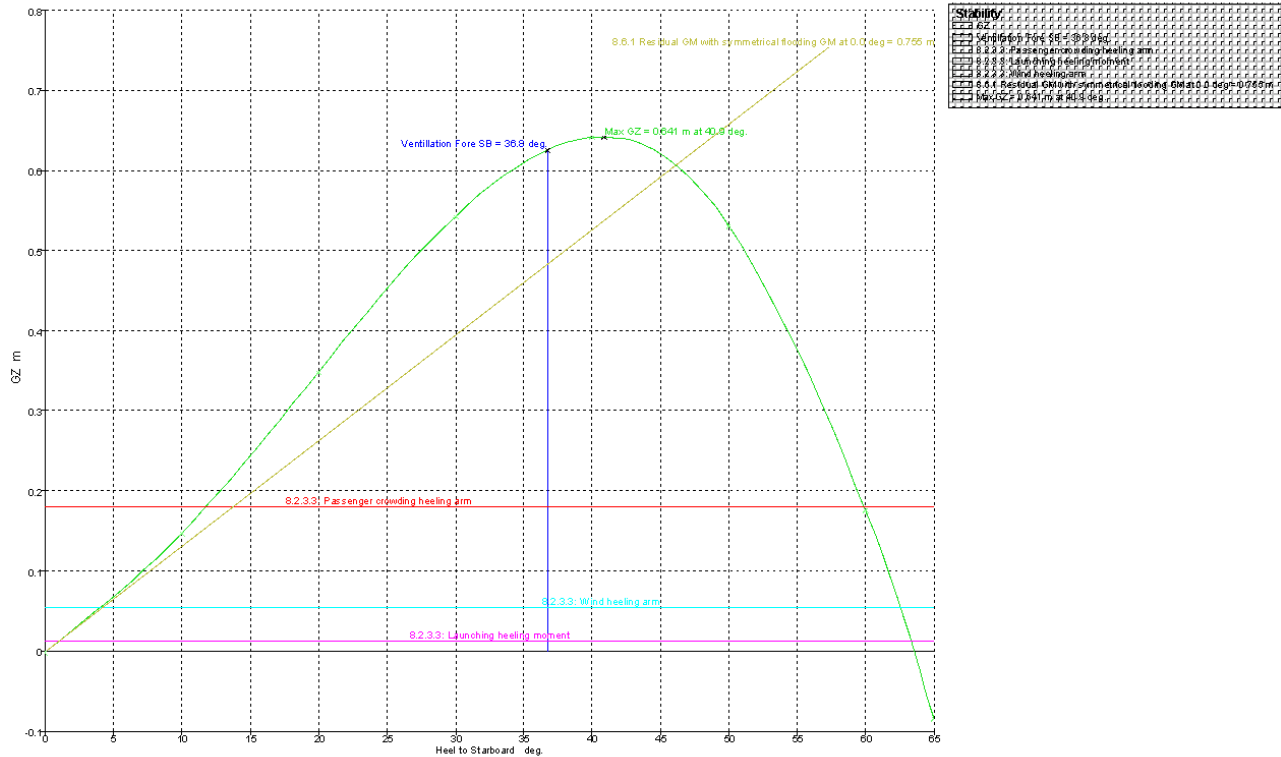
ABV AC PLANT ROOM[] Fully flooded 95

ABV SEWAGE TRMNT[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.800	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.800	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.846	-2.612	0.036	30.879	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.593	2.338	4.230	101.459	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.593	-2.338	4.230	101.459	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.737	-4.200	1.737	5.281	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.695	-1.500	3.343	10.315	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.717	4.200	5.237	4.581	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.708	64.370	-0.303	3.933	253.976	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.573	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.234	1.500	4.513	10.806	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.478	0.500	6.121	10.806	
.WATER BALLAST										
WBT No1	80%	119.245	71.547	116.337	69.802	101.730	0.000	1.525	94.797	Maximum
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.066	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.048	49.337	3.947	59.165	-8.389	2.352	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	62.384	5.422	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.396	0.000	0.000	0.000	Maximum
TOTAL BALLAST	51.4%	725.449	372.860	707.755	363.785	27.876	-0.091	4.474	97.287	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.005	3.150	1.840	4.315	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.417	3.150	2.000	8.629	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.625	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.625	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.109	5.223	0.885	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.109	2.173	0.885	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.813	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	44.813	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.205	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.208	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.928	0.000	0.520	39.979	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.968	118.649	60.441	45.041	1.935	1.430	58.428	
.MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.232	-2.699	0.241	31.509	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.813	0.000	0.263	4.346	Maximum
No 1 FO DRAIN D&RTY OIL	40%	2.694	1.077	2.694	1.077	37.340	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.340	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.807	0.000	0.120	84.026	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	54.036	-4.476	0.197	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.043	-2.550	0.181	1.853	Maximum
TOTAL MISC	34.64%	66.499	19.571	66.499	19.571	46.128	-1.372	0.230	123.269	
Total Loadcase			5823.628	1463.188	738.383	50.566	0.002	8.675	543.764	
FS correction									0.093	
VCG fluid									8.769	

Εικόνα 189: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 190: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Εικόνα 191: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 96.700 m)		20.6	na	5.327	3.960	1.986	0.104	-1.624	-3.093	-4.600	-6.095	-7.430	-8.603	-9.496	-10.016	-10.137	-9.863	-9.338	-8.492	-7.212	-5.340	-4.008
Deck Edge (immersion pos = 96.700 m)		31	na	5.403	3.730	1.830	0.183	-1.473	-3.062	-4.600	-6.089	-7.427	-8.612	-9.616	-10.062	-10.163	-9.949	-9.411	-8.636	-7.299	-5.321	-4.004
Ventilation Fore PS	Downflooding point	38.8	0	6.768	5.032	3.106	1.203	-0.673	-2.019	-4.066	-6.763	-7.247	-8.776	-9.616	-10.066	-10.063	-10.027	-10.499	-9.693	-8.281	-6.769	-5.156
Ventilation Fore SB	Downflooding point	148.6	0	6.768	6.288	6.614	10.671	11.471	12.033	12.196	11.649	11.068	9.663	8.927	8.601	8.231	3.423	1.602	-0.190	-1.649	-3.903	-6.156
Ventilation Mid PS	Downflooding point	48.1	0	6.166	7.429	9.618	9.964	1.679	-0.164	-1.890	-3.765	-6.467	-7.006	-8.229	-9.369	-10.062	-10.599	-10.949	-9.694	-8.082	-7.402	-6.613
Ventilation Mid SB	Downflooding point	148.1	0	6.166	10.707	11.072	13.001	13.610	14.263	14.364	13.987	13.124	11.661	10.266	9.371	8.262	4.984	1.798	-0.412	-2.402	-4.203	-6.613
Ventilation Aft PS	Downflooding point	69.2	0	10.478	9.772	6.672	6.101	3.282	1.927	-0.107	-1.700	-3.261	-4.644	-6.096	-6.864	-7.079	-6.933	-6.791	-6.843	-7.000	-6.843	-6.100
Ventilation Aft SB	Downflooding point	163.6	0	10.478	12.652	13.432	14.644	16.402	16.964	16.217	16.005	15.541	14.234	12.696	10.757	8.476	6.667	3.364	0.808	-1.466	-3.961	-6.100

Εικόνα 192: Προσδιορισμός της θέσης των Key Points

Loadcase - Half Load 50%

Damage Case - 10-11-12

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

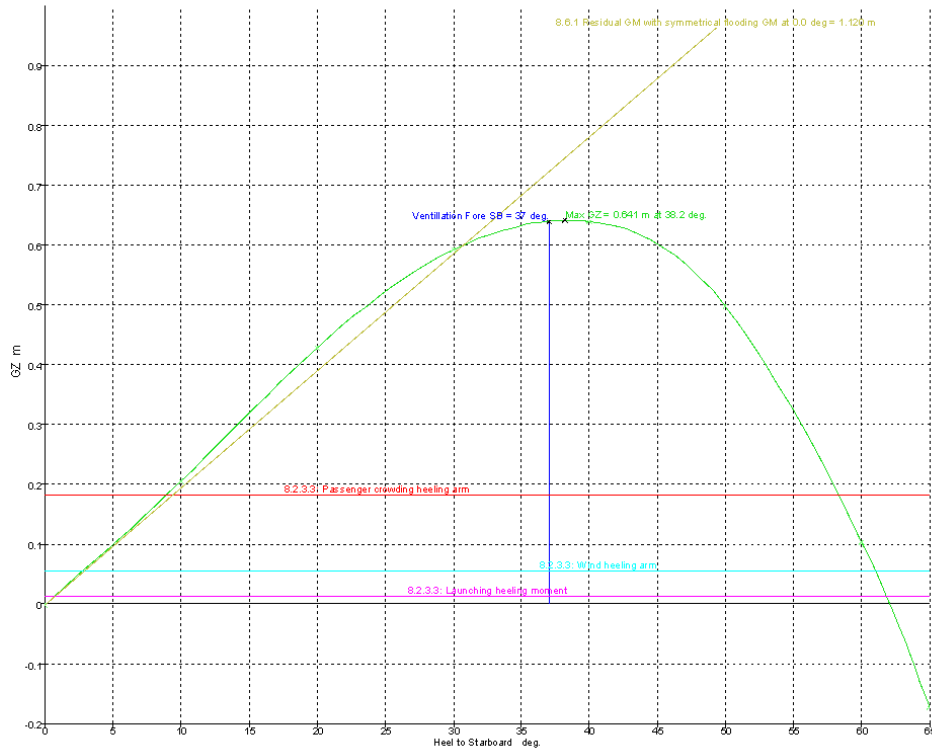
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
WBT No1[]	Fully flooded	95		
GREY WATER TANK[]	Fully flooded	95		
AC PLANT ROOM[]	Fully flooded	95		
SEWAGE TRMNT[]	Fully flooded	95		
BOW THRUSTER[]	Fully flooded	95		
ABV AC PLANT ROOM[]	Fully flooded	95		
ABV SEWAGE TRMNT[]	Fully flooded	95		
ABV BOW THRUSTER[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.856	-2.612	0.037	30.881	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.808	2.337	4.230	101.465	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.808	-2.337	4.230	101.465	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.737	-4.200	1.736	5.282	Maximum
HFO SVCE	80%	68.561	54.849	69.960	55.968	57.692	-1.500	3.339	10.316	Maximum
MGO SERVICE	80%	19.554	15.643	23.004	18.404	57.716	4.200	5.236	4.581	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.379	-0.303	3.932	253.989	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.573	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.236	1.500	4.513	10.808	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	19.600	0.000	6.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.476	0.500	5.121	10.808	
.WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.066	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum
Heeling Port	8%	50.570	4.046	49.337	3.947	59.176	-8.368	2.353	2.489	Maximum
Heeling Stb	0%	50.570	0.000	49.337	0.000	62.384	5.422	2.050	0.000	Maximum
No 2 WBT	0%	120.288	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	49.7%	608.204	301.312	591.418	293.963	10.339	-0.112	5.174	2.489	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.006	3.150	1.840	4.315	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.051	58.418	3.150	2.000	8.630	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.626	-0.750	1.515	0.608	Maximum
LO RNVD	35%	5.540	1.939	6.156	2.155	51.626	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.125	5.223	0.888	1.445	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.125	-2.173	0.888	1.445	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	0%	6.512	0.000	7.235	0.000	44.613	-3.475	0.600	0.000	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.205	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.209	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.829	0.000	0.520	39.981	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.968	118.649	60.441	45.045	1.935	1.430	58.431	
.MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.234	-2.699	0.241	31.511	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.824	0.000	0.264	4.346	Maximum
No 1 FO DRAIN DeRTY OIL	40%	2.694	1.077	2.694	1.077	37.342	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.342	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.808	0.000	0.120	84.029	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	54.036	-4.476	0.198	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.045	-2.550	0.181	1.853	Maximum
TOTAL MISC	34.64%	56.499	19.571	56.499	19.571	46.133	-1.372	0.230	123.275	
Total Loadcase			5752.078	1346.851	668.581	49.930	0.002	8.784	448.992	
FS correction									0.078	
VCG fluid									8.842	

Εικόνα 193: Κατάσταση φόρτωσης, πληρότητα 50%



Curve	Color	Description
1	Yellow	GZ curve
2	Red	8.2.3.3: Passenger crowding heeling arm
3	Cyan	8.2.3.3: Wind heeling arm
4	Magenta	8.2.3.3: Launching heeling moment
5	Blue	Ventilation Fore SB = 37 deg
6	Yellow	8.6.1 Residual GM with symmetrical flooding GM at 0.0 deg = 1.126 m

Εικόνα 194: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.591	-0.427	-0.204	0.002	0.209	0.432	0.595	0.643	0.500	0.106	-0.481	-1.142	-1.808	-2.418	-2.940	-3.326	-3.517	-3.473	-3.144	-2.393	-1.181	-0.002
Area under GZ curve from zero heel m deg	9.3016	4.1651	0.9876	0.0040	1.0346	4.2503	6.4916	15.7733	21.6794	24.9104	23.1496	15.0609	0.2995	-20.8773	-47.7562	-79.2152	-113.8098	-148.7562	-182.1495	-210.0814	-227.7705	-233.5094
Displacement t	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752
Draft at FP m	7.422	7.256	7.028	6.939	7.019	7.249	7.423	7.353	7.193	7.223	7.426	8.264	n/a	-4.305	-6.430	-6.983	-6.388	-6.655	-6.940	-7.302	-7.483	-7.495
Draft at AP m	2.343	3.017	3.433	3.572	3.439	3.022	2.342	1.289	-0.449	-3.526	-9.508	-28.899	n/a	-40.915	-23.438	-17.341	-14.132	-12.172	-10.980	-10.310	-10.172	-10.150
WL Length m	119.569	119.406	115.549	111.952	115.821	119.399	119.570	119.813	121.715	123.402	124.063	124.384	124.379	124.081	123.550	123.557	119.717	118.843	118.940	118.388	117.538	116.248
Beam max extents on WL m	18.480	19.657	19.189	18.900	18.188	19.657	19.480	19.030	18.254	14.378	13.250	12.843	13.071	12.718	13.248	14.160	15.207	16.367	18.076	20.113	19.182	18.901
Wetted Area m ²	2563.500	2516.140	2459.396	2428.001	2458.311	2515.280	2563.537	2612.470	2648.677	2688.828	2698.481	2681.489	2656.401	2658.406	2658.576	2661.738	2711.005	2798.918	2932.721	3118.694	3198.239	3169.435
Waterpl. Area m ²	1454.848	1461.302	1445.250	1425.827	1445.588	1461.391	1454.848	1434.074	1348.824	1208.215	1117.022	1078.609	1069.478	1077.552	1102.004	1141.197	1221.693	1318.185	1438.303	1630.138	1661.937	1630.913
Prismatic coeff. (Cp)	0.529	0.522	0.532	0.548	0.531	0.522	0.529	0.533	0.538	0.538	0.545	0.551	0.558	0.581	0.587	0.572	0.567	0.504	0.400	0.281	0.291	0.283
Block coeff. (Cb)	0.323	0.350	0.370	0.387	0.370	0.350	0.323	0.317	0.363	0.411	0.458	0.487	0.392	0.398	0.333	0.306	0.298	0.268	0.281	0.291	0.283	0.248
LCB from zero pt. (+ve fwd) m	50.163	50.166	50.130	50.120	50.112	50.137	50.166	50.181	50.200	50.235	50.258	50.294	50.285	50.247	50.219	50.171	50.119	50.064	50.028	49.997	49.961	49.962
LCF from zero pt. (+ve fwd) m	45.959	45.221	45.225	45.534	45.207	45.206	45.961	46.337	46.443	45.846	46.892	47.828	48.708	48.741	47.847	46.085	45.228	44.207	43.471	42.727	41.395	41.359
Max deck inclination deg	30.0786	20.0995	10.1615	1.7282	10.1802	20.0999	30.0767	40.0588	50.0463	60.0382	70.0279	80.0150	90.0000	99.9837	106.9684	119.9574	129.9524	139.9518	149.9521	159.9498	169.9080	178.8394
Trim angle (+ve by stern) deg	-2.8011	-2.1708	-1.8414	-1.7282	-1.8341	-2.1834	-2.8022	-3.1048	-3.9105	-5.4927	-8.8130	-17.4454	n/a	-18.1319	-9.1501	-5.8011	-3.9837	-2.8099	-2.0559	-1.5410	-1.3878	-1.3608

Εικόνα 195: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 86.706 m)		31.4	n/a	8.777	4.078	2.159	0.233	-1.003	-3.134	-4.757	-6.289	-7.622	-8.788	-9.684	-10.273	-10.475	-10.282	-9.640	-8.164	-6.024	-4.771	-3.933
Deck Edge (immersion pos = 86.706 m)		31.7	n/a	8.693	4.148	2.223	0.292	-1.452	-3.094	-4.720	-6.251	-7.618	-8.796	-9.717	-10.309	-10.522	-10.413	-10.020	-8.278	-6.108	-4.653	-3.911
Ventilation Fore PS	Downflooding point	37	0	7.241	5.444	3.561	1.330	-0.594	-3.079	-4.207	-5.969	-7.672	-9.991	-10.149	-10.981	-11.973	-11.279	-10.695	-10.228	-9.691	-7.955	-6.904
Ventilation Fore SB	Downflooding point	145.3	0	7.241	5.569	6.899	10.689	11.473	11.671	12.000	11.827	10.895	9.729	8.287	6.651	4.944	2.974	1.049	-0.699	-2.590	-4.310	-6.904
Ventilation Mid PS	Downflooding point	46.7	0	6.480	7.710	5.751	3.737	1.808	-0.284	-1.913	-3.702	-5.390	-6.921	-8.283	-9.323	-10.087	-10.495	-10.465	-10.042	-9.097	-7.783	-6.211
Ventilation Mid SB	Downflooding point	147.3	0	6.480	10.988	12.287	13.174	13.959	14.391	14.425	14.024	13.183	11.827	10.308	9.367	8.289	3.999	1.888	-0.803	-3.838	-4.494	-6.211
Ventilation Aft PS	Downflooding point	81.5	0	10.577	8.885	7.154	5.333	3.543	1.933	0.298	-1.315	-3.808	-4.198	-4.444	-4.531	-4.423	-4.083	-3.383	-2.220	-7.828	-8.247	-4.683
Ventilation Aft SB	Downflooding point	159.3	0	10.577	12.185	13.584	14.779	15.692	16.289	16.695	16.421	15.777	14.674	13.159	11.392	9.803	6.491	3.777	1.258	-1.087	-2.968	-4.683

Εικόνα 196: Προσδιορισμός της θέσης των Key Points

Damage Case - 11-12-13

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

WBT No1[] Fully flooded 95

FPT[] Fully flooded 95

GREY WATER TANK[] Fully flooded 95

SEWAGE TRMNT[] Fully flooded 95

BOW THRUSTER[] Fully flooded 95

FORE[] Fully flooded 95

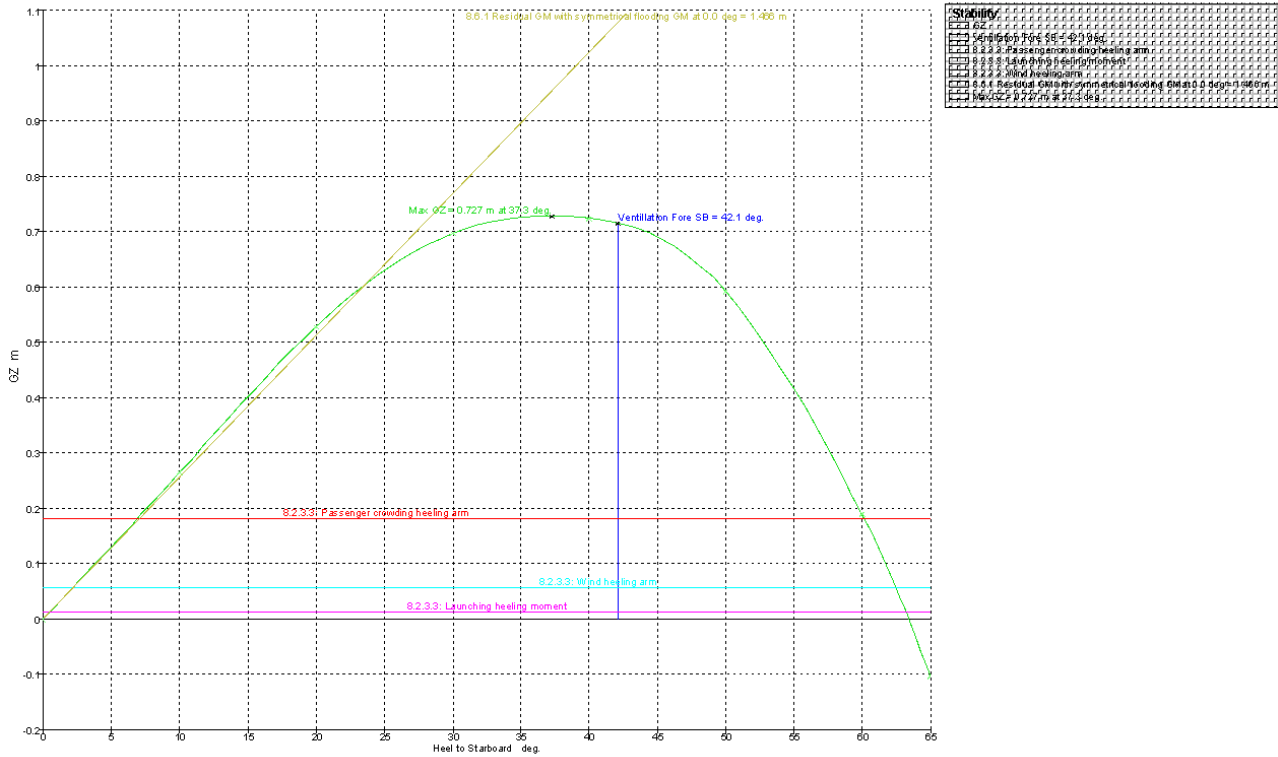
ABV SEWAGE TRMNT[] Fully flooded 95

ABV BOW THRUSTER[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars UPPER	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars hoistable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.5	15.000	7.500			54.350	0.000	15.200	0.000	User Specified
total			5091.410			51.887	0.000	9.340	0.000	
.FUEL OIL										
FO OVFL	5%	14.461	0.723	14.745	0.737	51.827	-2.612	0.036	30.877	Maximum
No 1 HFO STOR SB	50%	130.737	65.368	133.405	66.702	68.571	2.338	4.229	101.452	Maximum
No 2 HFO STOR PS	50%	130.737	65.368	133.405	66.702	68.571	-2.338	4.229	101.452	Maximum
HFO Settling	20%	54.849	10.970	55.968	11.194	57.727	-4.200	1.734	5.281	Maximum
HFO SVCE	80%	68.661	54.849	69.960	55.968	57.687	-1.500	3.335	10.315	Maximum
MGO SERVICE	80%	19.654	15.643	23.004	18.404	57.708	4.200	5.234	4.581	Maximum
TOTAL FUEL	50.83%	418.888	212.921	430.488	219.707	64.354	-0.303	3.930	253.957	
.FRESH WATER TANKS										
No 1 FWT	0%	49.932	0.000	49.932	0.000	81.573	-1.000	3.600	0.000	Maximum
No 2 FWT	50%	49.932	24.966	49.932	24.966	79.232	1.500	4.513	10.805	Maximum
No 3 FWT	100%	49.932	49.932	49.932	49.932	16.600	0.000	5.425	0.000	Maximum
TOTAL FRESH	50%	149.796	74.898	149.796	74.898	39.477	0.500	5.121	10.805	
.WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 1 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT (Damaged)	Damaged									
Heeling Port	8%	50.670	4.046	49.337	3.947	59.149	-8.369	2.352	2.489	Maximum
Heeling Stb	0%	50.670	0.000	49.337	0.000	62.384	5.422	2.050	0.000	Maximum
No 2 WBT	0%	120.268	0.000	117.335	0.000	33.398	0.000	0.000	0.000	Maximum
TOTAL BALLAST	58.09%	518.676	301.312	506.025	293.963	10.339	-0.112	5.174	2.489	
.LUBRICATING OIL										
CPP&RG LO STOR	40%	14.446	5.778	16.051	6.420	56.005	3.150	1.840	4.314	Maximum
ME&AE LO STORAGE	50%	28.892	14.446	32.102	16.061	58.416	3.150	2.000	8.629	Maximum
LO RNVTG	35%	5.840	1.939	6.156	2.155	51.623	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.840	1.939	6.156	2.155	51.623	0.750	1.515	0.608	Maximum
No 1 LO Circ	80%	6.416	5.133	7.129	5.703	41.087	5.223	0.884	1.444	Maximum
No 2 LO Circ	80%	6.416	5.133	7.129	5.703	41.087	2.173	0.884	1.444	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.800	0.000	Maximum
No 4 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-3.475	0.800	0.000	Maximum
ST LO STOR	80%	4.186	3.349	4.651	3.721	23.205	-0.900	2.580	0.700	Maximum
ST LO DRAIN	50%	4.186	2.093	4.651	2.326	23.208	0.900	2.325	0.700	Maximum
Thermo oil Storage & Dr Tk	80%	15.195	12.156	20.260	16.208	34.626	0.000	0.520	36.976	Maximum
TOTAL LUBE OIL	50.09%	103.745	51.966	118.649	60.441	45.036	1.935	1.430	56.424	
.MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	40%	14.773	5.909	14.773	5.909	49.230	-2.699	0.241	31.507	Maximum
DIRTY OIL	40%	15.903	6.361	15.903	6.361	41.798	0.000	0.263	4.346	Maximum
No 1 FO DRAIN D&RTY OIL	40%	2.694	1.077	2.694	1.077	37.339	0.503	0.260	0.184	Maximum
No2 FO DRAIN CLEAN OIL	40%	2.694	1.077	2.694	1.077	37.339	-0.503	0.260	0.184	Maximum
CW DRAIN	20%	9.849	1.970	9.849	1.970	47.607	0.000	0.120	84.019	Maximum
Bilge Dirty	30%	4.842	1.453	4.842	1.453	54.033	-4.476	0.197	1.167	Maximum
Bilge Clean	30%	5.745	1.724	5.745	1.724	54.040	-2.550	0.181	1.853	Maximum
TOTAL MISC	34.64%	56.499	19.571	56.499	19.571	46.122	-1.372	0.229	123.280	
Total Loadcase			5752.076	1261.457	668.581	49.929	0.002	8.764	448.935	
FS correction									0.078	
VCG fluid									8.842	

Εικόνα 197: Κατάσταση φόρτωσης, πληρότητα 50%



Εικόνα 198: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.606	-0.528	-0.283	0.002	0.287	0.531	0.699	0.727	0.594	0.190	-0.428	-1.127	-1.837	-2.503	-3.073	-3.496	-3.721	-3.694	-3.354	-2.528	-1.282	-0.002
Area under GZ curve from zero heel m deg	11.4542	5.2822	1.2888	0.0040	1.3362	5.3638	11.6250	18.8893	25.6549	29.8000	28.7033	20.9089	8.1589	-15.8041	-43.5860	-76.5907	-112.8817	-150.1784	-185.7454	-215.5623	-234.7065	-240.9883
Displacement t	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752	5752
Draft at FP m	6.118	6.083	5.998	5.868	5.692	5.388	4.982	4.520	4.012	3.458	2.858	2.212	1.520	0.782	-0.000	-0.782	-1.520	-2.212	-2.858	-3.458	-4.012	-4.520
Draft at AP m	2.775	3.414	3.808	3.955	3.812	3.420	2.777	1.742	-0.004	-3.131	-8.248	-13.820	-19.820	-26.220	-33.000	-40.150	-47.680	-55.500	-63.620	-72.050	-80.800	-90.000
WL Length m	118.351	118.348	118.182	117.323	115.188	111.338	105.348	97.170	86.435	73.486	58.701	42.254	24.408	12.178	2.818	-2.818	-8.258	-13.588	-18.708	-23.628	-28.358	-32.908
Beam max extents on WL m	19.040	18.487	18.188	18.600	19.168	19.487	19.040	18.288	16.254	14.378	13.250	12.622	13.081	12.843	13.238	14.105	15.110	16.277	18.025	20.113	18.182	18.901
Wetted Area m ²	2450.162	2421.152	2388.311	2358.197	2338.277	2420.832	2446.825	2470.816	2519.690	2532.941	2557.449	2572.856	2581.955	2587.990	2598.082	2617.992	2681.586	2778.285	2907.970	3085.378	3177.638	3180.287
Waterpl. Area m ²	1516.787	1545.138	1552.505	1533.941	1552.701	1545.327	1515.857	1480.088	1408.174	1244.907	1148.811	1091.772	1066.304	1067.802	1099.734	1180.332	1248.573	1357.544	1467.414	1700.037	1748.382	1728.115
Prismatic coeff. (Cp)	0.589	0.571	0.557	0.585	0.557	0.571	0.589	0.602	0.581	0.583	0.584	0.581	0.581	0.583	0.588	0.585	0.583	0.583	0.602	0.587	0.593	0.582
Block coeff. (Cb)	0.348	0.371	0.426	0.458	0.426	0.371	0.348	0.348	0.374	0.431	0.482	0.488	0.410	0.380	0.340	0.309	0.287	0.288	0.279	0.289	0.381	0.414
LCB from zero pt. (+ve fwd) m	50.088	50.079	50.054	50.039	50.041	50.068	50.081	50.102	50.131	50.178	50.219	50.240	50.263	50.241	50.227	50.180	50.134	50.084	50.038	50.008	49.992	49.987
LCF from zero pt. (+ve fwd) m	48.588	48.282	48.115	48.575	48.108	48.273	48.583	48.849	45.203	45.833	46.342	46.816	48.545	48.309	48.974	48.838	45.425	45.383	45.785	45.188	43.640	43.670
Max deck inclination deg	30.0332	20.0369	10.0585	0.9642	10.0580	20.0394	30.0331	40.0276	50.0243	60.0238	70.0205	80.0125	90.0000	99.9848	109.9891	119.9555	129.9458	139.9409	149.9401	159.9383	169.9301	178.5168
Trim angle (+ve by stern) deg	-1.7120	-1.3728	-1.1058	-0.9642	-1.1010	-1.3658	-1.7093	-2.1298	-2.6334	-3.2423	-7.4010	-15.9727	na	-17.5448	-20.9113	-25.2308	-3.1115	-2.2994	-1.7088	-1.5175	-1.4834	

Εικόνα 199: Μοχλοβραχίονας επαναφοράς GZ

Key point	Type	Immerision angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Main Line (Immerision pos = 84.832 m)		38.9	na	8.675	4.675	3.989	1.182	-0.804	-2.272	-3.869	-5.680	-7.154	-8.417	-9.382	-10.085	-10.389	-10.400	-10.074	-9.315	-8.106	-6.822	-5.687
Deck Edge (Immerision pos = 84.832 m)		38.9	na	8.791	5.048	3.133	1.213	-0.852	-2.230	-3.869	-5.843	-7.150	-8.428	-9.415	-10.091	-10.417	-10.483	-10.109	-9.399	-8.180	-6.905	-5.813
Ventilation Fore PS	Downflooding point	42.1	0	8.124	8.330	4.325	2.284	0.380	-1.484	-3.417	-5.029	-7.083	-8.809	-9.839	-10.741	-11.272	-11.408	-11.105	-10.325	-8.948	-7.584	-6.025
Ventilation Fore SS	Downflooding point	144.9	0	8.124	8.988	10.788	11.888	12.427	12.982	12.808	12.273	11.558	10.115	8.586	6.882	4.945	2.941	0.808	-0.589	-2.855	-4.338	-6.025
Ventilation Mid PS	Downflooding point	82.1	0	8.882	8.120	8.184	4.182	2.285	0.384	-1.482	-3.338	-5.084	-6.895	-8.027	-9.127	-9.823	-10.373	-10.423	-10.002	-8.948	-7.707	-6.180
Ventilation Mid SS	Downflooding point	147.5	0	8.882	11.388	12.843	13.833	14.401	14.859	14.854	14.382	13.484	12.188	10.547	8.585	6.412	4.078	1.708	-0.583	-2.580	-4.428	-6.180
Ventilation Aft PS	Downflooding point	81.1	0	10.382	8.882	8.630	5.131	3.388	1.703	0.187	-1.310	-2.738	-4.080	-5.303	-6.383	-7.228	-7.855	-8.125	-8.000	-7.348	-6.082	-4.828
Ventilation Aft SS	Downflooding point	138.2	0	10.382	11.883	13.383	14.878	15.859	16.174	16.823	16.433	15.882	14.793	13.282	11.371	9.120	6.827	4.013	1.444	-0.884	-2.891	-4.828

Εικόνα 200: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Loadcase - Arrival 10%

Damage Case - 1-2-3

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

STEERING GEAR ROOM[] Fully flooded 95

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

ABV STEERING GEAR ROOM[] Fully flooded 95

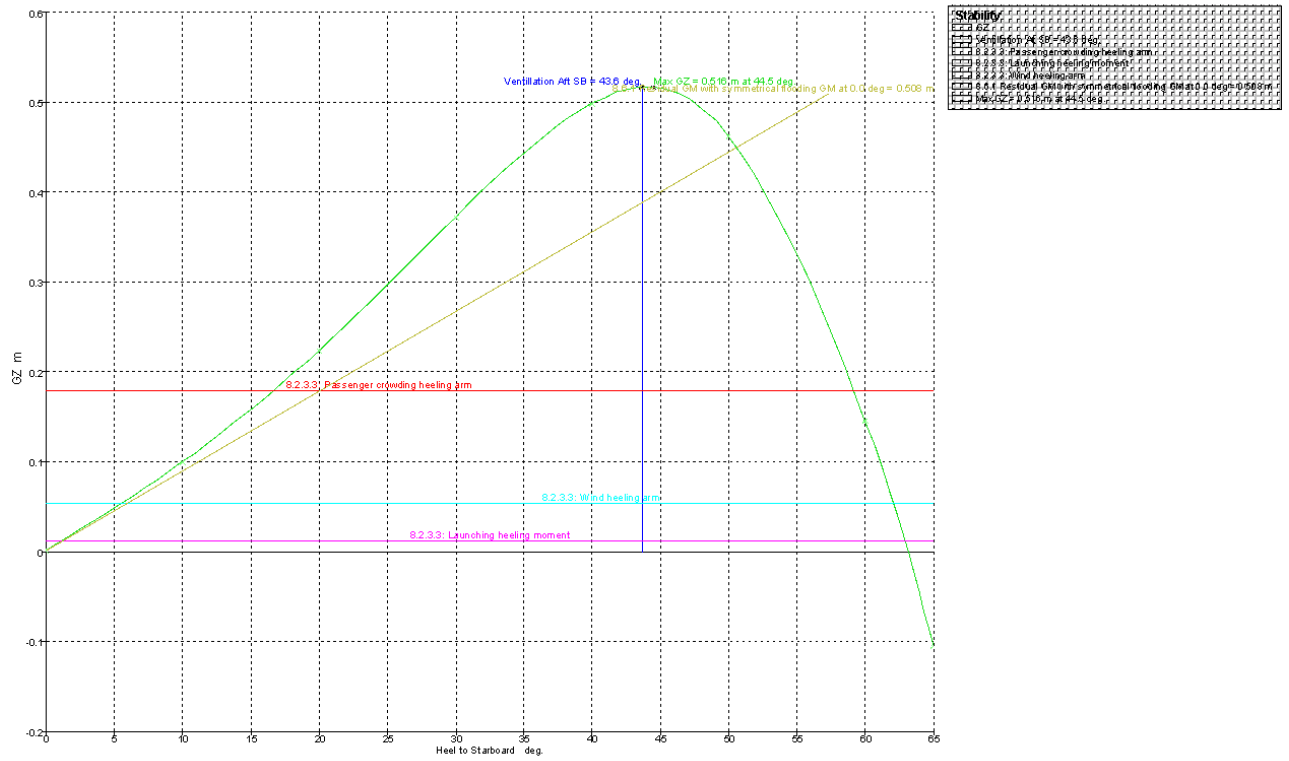
ABV SLOPE[] Fully flooded 85

ABV AUX EQPMNT[] Fully flooded 85

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lugg	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars portable platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	68.288	2.344	3.725	101.406	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	68.288	-2.344	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.670	-4.200	1.999	5.279	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.670	-1.500	1.732	10.310	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.670	4.200	4.920	4.576	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.468	56.362	60.171	-0.370	2.856	152.436	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.600	0.000	3.782	15.552	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.200	-1.500	3.782	10.600	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.200	1.500	3.782	10.600	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.333	0.000	3.782	37.152	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	58.865	-8.294	2.050	0.000	Maximum
Heeling Stp	15%	50.570	7.586	49.337	7.401	58.980	8.424	2.576	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.089	34.681	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.000	3.150	1.360	4.312	Maximum
ME&E LO STORAGE	10%	28.892	2.889	32.102	3.210	58.400	3.150	1.360	8.625	Maximum
LO RNV'TG	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNV'TD	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	5.223	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	2.173	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	-2.173	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	40.800	-5.213	0.635	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.200	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Heavy oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.028	34.910	0.000	0.065	39.958	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	48.911	0.914	1.243	57.020	
MISC										
GREY WATER TANK	80%	119.826	95.860	119.826	95.860	92.151	0.000	1.961	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.200	-2.700	0.420	31.493	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.600	0.000	0.455	4.344	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.316	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.316	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.600	0.000	0.480	83.981	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.997	-4.491	0.492	1.166	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.000	-2.550	0.480	1.652	Maximum
TOTAL MISC	78.28%	176.325	137.992	176.325	137.992	78.258	-0.413	1.504	479.328	
Total Loadcase			5847.707	1583.013	753.227	50.995	0.000	8.540	823.222	
FS correction									0.141	
VCG fluid									8.681	

Εικόνα 201: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 202: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.372	-0.223	-0.099	0.000	0.096	0.222	0.371	0.497	0.461	0.145	-0.397	-1.041	-1.704	-2.331	-2.873	-3.280	-3.487	-3.430	-3.027	-2.247	-1.199	0.001
Area under GZ curve from zero heel (m ²)	5.0363	2.0731	0.4855	-0.0009	0.4762	2.0549	5.0102	9.4175	14.4068	17.8660	16.5426	9.4001	-4.3328	-24.5610	-50.6695	-81.5689	-115.5908	-150.4280	-183.0340	-209.6861	-227.0927	-233.1497
Displacement t	5848	5848	5848	5848	5848	5848	5848	5848	5847	5847	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848
Draft at FP m	2.871	3.298	3.503	3.504	3.504	3.299	2.870	2.096	0.898	-1.754	-6.997	-22.867	n/a	-39.793	-23.853	-18.414	-15.618	-13.910	-12.800	-12.162	-11.957	-11.984
Draft at AP m	6.341	6.368	6.359	6.328	6.359	6.367	6.341	6.134	5.820	5.562	5.493	5.750	n/a	-4.328	-4.659	-4.770	-4.839	-4.938	-5.146	-5.436	-5.621	-5.687
WL Length m	123.374	123.361	123.370	123.003	123.370	123.361	123.374	123.389	119.476	111.714	115.627	118.239	120.370	121.839	122.773	123.441	123.939	124.291	124.407	123.971	123.716	123.679
Beam max extents on WL m	20.136	19.904	19.192	18.948	19.192	19.904	20.136	19.371	18.254	14.378	13.250	12.644	12.451	12.643	13.250	14.378	16.057	18.158	21.122	20.113	19.192	18.903
Wetted Area m ²	2489.685	2489.972	2527.409	2523.173	2527.408	2490.049	2489.784	2514.873	2553.924	2555.028	2565.176	2570.443	2583.757	2595.863	2627.149	2672.650	2737.596	2838.484	2972.292	3105.347	3225.016	3193.863
Wetted Area m ²	1499.633	1495.020	1496.650	1486.398	1496.659	1495.065	1499.589	1491.244	1381.884	1218.136	1088.799	1032.742	1001.790	999.586	1025.141	1083.858	1178.333	1306.115	1479.852	1648.829	1809.329	1832.629
Pneumatic coeff. (Cp)	0.481	0.475	0.470	0.471	0.470	0.475	0.481	0.484	0.505	0.541	0.520	0.505	0.492	0.482	0.474	0.462	0.444	0.423	0.395	0.378	0.366	0.360
Block coeff. (Cb)	0.287	0.319	0.378	0.391	0.378	0.319	0.287	0.283	0.340	0.406	0.409	0.400	0.387	0.346	0.304	0.268	0.237	0.214	0.197	0.233	0.287	0.360
LCB from zero pt. (+ve to) m	50.838	50.842	50.848	50.853	50.850	50.845	50.837	50.825	50.816	50.794	50.772	50.730	50.717	50.704	50.709	50.728	50.780	50.802	50.846	50.876	50.894	50.867
LCF from zero pt. (+ve to) m	55.393	54.142	52.741	52.547	52.741	54.142	55.392	57.212	59.411	58.728	57.994	57.539	57.225	56.983	56.778	56.492	56.192	55.931	56.098	58.232	61.525	61.008
Max deck inclination deg	30.0358	20.0523	10.1023	1.4061	10.1022	20.0523	30.0358	40.0261	50.0208	60.0177	70.0152	80.0100	90.0000	99.9847	109.9641	119.9386	129.9080	139.8715	149.8265	159.7505	169.5070	178.7782
Trim angle (+ve by stem) deg	1.7781	1.5732	1.4635	1.4061	1.4629	1.5720	1.7782	2.0689	2.6230	3.7440	6.3744	14.3572	n/a	17.6001	8.7416	6.9581	5.5089	4.5880	3.9158	3.4428	3.2439	3.2238

Εικόνα 203: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (Immersion pos ± 0.128 m)		32.8	n/a	6.028	4.278	2.412	0.501	-1.292	-3.023	-4.773	-6.519	-8.147	-9.553	-10.688	-11.500	-11.988	-12.080	-11.752	-10.988	-9.748	-8.106	-6.138
Deck Edge (Immersion pos ± 0.128 m)		33.1	n/a	6.104	4.351	2.481	0.560	-1.238	-2.979	-4.741	-6.500	-8.140	-9.559	-10.708	-11.530	-12.010	-12.117	-11.815	-11.038	-9.825	-8.303	-6.814
Μοχλοβραχίονας Fore PS	Μοχλοβραχίονας point	55.4	0	9.904	8.192	6.334	4.438	2.590	0.868	-0.754	-2.176	-3.422	-4.507	-5.405	-6.101	-6.588	-6.781	-6.704	-6.288	-5.448	-4.139	-2.541
Μοχλοβραχίονας Fore SB	Μοχλοβραχίονας point	165.2	0	9.904	11.447	12.745	13.809	14.638	15.226	15.475	15.430	15.025	14.220	13.032	11.488	9.639	7.555	5.328	3.070	0.953	-0.889	-2.541
Μοχλοβραχίονας Mid PS	Μοχλοβραχίονας point	52.2	0	10.081	8.317	6.374	4.343	2.348	0.413	-1.498	-3.307	-4.976	-6.486	-7.742	-8.757	-9.481	-9.879	-9.911	-9.514	-8.641	-7.343	-5.788
Μοχλοβραχίονας Mid SB	Μοχλοβραχίονας point	149.8	0	10.081	11.598	12.832	13.784	14.482	14.875	14.851	14.429	13.606	12.395	10.830	8.961	6.846	4.582	2.207	-0.086	-2.192	-4.088	-5.788
Μοχλοβραχίονας Aft PS	Μοχλοβραχίονας point	43.8	0	8.525	6.736	4.777	2.719	0.719	-1.267	-3.275	-5.293	-7.205	-8.913	-10.380	-11.498	-12.267	-12.659	-12.621	-12.081	-11.048	-8.897	-6.141
Μοχλοβραχίονας Aft SB	Μοχλοβραχίονας point	137.8	0	8.525	10.017	11.239	12.165	12.883	13.215	13.084	12.454	11.390	9.963	8.224	6.240	4.070	1.791	-0.485	-2.648	-4.584	-6.420	-8.141

Εικόνα 204: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 2-3-4

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

SLOPE[] Fully flooded 95

AUX EQPMNT[] Fully flooded 95

AUX ER[] Fully flooded 85

ABV SLOPE[] Fully flooded 85

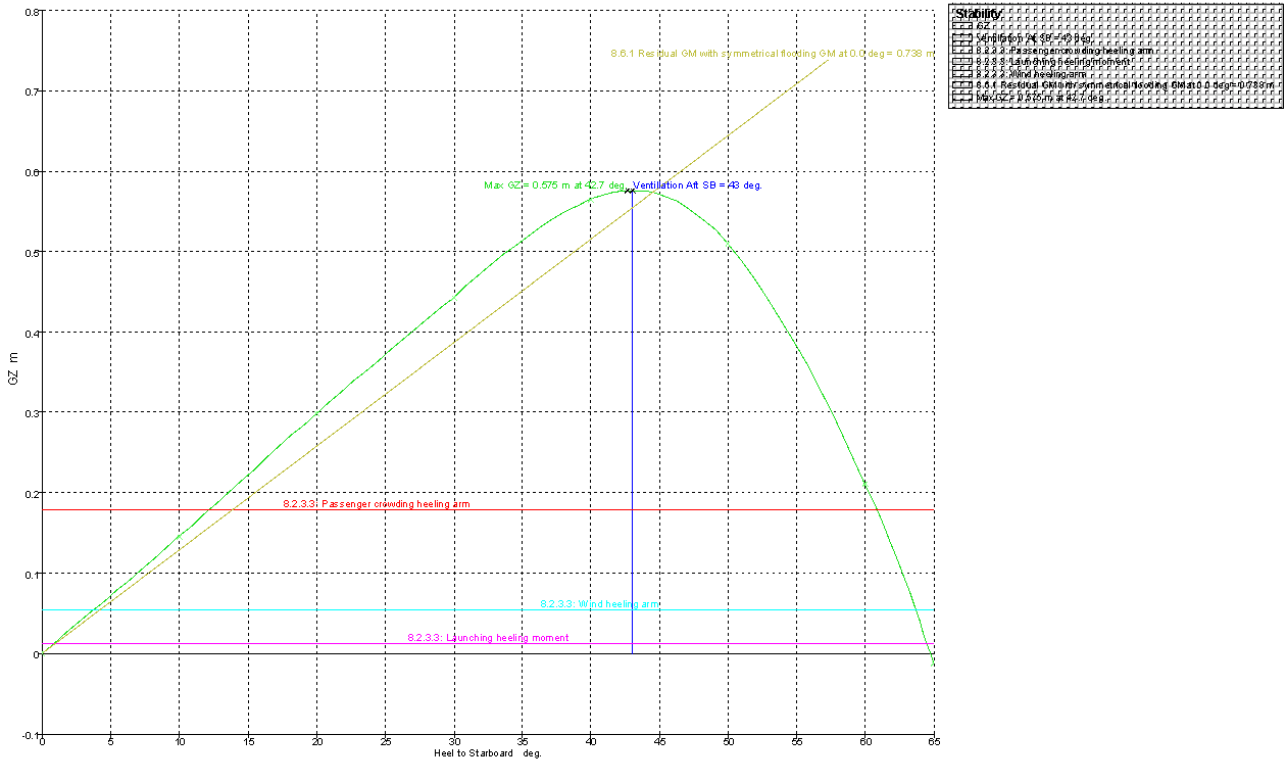
ABV AUX EQPMNT[] Fully flooded 85

ABV AUX ER (RO-RO)[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total F&M tonne.m	F&M Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars toilet/pla platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.542	-5.103	0.258	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	67.801	0.563	4.072	101.406	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	62.592	-4.250	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.603	-4.444	2.087	11.761	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.614	-2.079	1.973	17.902	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.604	3.812	5.083	9.789	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.468	56.362	60.005	-1.129	3.061	171.721	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.537	-1.209	4.098	15.552	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.101	-2.460	4.053	10.800	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.101	0.540	4.053	10.800	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.246	-1.043	4.067	37.152	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	-1.348	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.833	-7.050	2.950	0.000	Maximum
Heeling Starboard	15%	50.570	7.586	49.337	7.401	58.925	8.288	2.627	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.623	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.089	34.680	0.115	3.754	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	55.989	2.029	1.644	4.312	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.355	2.029	1.644	8.625	Maximum
LO RNV'T'G	35%	5.540	1.939	6.156	2.155	51.573	-1.000	1.620	1.320	Maximum
LO RNV'T'D	35%	5.540	1.939	6.156	2.155	51.573	0.500	1.620	1.320	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	1.966	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-0.048	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-2.945	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	39.882	-5.725	0.741	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.179	-1.515	2.139	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.179	0.285	2.139	0.700	Maximum
Drainage oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.028	34.860	-2.664	0.392	39.958	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	48.628	-0.041	1.451	58.444	
MISC										
GREY WATER TANK	80%	119.826	95.860	119.826	95.860	92.176	-0.590	2.058	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.195	-3.467	0.562	31.493	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.511	-0.235	0.536	4.344	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.306	0.443	0.543	0.198	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.306	-0.563	0.543	0.198	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.600	-1.070	0.583	83.981	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.997	-4.632	0.533	1.166	Maximum
Bilge Clean	80%	5.745	4.598	5.745	4.598	53.991	-2.721	0.527	1.852	Maximum
TOTAL MISC	78.26%	176.325	137.992	176.325	137.992	78.265	-0.974	1.598	479.356	
Total Loadcase			5847.707	1583.013	753.227	50.993	-0.025	8.545	843.980	
FS correction								0.144		
VCG fluid								8.689		

Εικόνα 205: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 206: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.460	-0.319	-0.168	-0.025	0.118	0.271	0.416	0.539	0.498	0.191	-0.295	-0.888	-1.504	-2.101	-2.634	-3.041	-3.257	-3.225	-2.884	-2.187	-1.128	0.028
Area under GZ curve from zero heel	7.2997	3.3963	0.9608	-0.0481	0.4559	2.4041	5.9421	10.6943	16.0134	19.5882	19.1907	13.3248	1.3593	-16.6992	-40.4521	-66.9628	-100.6351	-133.2748	-164.0928	-189.7733	-206.5446	-212.0863
Displacement t	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848
Draft at FP m	3.113	3.427	3.616	3.689	3.617	3.428	3.113	2.489	1.234	-0.832	-5.275	-18.885	n/a	-35.105	-21.284	-16.570	-14.152	-12.887	-11.756	-11.291	-11.284	-11.311
Draft at AP m	6.657	6.837	6.842	6.818	6.840	6.838	6.657	6.296	5.865	5.410	5.028	4.446	n/a	-6.249	-6.034	-5.973	-5.958	-6.013	-6.207	-6.461	-6.539	-6.513
WL Length m	123.371	123.372	123.423	122.692	123.423	123.372	123.371	123.379	120.459	114.556	117.210	119.970	121.723	122.746	123.435	123.918	124.238	124.315	123.812	123.212	123.053	122.747
Beam max extents on WL m	20.429	20.015	19.192	18.925	19.192	20.015	20.429	19.371	16.254	14.939	13.250	12.644	12.452	12.643	13.250	14.378	15.997	17.872	20.372	20.113	19.192	18.952
Wetted Area m ²	2568.359	2586.100	2609.888	2610.560	2609.919	2586.126	2568.658	2589.310	2624.170	2635.748	2631.941	2633.211	2648.729	2653.589	2679.030	2714.922	2767.830	2852.203	2978.326	3108.654	3175.840	3178.518
Wetted Area m ²	1452.397	1449.059	1466.625	1453.746	1466.687	1449.055	1452.380	1441.058	1344.375	1226.858	1109.354	1053.813	1022.116	979.699	958.518	1053.202	1142.822	1267.456	1426.248	1628.841	1763.838	1759.859
Prismatic coeff. (Cp)	0.456	0.443	0.438	0.441	0.438	0.443	0.456	0.466	0.490	0.521	0.510	0.497	0.487	0.482	0.481	0.479	0.473	0.462	0.443	0.427	0.416	0.415
Block coeff. (Cb)	0.274	0.304	0.356	0.364	0.356	0.304	0.274	0.277	0.332	0.379	0.412	0.405	0.395	0.354	0.315	0.280	0.252	0.233	0.223	0.260	0.324	0.413
LCB from zero pt. (x _{LCB}) m	50.838	50.839	50.833	50.833	50.838	50.834	50.838	50.842	50.839	50.829	50.808	50.789	50.763	50.785	50.773	50.789	50.813	50.840	50.868	50.902	50.916	50.912
LCF from zero pt. (x _{LCF}) m	55.285	53.522	51.511	51.443	51.511	53.520	55.285	57.809	59.916	59.436	57.840	56.789	56.408	57.683	57.790	57.897	57.494	57.305	57.770	58.563	60.321	59.726
Max deck inclination deg	30.0373	20.0645	10.1303	1.8031	10.1301	20.0646	30.0373	40.0235	50.0170	60.0128	70.0104	80.0066	90.0000	99.9899	109.9773	119.9628	129.9488	139.9288	149.9086	159.8798	169.7227	177.5431
Trim angle (x _{st} by stem) deg	1.8154	1.7467	1.6527	1.6031	1.6514	1.7481	1.8154	1.9603	2.3720	3.1957	5.2652	11.7875	n/a	14.4722	7.7671	5.4148	4.1916	3.4162	2.8416	2.4735	2.4199	2.4589

Εικόνα 207: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = -0.124 m)		31.4	na	5.530	3.802	1.989	0.227	-1.415	-3.051	-4.897	-6.361	-7.922	-9.302	-10.359	-11.036	-11.372	-11.352	-10.936	-10.060	-8.765	-7.357	-5.688
Deck Edge (immersion pos = -0.124 m)		31.8	na	5.612	3.875	2.038	0.290	-1.362	-3.000	-4.865	-6.342	-7.916	-9.306	-10.370	-11.060	-11.416	-11.408	-11.000	-10.120	-8.850	-7.474	-5.964
Ψευδώνυμο Fore point	Ψευδώνυμο point	53.1	0	9.754	8.039	6.178	4.220	2.323	0.590	-1.154	-2.881	-4.011	-5.144	-6.082	-6.830	-7.323	-7.541	-7.447	-6.980	-6.071	-4.846	-3.027
Ψευδώνυμο Fore SB	Ψευδώνυμο point	161.9	0	9.754	11.294	12.588	13.591	14.371	14.918	15.077	14.929	14.442	13.591	12.355	10.770	8.867	6.807	4.593	2.374	0.337	-1.393	-3.027
Ψευδώνυμο Mid PS	Ψευδώνυμο point	51.1	0	9.801	8.042	6.108	4.104	2.130	0.211	-1.717	-3.959	-6.256	-8.789	-10.043	-10.033	-9.723	-10.080	-10.062	-9.605	-8.663	-7.315	-5.750
Ψευδώνυμο Mid SB	Ψευδώνυμο point	146.2	0	9.801	11.320	12.566	13.543	14.270	14.675	14.834	14.161	13.333	12.103	10.540	8.696	6.616	4.373	2.066	-0.170	-2.209	-4.036	-5.750
Ψευδώνυμο Aft PS	Ψευδώνυμο point	43	0	8.079	6.303	4.371	2.453	0.577	-1.322	-3.261	-5.221	-7.086	-8.778	-10.163	-11.181	-11.849	-12.141	-12.010	-11.383	-10.297	4.682	-7.472
Ψευδώνυμο Aft SB	Ψευδώνυμο point	140.6	0	8.079	9.583	10.832	11.896	12.721	13.151	13.101	12.530	11.515	10.106	8.431	6.560	4.500	2.322	0.126	-1.942	-3.838	-5.702	-7.472

Εικόνα 208: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 3-4-5

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

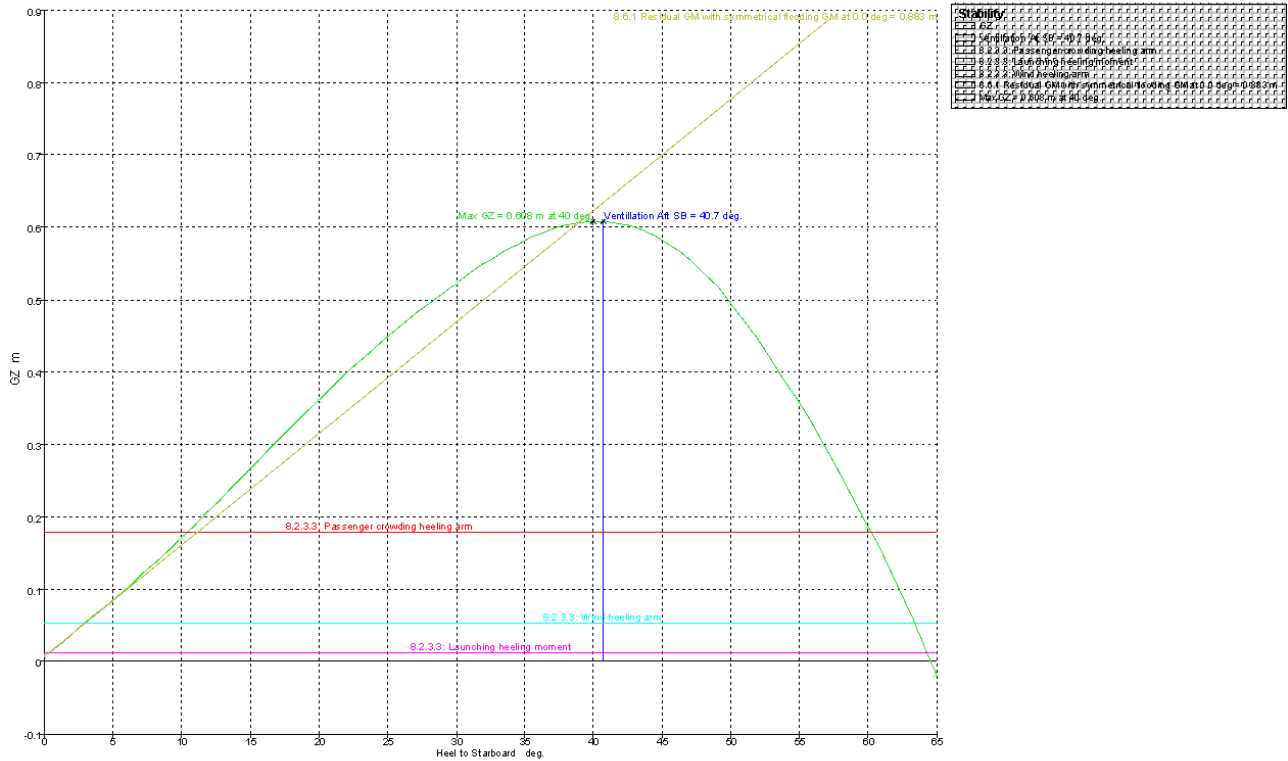
Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

No 4 LO Circ[] Fully flooded 95
 AUX EQPMNT[] Fully flooded 95
 AUX ER[] Fully flooded 85
 ER[] Fully flooded 85
 ABV AUX EQPMNT[] Fully flooded 85
 ABV AUX ER (RO-RO)[] Fully flooded 95
 ABV ER[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars Upper platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.362	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	66.971	2.372	3.743	101.446	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	62.592	-1.600	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.641	-4.200	2.001	5.281	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.625	-1.500	1.734	10.314	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.624	4.200	4.922	4.580	Maximum
TOTAL FUEL	12.83%	418.868	53.740	430.468	56.362	59.619	-0.363	2.862	152.484	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.498	0.000	3.784	15.558	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.053	-1.500	3.785	10.804	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.053	1.500	3.785	10.804	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.201	0.000	3.784	37.167	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.822	-5.600	2.050	0.000	Maximum
Heeling Starboard	15%	50.570	7.586	49.337	7.401	58.866	8.427	2.578	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.368	707.755	531.089	34.679	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	55.981	3.150	1.360	4.314	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.325	3.150	1.361	8.628	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.579	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.579	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.165	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.165	0.900	1.985	0.700	Maximum
Drainage oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.789	0.000	0.067	39.974	Maximum
TOTAL LUBE OIL	10.87%	97.234	10.569	111.414	12.061	49.360	1.292	1.281	55.532	
MISC										
GREY WATER TANK	80%	119.826	95.860	119.826	95.860	92.088	0.000	1.962	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.184	-2.700	0.420	31.505	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.495	0.000	0.456	4.346	Maximum
No 1 FO DRAIN Oil	80%	2.694	2.155	2.694	2.155	37.305	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.305	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.598	0.000	0.480	84.014	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.983	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	53.986	-2.550	0.480	1.853	Maximum
TOTAL MISC	78.26%	176.325	137.992	176.325	137.992	78.201	-0.413	1.505	479.376	
Total Loadcase			5847.056	1575.778	752.504	50.991	0.000	8.541	821.845	
FS correction									0.141	
VCG fluid									8.681	

Εικόνα 209: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 210: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.523	-0.362	-0.170	-0.006	0.158	0.350	0.512	0.603	0.499	0.191	-0.251	-0.790	-1.352	-1.896	-2.400	-2.806	-3.041	-3.047	-2.749	-2.074	-1.051	0.000
Area under GZ curve from zero heel	7.9654	3.5199	0.8599	-0.0116	0.7341	3.2686	7.8103	13.2932	18.9853	22.5723	22.3674	17.2137	6.4976	-6.7677	-31.3032	-57.4483	-86.8468	-117.5022	-146.7630	-171.2154	-186.9343	-162.2216
Displacement t	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847	5847
Draft at FP m	3.656	3.976	4.185	4.254	4.187	3.976	3.658	3.032	1.921	0.172	-3.415	-14.658	n/a	-30.497	-18.950	-14.995	-12.966	-11.750	-11.008	-10.715	-10.778	-10.824
Draft at AP m	7.187	7.342	7.295	7.272	7.294	7.342	7.187	6.872	6.556	6.252	6.078	6.306	n/a	-4.418	-5.253	-5.668	-5.937	-6.177	-6.472	-6.725	-6.702	
WL Length m	123.359	123.371	123.380	122.999	123.381	123.371	123.359	123.370	121.543	119.093	118.985	121.442	122.629	123.341	123.835	124.164	124.315	124.044	123.191	122.895	122.605	122.124
Beam max extends on WL m	20.884	20.104	19.192	18.909	19.192	20.104	20.884	19.340	16.254	15.117	13.250	12.643	12.451	12.643	13.250	14.378	16.103	17.997	20.315	20.113	19.192	18.941
Wetted Area m ²	2719.963	2742.539	2748.482	2744.683	2748.606	2742.545	2719.541	2747.291	2776.472	2799.048	2787.481	2789.091	2795.546	2804.639	2820.850	2844.746	2881.618	2948.551	3058.815	3182.790	3214.782	3219.674
Wetted Area m ²	1364.920	1377.739	1378.069	1364.365	1378.145	1377.741	1364.906	1337.774	1228.848	1161.562	1067.272	1012.653	982.296	957.846	939.207	933.163	1063.619	1182.545	1354.056	1558.194	1634.917	1619.656
Prismatic coeff. (Cp)	0.417	0.405	0.403	0.406	0.403	0.405	0.417	0.432	0.452	0.470	0.473	0.484	0.458	0.453	0.454	0.459	0.463	0.468	0.458	0.443	0.431	0.431
Block coeff. (Cb)	0.254	0.284	0.334	0.342	0.334	0.284	0.254	0.264	0.314	0.343	0.391	0.388	0.380	0.342	0.307	0.276	0.249	0.235	0.230	0.286	0.333	0.429
LCB from zero pt. (+ve to st) m	50.846	50.843	50.848	50.843	50.856	50.843	50.845	50.848	50.849	50.846	50.830	50.822	50.803	50.796	50.797	50.813	50.842	50.871	50.898	50.917	50.922	50.934
LCF from zero pt. (+ve to st) m	55.578	52.788	51.342	51.327	51.343	52.788	55.578	59.324	61.514	61.886	59.557	57.886	56.902	57.597	58.893	59.026	58.961	58.706	58.483	59.752	59.494	59.212
Max deck inclination deg	30.0370	20.0629	10.1212	1.5463	10.1209	20.0629	30.0370	40.0236	50.0171	60.0122	70.0088	80.0054	90.0000	99.9917	109.9817	119.9713	129.9608	139.9503	149.9388	159.9106	169.7952	177.8887
Trim angle (+ve by stem) deg	1.8077	1.7243	1.5939	1.5463	1.5919	1.7243	1.8082	1.9672	2.3741	3.1126	4.8529	10.6208	n/a	13.1302	6.9646	4.7689	3.5977	2.8540	2.3234	2.0570	2.0762	2.1113

Εικόνα 211: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos +0.136 m)		28.7	n/a	5.084	3.359	1.496	-0.232	-1.857	-3.495	-6.110	-8.720	-11.345	-14.000	-16.678	-19.385	-22.127	-24.900	-27.700	-30.523	-33.367	-36.230	-39.110
Deck Edge (immersion pos +0.136 m)		28	n/a	5.160	3.429	1.565	-0.169	-1.803	-3.452	-6.096	-8.701	-11.329	-14.000	-16.698	-19.427	-22.191	-24.987	-27.812	-30.663	-33.538	-36.436	-39.356
Υπόστρωμα Fore PS	Δοκίμηση	50.7	0	9.201	7.491	5.686	3.750	1.890	0.118	-1.647	-3.288	-4.899	-6.579	-8.338	-10.170	-12.060	-14.000	-16.000	-18.060	-20.180	-22.360	-24.600
Υπόστρωμα Fore SB	Δοκίμηση	159.4	0	9.201	10.746	12.077	13.122	13.938	14.477	14.958	14.325	13.757	12.850	11.612	10.104	8.184	6.132	3.972	1.826	-0.118	-1.797	-3.438
Υπόστρωμα Mid PS	Δοκίμηση	48.8	0	9.286	7.532	5.611	3.639	1.698	-0.232	-2.182	-4.071	-5.805	-7.342	-8.627	-9.600	-10.226	-10.400	-10.260	-9.861	-9.200	-8.382	-7.407
Υπόστρωμα Mid SB	Δοκίμηση	148	0	9.286	10.811	12.069	13.078	13.834	14.232	14.188	13.671	12.707	11.530	9.959	8.140	6.117	3.950	1.729	-0.422	-2.426	-4.219	-5.934
Υπόστρωμα Aft PS	Δοκίμηση	40.7	0	7.613	5.843	3.853	1.992	0.136	-1.765	-3.691	-6.612	-9.456	-12.140	-14.638	-16.911	-18.917	-20.590	-21.870	-22.700	-23.120	-23.180	-22.880
Υπόστρωμα Aft SB	Δοκίμηση	140.8	0	7.613	9.124	10.355	11.439	12.281	12.708	12.671	12.141	11.147	9.744	8.090	6.230	4.277	2.223	0.155	-1.810	-3.700	-5.596	-7.360

Εικόνα 212: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 4-5-6

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

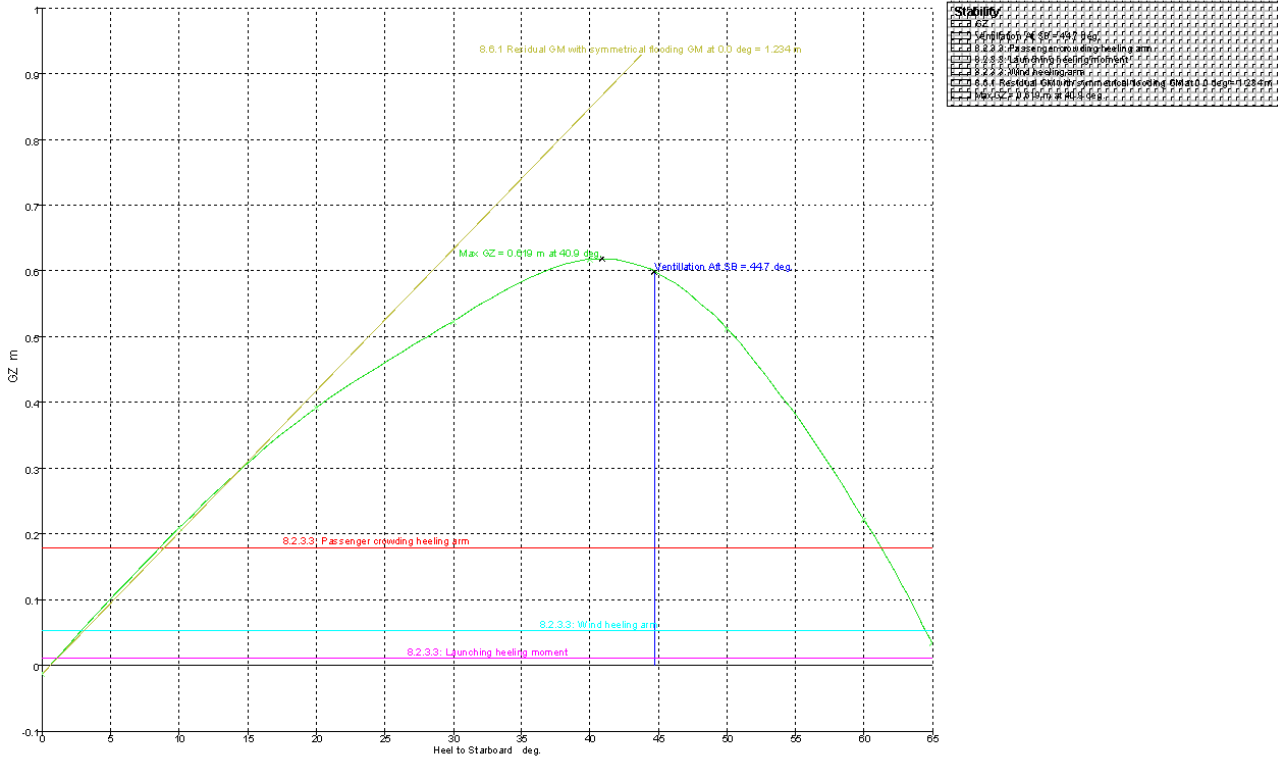
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
CW DRAIN[]	Fully flooded	95		
No 4 LO Circ[]	Fully flooded	95		
AUX ER[]	Fully flooded	85		
ER[]	Fully flooded	85		
WORKSHOP[]	Fully flooded	95		
ABV AUX ER (RO-RO)[]	Fully flooded		95	
ABV ER[]	Fully flooded	95		
ABV WORKSHOP[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long-Arm m	Trans-Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	189.510			51.700	0.000	15.200	0.000	User Specified
Cans Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cans Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cans hanging platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO DVFL	5%	14.451	0.723	14.745	0.737	51.370	-2.612	0.035	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	67.018	2.371	3.742	101.443	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	62.592	-1.800	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.650	-4.200	2.004	5.281	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.634	-1.500	1.736	10.314	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.633	4.200	4.924	4.580	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.488	56.362	59.837	-0.363	2.863	152.480	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.501	0.000	3.784	15.558	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.058	-1.500	3.784	10.804	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.058	1.500	3.784	10.804	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.206	0.000	3.784	37.166	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.526	0.000	85.393	0.000	108.191	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	55.817	-5.600	2.050	0.000	Maximum
Heeling Starboard	15%	50.570	7.586	49.337	7.401	58.870	8.427	2.578	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.089	34.679	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	55.982	3.150	1.360	4.314	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.328	3.150	1.361	8.628	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.579	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.579	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	36.989	-1.449	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.166	-0.900	1.965	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.166	0.900	1.965	0.700	Maximum
Inventory of Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.794	0.000	0.067	39.973	Maximum
TOTAL LUBE OIL	10.87%	97.234	10.569	111.414	12.081	49.362	1.292	1.261	55.530	
MISC										
GREY WATER TANK	80%	119.826	95.860	119.826	95.860	92.090	0.000	1.962	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.185	-2.700	0.420	31.504	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.499	0.000	0.456	4.346	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.306	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.306	-0.503	0.520	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.983	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	53.986	-2.550	0.460	1.853	Maximum
TOTAL MISC	78.16%	166.475	130.113	166.475	130.113	60.057	-0.438	1.567	395.361	
Total Loadcase			5839.177	1565.929	744.624	50.995	0.000	8.552	737.824	
FS correction								0.126		
VCG fluid								8.678		

Εικόνα 213: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 214: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.523	-0.391	-0.208	0.014	0.236	0.418	0.547	0.644	0.512	0.204	-0.197	-0.670	-1.222	-1.788	-2.309	-2.731	-3.005	-3.057	-2.785	-2.032	-0.994	0.000
Area under GZ curve from zero heel to deg	8.6282	4.0304	0.9681	0.0255	1.2658	4.5819	9.4105	15.4827	21.4831	25.1458	25.2362	20.9659	11.5487	-3.5182	-24.0656	-49.3667	-78.1968	-106.7158	-138.2777	-162.7310	-177.9354	-182.8474
Displacement t	5840	5840	5839	5839	5840	5839	5839	5839	5839	5838	5839	5839	5839	5839	5839	5839	5839	5839	5839	5839	5839	5839
Draft at FP m	4.631	5.122	5.295	5.368	5.297	5.122	4.829	4.274	3.394	2.077	-0.336	-7.919	na	-22.999	-15.204	-12.591	-11.299	-10.562	-10.188	-10.220	-10.272	-7.414
Draft at AP m	6.197	6.480	6.530	6.508	6.530	6.480	6.198	5.641	4.958	4.111	2.781	-0.321	na	-12.308	-9.328	-8.336	-7.862	-7.605	-7.502	-7.514	-7.445	-7.414
WL Length m	123.331	123.339	123.367	122.933	123.367	123.339	123.331	123.319	123.326	123.345	121.450	122.834	123.508	123.917	124.156	124.210	123.972	123.279	122.397	122.050	122.082	121.032
Beam max extents on WL m	20.672	20.068	19.192	18.942	19.192	20.068	20.672	19.356	16.254	14.378	13.942	12.644	12.451	12.643	13.250	14.378	15.930	17.510	19.403	20.113	19.192	18.911
Wetted Area m ²	2748.904	2766.561	2800.806	2792.997	2801.020	2766.848	2747.163	2757.608	2769.924	2819.709	2832.041	2804.771	2781.293	2793.409	2808.949	2826.306	2853.452	2908.619	3018.142	3163.928	3194.907	3198.724
Wetted Area m ²	1344.374	1349.832	1387.573	1388.114	1387.641	1349.824	1344.316	1339.813	1237.362	1165.690	1151.277	1058.725	973.210	927.817	936.018	975.239	1055.065	1181.015	1372.956	1587.357	1596.947	1571.351
Prismatic coeff. (Cp)	0.441	0.423	0.416	0.417	0.416	0.423	0.441	0.482	0.478	0.485	0.494	0.486	0.483	0.487	0.494	0.506	0.522	0.534	0.531	0.508	0.494	0.496
Block coeff. (Cb)	0.283	0.290	0.339	0.377	0.339	0.290	0.263	0.273	0.322	0.366	0.390	0.439	0.437	0.390	0.348	0.311	0.283	0.270	0.266	0.285	0.370	0.496
LCG from zero pt. (+ve to starboard) m	50.945	50.938	50.939	50.939	50.944	50.937	50.938	50.941	50.948	50.945	50.948	50.935	50.925	50.919	50.918	50.918	50.922	50.940	50.947	50.948	50.950	50.948
LCF from zero pt. (+ve to starboard) m	54.030	51.178	48.394	48.017	48.397	51.177	54.027	57.402	59.332	60.014	59.319	56.748	57.656	58.414	58.323	57.997	57.461	56.714	55.500	55.925	58.112	56.252
Max deck inclination deg	30.0056	20.0103	10.0192	0.5846	10.0192	20.0103	30.0056	40.0020	50.0020	60.0014	70.0009	80.0007	90.0000	99.9986	109.9968	119.9940	129.9906	139.9860	149.9788	159.9634	169.9035	178.5355
Trim angle (+ve by stern) deg	0.7001	0.6962	0.6331	0.5846	0.6321	0.6963	0.7016	0.7008	0.8064	1.0419	1.5969	3.8877	na	5.4631	3.0088	2.1792	1.7610	1.5153	1.3661	1.3148	1.4215	1.4845

Εικόνα 215: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (Immersion pos ± d. 124 m)		34.1	na	5.659	4.115	2.308	0.027	-0.912	-2.487	-4.047	-5.593	-7.098	-8.574	-10.012	-11.417	-12.798	-14.155	-15.492	-16.812	-18.118	-19.412	-20.695
Deck Edge (Immersion pos ± d. 124 m)		34.5	na	5.016	4.189	2.177	0.696	-0.659	-2.423	-4.015	-5.573	-7.098	-8.581	-10.032	-11.449	-12.842	-14.211	-15.559	-16.891	-18.202	-19.495	-20.772
Veriçma Fote PS	Çağırkörüme zantı	49.0	0	8.303	6.659	4.604	2.941	1.153	-0.600	-2.372	-4.095	-5.659	-7.164	-8.611	-10.012	-11.380	-12.721	-14.048	-15.365	-16.667	-17.957	-19.237
Veriçma Fote SD	Çağırkörüme zantı	157	0	8.303	9.865	11.217	12.322	13.205	13.782	13.865	13.524	12.854	11.897	10.619	9.062	7.273	5.224	3.290	1.282	-0.561	-2.205	-3.648
Veriçma Ma PS	Çağırkörüme zantı	48.5	0	9.022	7.274	5.387	3.489	1.601	-0.286	-2.224	-4.142	-5.932	-7.474	-8.730	-9.679	-10.292	-10.545	-10.415	-9.882	-8.848	-7.482	-5.910
Veriçma Ma SD	Çağırkörüme zantı	143	0	9.022	10.553	11.846	12.912	13.741	14.183	14.133	13.606	12.668	11.412	9.868	8.070	6.082	3.921	1.723	-0.420	-2.369	-4.203	-5.910
Veriçma H PS	Çağırkörüme zantı	44.7	0	8.163	6.387	4.468	2.639	0.863	-0.963	-2.852	-4.736	-6.574	-8.192	-9.481	-10.432	-11.041	-11.277	-11.127	-10.555	-9.557	-8.134	-6.798
Veriçma H SD	Çağırkörüme zantı	144.8	0	8.163	9.666	10.952	12.065	13.011	13.514	13.515	13.024	12.037	10.706	9.129	7.326	5.324	3.198	1.020	-1.107	-3.065	-5.033	-6.798

Εικόνα 216: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 5-6-7

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

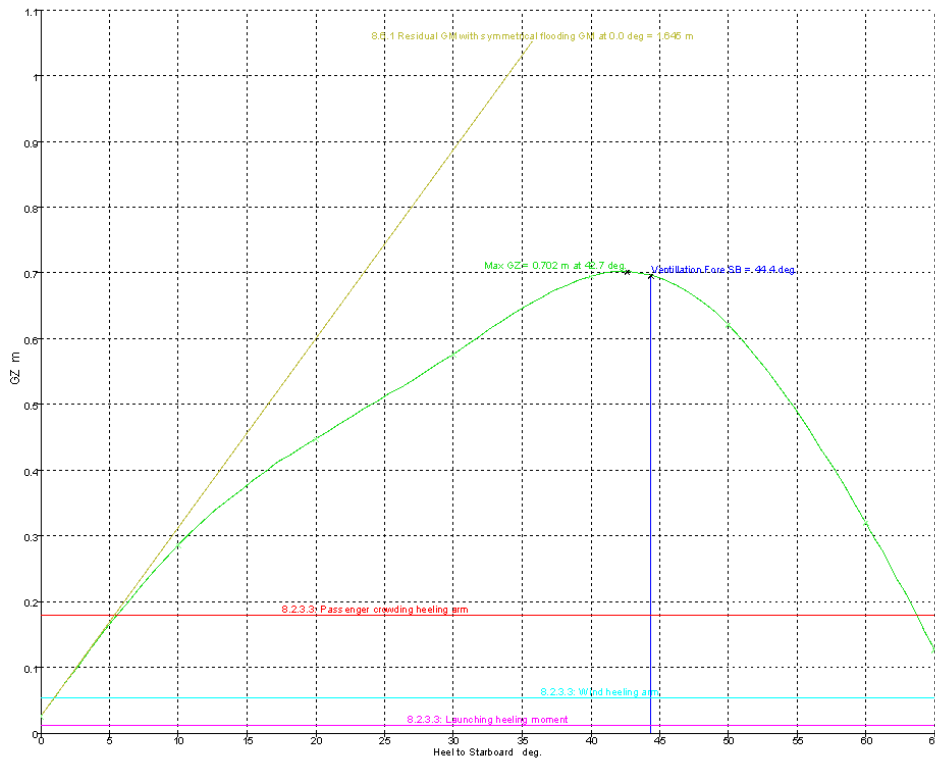
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
Heeling Port[]	Fully flooded	95		
CW DRAIN[]	Fully flooded	95		
No 4 LO Circ[]	Fully flooded	95		
ER[]	Fully flooded	85		
WORKSHOP[]	Fully flooded	95		
HEELING[]	Fully flooded	95		
ABV ER[]	Fully flooded	95		
ABV WORKSHOP[]	Fully flooded	95	95	
ABV HEELING[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m³	Total Volume m³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cans Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cans Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cans to platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.684	0.000	9.333	0.000	
FUEL OIL										
FO DVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	68.288	2.344	3.725	101.406	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	68.288	-2.344	3.800	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.670	-4.200	1.999	5.279	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.670	-1.500	1.732	10.310	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.670	4.200	4.920	4.576	Maximum
TOTAL FUEL	12.83%	416.888	53.740	430.488	56.362	60.171	-0.370	2.856	152.436	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.600	0.000	3.762	15.552	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.200	-1.500	3.762	10.800	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.200	1.500	3.762	10.800	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.333	0.000	3.762	37.152	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Sit	15%	50.570	7.586	49.337	7.401	58.980	8.424	2.576	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	80.66%	674.879	544.366	658.418	531.089	34.681	0.117	3.753	97.287	
LUBRICATING OIL										
CPPARG LO STOR	10%	14.448	1.445	16.051	1.605	56.000	3.150	1.360	4.312	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	56.400	3.150	1.360	8.625	Maximum
LO RNV'T'G	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNV'T'D	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	5.223	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	2.173	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	-2.173	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.200	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.985	0.700	Maximum
Dirty oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.910	0.000	0.065	39.958	Maximum
TOTAL LUBE OIL	10.87%	97.234	10.569	111.414	12.081	49.411	1.292	1.280	55.510	
MISC										
GREY WATER TANK	80%	119.828	95.860	119.828	95.860	92.151	0.000	1.961	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.200	-2.700	0.420	31.493	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.600	0.000	0.455	4.344	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.316	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.316	-0.503	0.520	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.997	-4.491	0.492	1.166	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.000	-2.550	0.480	1.852	Maximum
TOTAL MISC	78.16%	186.475	130.113	186.475	130.113	80.113	-0.438	1.566	395.347	
Total Loadcase			5839.177	1516.592	744.624	51.000	0.000	8.552	737.732	
FS correction								0.126		
VCG fluid								8.678		

Εικόνα 217: Κατάσταση φόρτωσης, πληρότητα 10%



8.2.3.3	Passenger crowding heeling arm
0.18	m

Εικόνα 218: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.576	-0.448	-0.286	-0.025	0.241	0.431	0.566	0.689	0.588	0.270	-0.135	-0.626	-1.209	-1.792	-2.323	-2.753	-3.032	-3.089	-2.826	-2.044	-0.990	0.000
Area under GZ curve from zero heel (m³)	10.4694	5.3444	1.6117	-0.0454	1.1204	4.5486	9.5336	15.9023	22.5091	26.9189	27.8527	23.9369	14.8088	-0.2248	-20.8652	-46.3452	-75.4213	-106.2319	-136.1796	-160.9136	-176.1339	-181.0109
Displacement t	5839	5840	5840	5839	5839	5839	5839	5839	5840	5839	5839	5839	5839	5839	5839	5839	5839	5840	5839	5839	5840	5839
Draft at FP m	5.489	5.747	5.856	5.924	5.885	5.781	5.519	4.998	4.251	3.197	1.343	-3.865	n/a	-18.295	-12.879	-11.102	-10.268	-9.837	-9.658	-9.692	-9.981	-9.918
Draft at AP m	5.224	5.591	5.786	5.784	5.773	5.605	5.237	4.571	3.585	2.191	-0.207	-7.326	n/a	-20.365	-13.251	-10.808	-9.555	-8.798	-8.351	-8.197	-8.114	-8.080
WL Length m	123.348	123.356	123.362	118.200	123.363	123.359	123.349	123.332	123.309	123.319	122.323	123.376	123.872	124.124	124.196	124.024	123.581	122.522	121.864	121.648	121.226	120.182
Beam max extents on WL m	20.343	20.011	19.192	18.977	19.192	20.014	20.364	19.371	16.254	14.378	13.783	12.643	12.451	12.643	13.250	14.357	15.678	16.962	18.478	20.113	19.234	18.903
Wetted Area m²	2710.460	2710.297	2737.008	2793.410	2742.156	2716.691	2716.088	2723.676	2759.296	2777.142	2781.058	2750.217	2715.726	2726.510	2739.098	2757.619	2796.167	2841.888	2947.098	3127.304	3153.375	3155.078
Waterpl. Area m²	1391.456	1390.347	1427.150	1490.123	1436.646	1393.758	1392.092	1416.486	1297.676	1229.518	1194.509	1079.544	999.132	975.513	992.982	1032.336	1110.068	1234.071	1417.176	1639.177	1616.017	1597.042
Prismatic coeff. (Cp)	0.472	0.450	0.438	0.454	0.437	0.448	0.470	0.494	0.509	0.517	0.522	0.520	0.524	0.532	0.544	0.561	0.586	0.612	0.612	0.585	0.575	0.577
Block coeff. (Cb)	0.278	0.303	0.353	0.429	0.353	0.302	0.277	0.283	0.336	0.383	0.413	0.469	0.494	0.440	0.396	0.355	0.323	0.309	0.306	0.322	0.413	0.575
LCB from zero pt. (+ve to st) m	51.013	51.010	51.005	51.003	51.013	51.007	51.011	51.016	51.011	51.018	51.022	51.027	51.031	51.020	51.008	50.997	50.987	50.976	50.972	50.970	50.966	50.967
LCF from zero pt. (+ve to st) m	52.002	49.948	47.577	45.734	47.672	49.998	52.028	54.025	56.224	57.462	58.370	59.255	57.155	56.667	56.094	55.532	54.796	53.915	52.760	52.481	53.048	53.096
Max deck inclination deg	30.0002	20.0001	10.0001	0.0719	10.0002	20.0002	30.0002	40.0003	50.0004	60.0003	70.0002	80.0001	90.0000	99.9999	110.0000	120.0000	129.9996	139.9983	149.9949	159.9876	169.9616	179.0632
Trim angle (+ve by stem) deg	-0.1359	-0.0797	-0.0485	-0.0719	-0.0577	-0.0904	-0.1443	-0.2186	-0.3414	-0.5155	-0.7945	-1.7730	n/a	-1.0604	-0.1907	0.1508	0.3652	0.5326	0.6693	0.7682	0.8954	0.9388

Εικόνα 219: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 92.958 m)		37.7	n/a	6.462	4.766	2.987	1.246	-0.370	-1.957	-3.524	-5.032	-6.400	-7.498	-8.230	-8.701	-8.965	-9.040	-8.811	-8.207	-7.157	-5.837	-4.297
Deck Edge (immersion pos = 93.958 m)		38	n/a	6.538	4.840	3.056	1.309	-0.324	-1.913	-3.481	-5.012	-6.383	-7.472	-8.252	-8.730	-8.908	-8.910	-8.674	-8.276	-7.231	-5.913	-4.373
Μετόπιστη Fore PS point	Ομοβραχίονο	44.3	0	7.852	6.175	4.343	2.512	0.754	-0.995	-2.761	-4.488	-6.097	-7.408	-8.411	-9.110	-9.485	-9.504	-9.152	-8.402	-7.225	-5.700	-4.088
Μετόπιστη Fore SB point	Ομοβραχίονο	155.4	0	7.852	6.435	10.760	11.887	12.806	13.368	13.477	13.130	12.369	11.344	10.054	8.509	6.753	4.859	2.900	0.973	-0.812	-2.444	-4.988
Μετόπιστη Mid PS point	Ομοβραχίονο	46	0	9.043	7.292	5.417	3.516	1.696	-0.194	-2.099	-3.997	-5.770	-7.252	-8.550	-9.510	-10.146	-10.421	-10.311	-9.775	-8.780	-7.381	-5.808
Μετόπιστη Mid SB point	Ομοβραχίονο	148.5	0	9.043	10.571	11.877	12.960	13.800	14.275	14.259	13.751	11.950	10.051	8.239	6.211	4.043	1.830	-0.331	-2.301	-4.101	-6.808	
Μετόπιστη Aft PS point	Ομοβραχίονο	48.6	0	8.741	6.881	5.148	3.304	1.528	-0.248	-2.066	-3.896	-5.576	-7.094	-8.338	-9.338	-10.034	-10.392	-10.383	-9.899	-9.032	-7.773	-6.242
Μετόπιστη Aft SB point	Ομοβραχίονο	147.8	0	8.741	10.263	11.611	12.754	13.674	14.233	14.301	13.864	13.035	11.836	10.277	8.424	6.334	4.087	1.766	-0.506	-2.569	-4.491	-6.242

Εικόνα 220: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 6-7-8

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

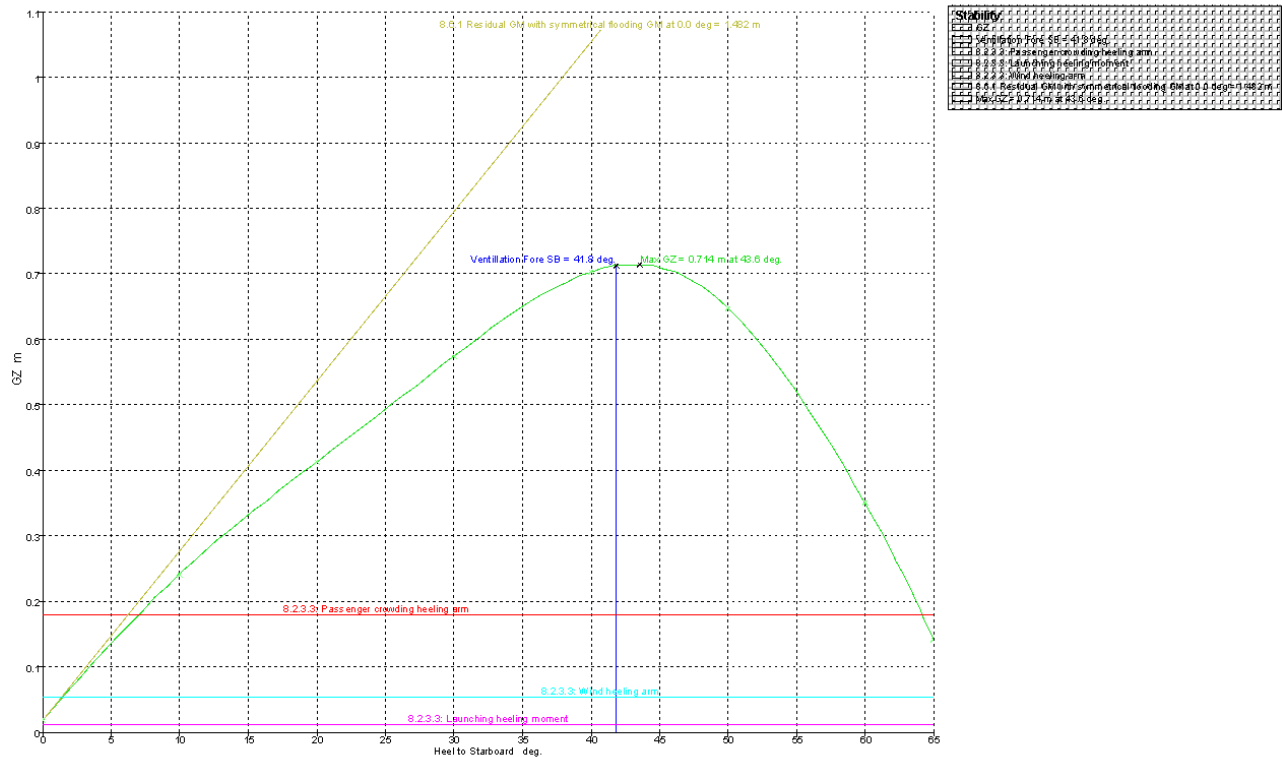
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
Heeling Port[]	Fully flooded	95		
CW DRAIN[]	Fully flooded	95		
WORKSHOP[]	Fully flooded	95		
HEELING[]	Fully flooded	95		
HFO STORAGE[]	Fully flooded	95		
ABV WORKSHOP[]	Fully flooded		95	
ABV HEELING[]	Fully flooded	95		
ABV HFO STORAGE[]	Fully flooded		95	

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.600	0.000	7.250	0.000	User Specified
Cars lower platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO DVFL	5%	14.451	0.723	14.745	0.737	51.586	-2.612	0.032	30.863	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	68.288	2.344	3.725	101.406	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	68.288	-2.344	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.670	-4.200	1.999	5.279	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.670	-1.500	1.732	10.310	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.670	4.200	4.920	4.578	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.488	56.362	60.171	-0.370	2.856	152.436	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.600	0.000	3.782	15.552	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.200	-1.500	3.782	10.800	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.200	1.500	3.782	10.800	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.333	0.000	3.782	37.152	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	108.453	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling St	15%	50.570	7.586	49.337	7.401	58.980	8.424	2.576	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	80.66%	674.879	544.366	656.418	531.089	34.681	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.000	3.150	1.360	4.312	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.400	3.150	1.360	8.625	Maximum
LO RNV'TG	35%	5.540	1.939	6.156	2.155	51.600	-0.750	1.515	0.607	Maximum
LO RNV'TD	35%	5.540	1.939	6.156	2.155	51.600	0.750	1.515	0.607	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	5.223	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	2.173	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	40.800	-2.173	0.600	0.000	Maximum
No 4 LO Circ (Damaged)	Damaged									
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.200	-0.900	1.965	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.200	0.900	1.965	0.700	Maximum
Drain oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.910	0.000	0.065	39.958	Maximum
TOTAL LUBE OIL	10.87%	97.234	10.569	111.414	12.081	49.411	1.292	1.280	55.510	
MISC										
GREY WATER TANK	80%	119.826	95.860	119.826	95.860	92.151	0.000	1.961	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.200	-2.700	0.420	31.493	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.600	0.000	0.455	4.344	Maximum
No 1 FO DRAIN DIRTY	80%	2.694	2.155	2.694	2.155	37.316	0.503	0.520	0.184	Maximum
OIL										
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.316	-0.503	0.520	0.184	Maximum
CW DRAIN (Damaged)	Damaged									
Bilge Dirty	80%	4.842	3.873	4.842	3.873	53.997	-4.491	0.492	1.166	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.000	-2.550	0.480	1.852	Maximum
TOTAL MISC	78.18%	166.475	130.113	166.475	130.113	80.113	-0.438	1.566	395.347	
Total Loadcase			5839.177	1516.592	744.624	51.000	0.000	8.552	737.732	
FS correction									0.126	
VCG fluid									8.678	

Εικόνα 221: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 222: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.576	-0.448	-0.286	-0.025	0.241	0.431	0.566	0.689	0.588	0.270	-0.135	-0.626	-1.209	-1.792	-2.323	-2.753	-3.032	-3.089	-2.826	-2.044	-0.990	0.000
Area under GZ curve from zero heel (m²)	10.4894	5.3444	1.6117	-0.0454	1.1204	4.5486	9.5336	15.9023	22.5091	26.9189	27.6527	23.9369	14.8088	-0.2248	-20.8652	-46.3452	-75.4213	-106.2319	-136.1796	-160.9136	-176.1339	-161.0109
Displacement t	5839	5840	5840	5839	5839	5839	5839	5839	5840	5839	5839	5839	5839	5839	5839	5839	5839	5840	5839	5839	5840	5839
Draft at FP m	5.489	5.747	5.856	5.924	5.895	5.781	5.519	4.996	4.251	3.197	1.343	-3.865	n/a	-18.295	-12.879	-11.102	-10.268	-9.837	-9.659	-9.892	-9.961	-9.918
Draft at AP m	5.224	5.591	5.796	5.784	5.773	5.605	5.237	4.571	3.585	2.191	-0.207	-7.326	n/a	-20.365	-13.251	-10.808	-9.555	-8.798	-8.351	-8.197	-8.114	-8.090
WL Length m	123.348	123.358	123.362	118.200	123.363	123.359	123.349	123.332	123.309	123.319	122.323	123.378	123.872	124.124	124.196	124.024	123.581	122.522	121.864	121.648	121.226	120.182
Beam max extents on WL m	20.343	20.011	19.192	18.977	19.192	20.014	20.364	19.371	16.254	14.378	13.783	12.643	12.451	12.643	13.250	14.357	15.678	16.962	18.478	20.113	19.234	18.903
Wetted Area m²	2710.460	2737.008	2793.410	2742.156	2716.688	2723.679	2759.298	2777.142	2781.058	2750.217	2715.726	2726.510	2739.098	2757.619	2786.167	2841.888	2947.086	3127.304	3153.375	3155.076		
Wetted Area m²	1391.456	1390.347	1427.150	1490.123	1436.648	1393.758	1392.092	1416.486	1297.676	1229.518	1194.509	1079.544	999.132	975.513	992.982	1032.336	1110.068	1234.071	1417.176	1639.177	1616.017	1597.042
Prismatic coeff (Cp)	0.472	0.450	0.438	0.454	0.437	0.448	0.470	0.494	0.509	0.517	0.522	0.520	0.524	0.532	0.544	0.561	0.586	0.612	0.612	0.585	0.575	0.577
Block coeff (Cb)	0.278	0.303	0.353	0.429	0.353	0.302	0.277	0.283	0.336	0.383	0.413	0.469	0.494	0.440	0.396	0.355	0.323	0.309	0.306	0.322	0.413	0.575
LCB from zero pt. (+ve fwd) m	51.013	51.010	51.005	51.003	51.013	51.007	51.011	51.016	51.011	51.018	51.022	51.027	51.031	51.020	51.008	50.997	50.987	50.978	50.972	50.970	50.966	50.987
LCF from zero pt. (+ve fwd) m	52.002	49.848	47.577	45.734	47.872	49.998	52.028	54.025	56.224	57.462	58.370	59.255	57.155	56.667	56.094	55.532	54.796	53.915	52.760	52.461	53.048	53.096
Max deck inclination deg	30.0002	20.0001	10.0001	0.0719	10.0002	20.0002	30.0002	40.0003	50.0004	60.0003	70.0002	80.0001	90.0000	99.9999	110.0000	120.0000	129.9996	139.9983	149.9949	159.9876	169.9616	179.0632
Trim angle (+ve by stem) deg	-0.1359	-0.0797	-0.0485	-0.0719	-0.0577	-0.0894	-0.1443	-0.2186	-0.3414	-0.5155	-0.7945	-1.1730	n/a	-1.0604	-0.1907	0.1508	0.3652	0.5326	0.6883	0.7682	0.8954	0.9368

Εικόνα 223: Μοχλοβραχίονας Επαναφοράς GZ

Key Point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m	
Margin Line (Immersion pos = 92.958 m)		37.7	n/a	6.462	4.768	2.987	1.246	-0.378	-1.957	-3.534	-5.032	-6.400	-7.466	-8.233	-8.701	-8.985	-9.046	-8.811	-8.207	-7.157	-5.637	-4.297
Deck Edge (Immersion pos = 92.958 m)		33	n/a	6.538	4.840	3.059	1.309	-0.324	-1.910	-3.491	-5.012	-6.393	-7.472	-8.252	-8.733	-8.906	-8.910	-8.674	-8.076	-7.231	-5.913	-4.373
Μετρήσιμη Fore PS	Δυνατότητα point	44.3	0	7.892	6.178	4.343	2.512	0.754	-0.895	-2.781	-4.489	-6.097	-7.406	-8.411	-9.110	-9.485	-9.504	-9.152	-8.402	-7.225	-5.700	-4.088
Μετρήσιμη Fore SB	Δυνατότητα point	155.4	0	7.892	9.435	10.780	11.887	12.806	13.368	13.477	13.130	12.368	11.344	10.054	8.598	6.753	4.699	2.900	0.973	-0.812	-2.444	-4.088
Μετρήσιμη Mid PS	Δυνατότητα point	49	0	9.043	7.292	5.417	3.576	1.888	-0.194	-2.089	-3.957	-5.770	-7.292	-8.659	-9.510	-10.146	-10.421	-10.311	-9.775	-8.760	-7.381	-5.809
Μετρήσιμη Mid SB	Δυνατότητα point	148.5	0	9.043	10.571	11.877	12.960	13.806	14.275	14.269	13.751	12.830	11.595	10.091	8.238	6.211	4.040	1.830	0.301	-2.301	-4.101	-5.809
Μετρήσιμη Aft PS	Δυνατότητα point	49.8	0	8.741	6.981	5.149	3.304	1.526	-0.249	-2.089	-3.896	-5.578	-7.064	-8.339	-9.304	-10.004	-10.393	-10.383	-9.959	-9.032	-7.773	-6.242
Μετρήσιμη Aft SB	Δυνατότητα point	147.3	0	8.741	10.263	11.611	12.754	13.674	14.233	14.301	13.864	13.035	11.838	10.277	8.424	6.334	4.087	1.769	-0.509	-2.569	-4.491	-6.242

Εικόνα 224: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 7-8-9

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

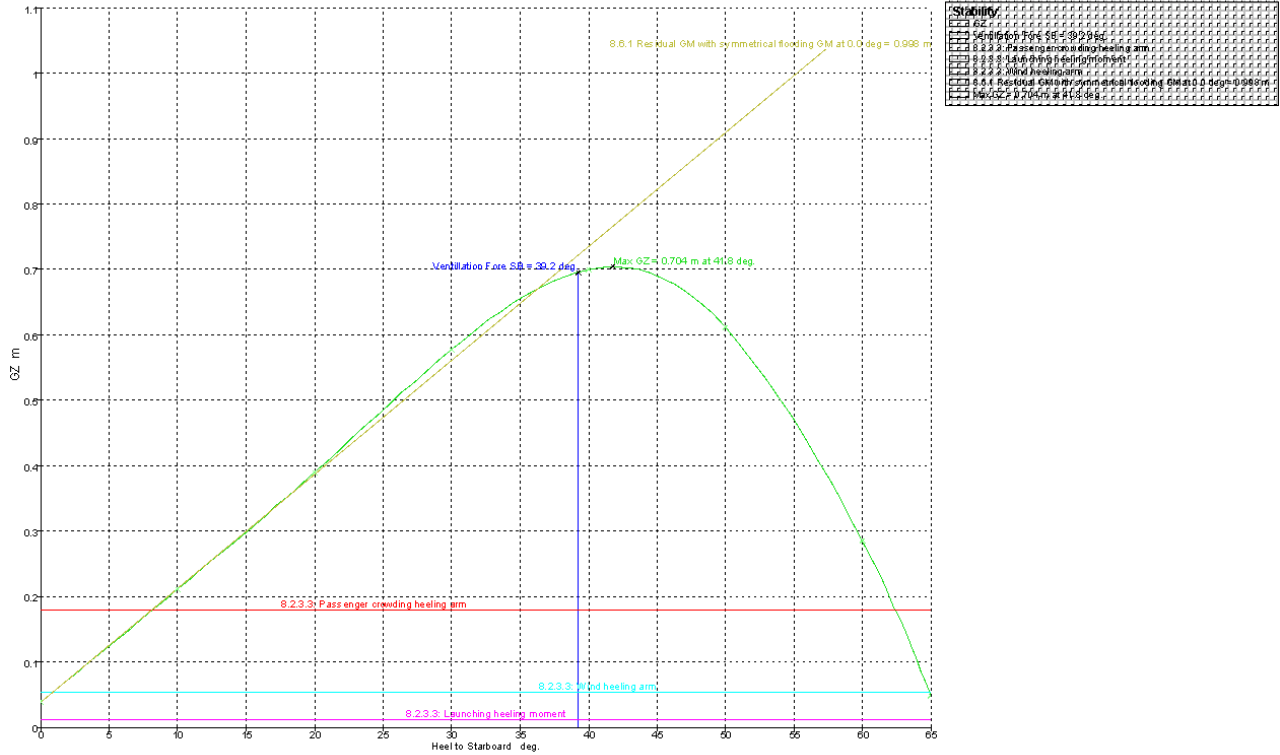
Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

Heeling Port[]	Fully flooded	95	
HEELING[]	Fully flooded	95	
HFO STORAGE[]	Fully flooded	95	
FW ROOM 1,2[]	Fully flooded	95	
ABV HEELING[]	Fully flooded	95	
ABV HFO STORAGE[]	Fully flooded	95	
ABV FW ROOM 1,2[]	Fully flooded	95	

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cans Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cans Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cans topside platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO DWFL	5%	14.451	0.723	14.745	0.737	51.687	-2.612	0.033	30.865	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	68.880	2.331	3.729	101.414	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	74.373	-1.400	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.695	-4.200	2.004	5.279	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.703	-1.500	1.736	10.311	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.703	4.200	4.923	4.579	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.468	56.362	60.339	-0.373	2.860	152.448	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.646	0.000	3.783	15.553	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.286	-1.500	3.783	10.801	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.286	1.500	3.783	10.801	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.393	0.000	3.783	37.155	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port (Damaged)	Damaged									
Heeling Sub	15%	50.570	7.586	49.337	7.401	59.032	8.422	2.576	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	80.66%	674.879	544.366	658.418	531.089	34.681	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.008	3.150	1.360	4.313	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.434	3.150	1.360	8.626	Maximum
LO RNVTG	35%	5.540	1.939	6.156	2.155	51.610	-0.750	1.515	0.608	Maximum
LO RNVTD	35%	5.540	1.939	6.156	2.155	51.610	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	41.758	-5.213	0.641	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.216	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.216	0.900	1.985	0.700	Maximum
Topside oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	34.985	0.000	0.065	39.961	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	48.989	0.914	1.243	57.024	
MISC.										
GREY WATER TANK	80%	119.826	95.861	119.826	95.861	92.180	0.000	1.961	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.207	-2.700	0.420	31.495	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.647	0.000	0.455	4.344	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.894	2.155	2.894	2.155	37.321	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.894	2.155	2.894	2.155	37.321	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.601	0.000	0.480	83.987	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	54.003	-4.491	0.492	1.166	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.006	-2.550	0.480	1.852	Maximum
TOTAL MISC	78.26%	176.325	137.992	176.325	137.992	78.281	-0.413	1.504	479.337	
Total Loadcase			5847.707	1533.676	753.227	50.997	0.000	8.540	823.251	
FS correction									0.141	
VCG fluid									8.681	

Εικόνα 225: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 226: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-0.577	-0.389	-0.211	-0.038	0.139	0.345	0.541	0.686	0.581	0.257	-0.233	-0.787	-1.353	-1.913	-2.422	-2.815	-3.032	-3.028	-2.744	-2.203	-0.968	0.000	
Area under GZ curve from zero heel	9.0590	4.2317	1.2393	-0.0890	0.4890	2.8927	7.3428	13.4951	19.9392	24.3098	24.5207	19.4445	8.7511	-7.5957	-29.3405	-65.6489	-85.0487	-115.5377	-144.7164	-168.8209	-183.7298	-188.4743	
Displacement 1	5848	5848	5848	5848	5848	5848	5847	5848	5848	5847	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	
Draft at FP m	6.888	7.014	7.000	6.971	7.024	7.047	6.919	6.571	6.144	5.599	4.916	3.468	n/a	-9.309	-8.329	-6.125	-8.123	-8.241	-8.468	-8.788	-9.017	-9.090	
Draft at AP m	3.490	3.945	4.224	4.349	4.234	3.956	3.500	2.705	1.294	-0.920	-5.304	-18.246	-32.046	-18.927	-14.354	-11.952	-10.479	-9.565	-8.136	-6.041	-3.011	-0.011	
WL Length m	118.979	119.092	119.116	112.754	119.138	119.120	119.008	118.717	119.574	123.053	123.508	124.054	124.286	124.193	123.886	123.308	122.161	120.704	120.489	120.617	119.670	118.650	
Beam max extents on WL m	19.916	19.844	19.192	18.900	19.192	19.852	19.938	19.309	16.254	14.378	13.250	13.118	12.786	12.643	13.250	14.275	15.423	16.528	17.753	19.192	18.903		
Wetted Area Area m ²	2657.066	2626.550	2603.490	2585.254	2608.790	2632.925	2662.713	2703.685	2745.617	2797.374	2718.917	2720.631	2719.822	2703.215	2694.673	2715.364	2753.014	2818.375	2926.416	3136.904	3141.386	3141.655	
Waterplane Area m ²	1516.700	1503.517	1491.381	1522.303	1495.589	1507.718	1519.085	1492.591	1386.933	1275.716	1203.827	1170.542	1134.753	1096.474	1097.822	1148.392	1222.910	1318.955	1446.859	1667.555	1613.320	1597.061	
Prismatic coeff. (Cp)	0.515	0.497	0.486	0.509	0.494	0.495	0.513	0.531	0.543	0.539	0.544	0.547	0.550	0.557	0.571	0.589	0.615	0.646	0.678	0.708	0.736	0.740	
Block coeff. (Cb)	0.309	0.335	0.366	0.368	0.364	0.333	0.308	0.307	0.361	0.403	0.451	0.471	0.430	0.394	0.358	0.329	0.314	0.317	0.329	0.343	0.457	0.585	
LCB from zero pt. (+ve to aft) m	51.140	51.141	51.140	51.130	51.122	51.132	51.142	51.144	51.164	51.166	51.177	51.186	51.192	51.187	51.158	51.127	51.085	51.053	51.030	51.014	51.003	50.997	
LCF from zero pt. (+ve to aft) m	50.506	49.135	48.108	48.604	48.133	49.169	50.535	50.649	50.350	52.648	55.497	56.975	56.654	54.543	52.590	51.595	50.559	49.280	47.829	46.413	46.484	46.527	
Max deck inclination deg	30.0343	20.0523	10.0966	1.3439	10.0978	20.0530	30.0348	40.0239	50.0187	60.0140	70.0102	80.0057	90.0000	99.9937	109.9890	119.9872	129.9884	139.9920	149.9964	159.9993	170.0000	179.9953	
Trim angle (+ve by stern) deg	-1.7407	-1.5724	-1.4223	-1.3439	-1.4294	-1.5835	-1.7520	-1.9805	-2.4839	-3.3372	-5.2226	-10.9910	n/a	-11.4955	-5.4152	-3.1888	-1.9616	-1.1468	-0.5623	-0.1781	-0.0124	0.0407	

Εικόνα 227: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m	
Margin Line (immersion pos = 94.832 m)		32.9	n/a	5.666	3.993	2.219	0.465	-1.197	-2.707	-4.275	-5.769	-7.155	-8.340	-9.265	-9.862	-10.089	-9.977	-9.668	-9.004	-8.024	-6.472	-5.348	-4.275
Deck Edge (immersion pos = 94.832 m)		33.2	n/a	5.744	4.060	2.284	0.528	-1.105	-2.695	-4.244	-5.751	-7.150	-8.340	-9.226	-9.795	-9.954	-9.632	-9.029	-8.108	-6.859	-5.430	-4.351	
Μοχλοβραχίονας Fore PS	Ομοσπονδία point	39.1	0	7.124	5.353	3.468	1.604	-0.154	-1.988	-3.600	-5.374	-7.010	-8.450	-9.562	-10.267	-10.601	-10.551	-10.090	-8.198	-7.879	-6.138	-4.718	
Μοχλοβραχίονας SB PS	Ομοσπονδία point	151.1	0	7.124	8.608	9.976	10.976	11.894	12.449	12.592	12.238	11.445	10.288	8.892	7.343	5.630	3.609	1.981	0.177	-1.489	-3.880	-6.478	
Μοχλοβραχίονας Mid PS	Ομοσπονδία point	48.9	0	9.112	7.358	5.480	3.528	1.647	-0.199	-2.056	-3.861	-5.612	-7.176	8.487	6.488	-10.181	-10.481	-10.401	-8.987	-8.830	-7.427	-5.848	
Μοχλοβραχίονας Aft PS	Ομοσπονδία point	149.0	0	9.112	10.635	11.918	13.194	14.265	14.264	13.859	12.978	11.700	10.102	8.255	6.190	3.984	1.739	-0.420	-2.370	-4.147	-6.848		
Μοχλοβραχίονας Aft SB	Ομοσπονδία point	55.3	0	9.889	8.193	6.300	4.487	2.653	0.919	-0.825	-2.491	-4.042	-5.454	-6.714	-7.790	-8.630	-9.102	-9.381	-8.143	-6.349	-4.060	-5.521	
Μοχλοβραχίονας Aft SB	Ομοσπονδία point	151.4	0	9.889	11.474	12.842	13.944	14.798	15.302	15.535	15.286	14.561	13.434	11.887	9.961	7.731	5.202	2.767	0.307	-1.855	-3.778	-5.521	

Εικόνα 228: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 8-9-10

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

Compartments Damaged -

Compartment or Tank Status Perm.% PartFlood.% PartFlood.WL

HFO STORAGE[] Fully flooded 95

FW ROOM 1,2[] Fully flooded 95

AC PLANT ROOM[] Fully flooded 95

ABV HFO STORAGE[] Fully flooded 95

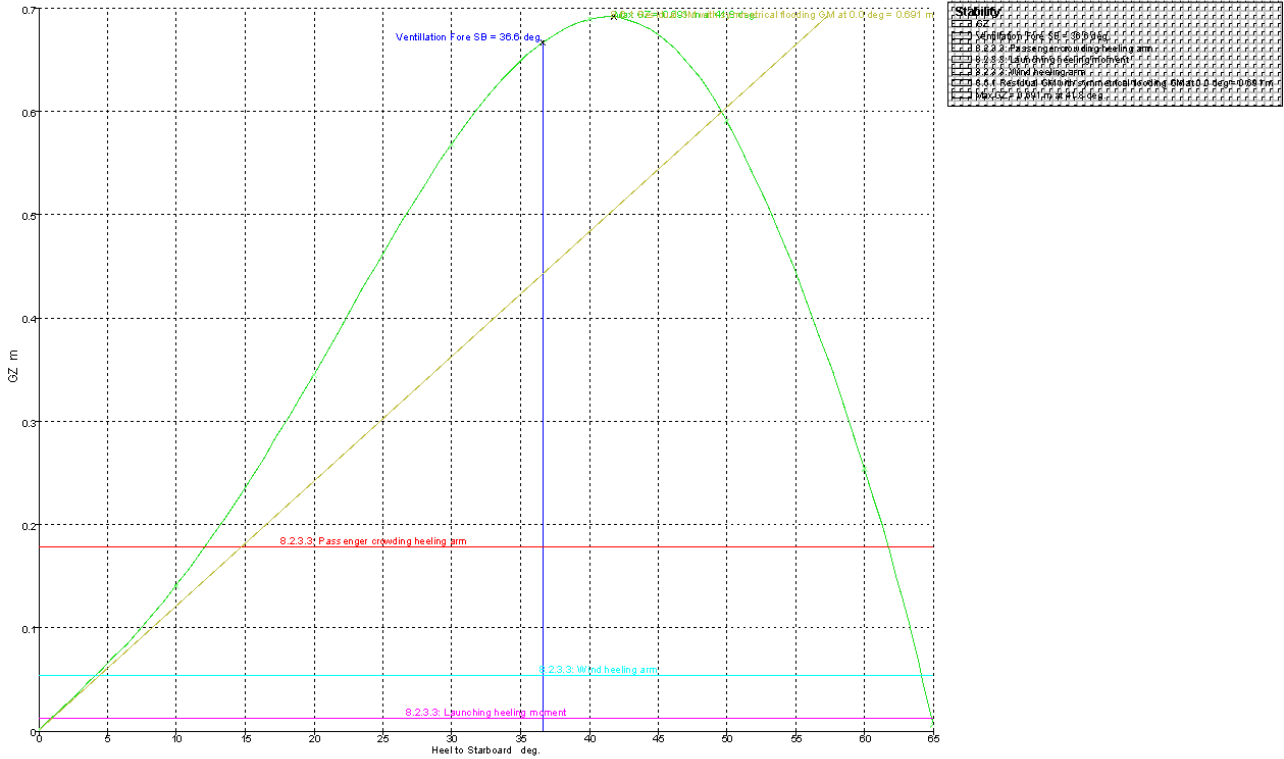
ABV FW ROOM 1,2[] Fully flooded 95

ABV AC PLANT ROOM[] Fully flooded 95

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m³	Total Volume m³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars lower platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.774	-2.612	0.034	30.871	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	69.392	2.320	3.738	101.434	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	74.373	-1.400	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.707	-4.200	2.003	5.280	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.720	-1.500	1.736	10.313	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.721	4.200	4.923	4.580	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.468	56.362	60.476	-0.375	2.862	152.478	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.686	0.000	3.784	15.556	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.323	-1.500	3.784	10.803	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.323	1.500	3.784	10.803	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.444	0.000	3.784	37.162	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 1 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.198	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	15%	50.570	7.586	49.337	7.401	59.077	8.421	2.577	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.089	34.682	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.016	3.150	1.360	4.314	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.463	3.150	1.361	8.627	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.618	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.618	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	42.493	-5.211	0.654	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.229	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.229	0.900	1.985	0.700	Maximum
Drain oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	35.011	0.000	0.066	39.969	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	116.649	12.804	49.050	0.914	1.244	57.035	
MISC										
GREY WATER TANK	80%	119.826	95.861	119.826	95.861	92.205	0.000	1.962	356.124	Maximum
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.213	-2.700	0.420	31.501	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.688	0.000	0.456	4.345	Maximum
No 1 FO DRAIN DeRXX	80%	2.694	2.155	2.694	2.155	37.325	0.503	0.520	0.184	Maximum
OIL										
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.325	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.601	0.000	0.490	84.004	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	54.009	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.012	-2.550	0.480	1.853	Maximum
TOTAL MISC	78.26%	176.325	137.992	176.325	137.992	78.303	-0.413	1.504	479.361	
Total Loadcase			5847.707	1583.013	753.227	50.999	-0.001	8.540	823.323	
FS correction									0.141	
VCG fluid									6.681	

Εικόνα 229: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 230: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.588	-0.345	-0.141	-0.001	0.140	0.344	0.567	0.688	0.590	0.254	-0.270	-0.852	-1.431	-1.981	-2.474	-2.856	-3.053	-3.024	-2.719	-1.989	-0.954	0.001
Area under GZ curve from zero heel (m^2)	7.8196	3.0544	0.8674	-0.0009	0.6590	3.0291	7.8146	14.0343	20.6262	25.0343	25.0571	19.4570	8.0274	-9.0681	-31.4062	-58.1745	-87.8956	-118.4774	-147.4911	-171.3921	-186.1755	-190.8510
Displacement t	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848	5848
Draft at FP m	7.556	7.646	7.604	7.559	7.600	7.642	7.554	7.294	7.007	6.719	6.459	6.306	n/a	-6.297	-6.654	-7.018	-7.309	-7.601	-7.950	-8.346	-8.582	-8.659
Draft at AP m	3.011	3.492	3.787	3.894	3.789	3.494	3.012	2.159	0.653	-1.822	-6.711	-21.098	n/a	-35.066	-20.491	-15.364	-12.667	-11.002	-9.955	-9.441	-9.334	-9.300
WL Length m	119.660	119.698	119.601	112.725	119.598	119.694	119.659	119.653	121.326	123.089	123.845	124.229	124.332	124.114	123.660	122.666	121.198	119.833	119.922	119.918	119.042	117.954
Beam max extents on WL m	19.956	19.842	19.192	18.900	19.192	19.842	19.955	19.332	16.254	14.378	13.250	12.648	13.126	12.643	13.250	14.258	15.395	16.530	17.889	20.113	19.192	18.903
Wetted Area m^2	2680.053	2643.622	2607.060	2576.631	2606.927	2643.301	2679.868	2727.015	2761.749	2753.642	2741.419	2735.467	2733.799	2729.635	2715.152	2722.554	2762.294	2831.606	2943.249	3141.283	3160.583	3156.437
Wetted Area m^2	1514.228	1491.965	1453.306	1411.960	1453.388	1491.985	1514.230	1471.602	1372.356	1230.545	1158.517	1135.994	1126.655	1110.821	1106.975	1149.004	1231.439	1326.563	1445.932	1637.353	1597.653	1576.085
Prismatic coeff. (Cp)	0.501	0.496	0.476	0.503	0.476	0.487	0.502	0.515	0.523	0.529	0.537	0.542	0.546	0.553	0.564	0.580	0.604	0.630	0.653	0.674	0.695	0.706
Block coeff. (Cb)	0.305	0.331	0.336	0.358	0.336	0.331	0.305	0.304	0.355	0.403	0.449	0.480	0.403	0.379	0.344	0.318	0.306	0.306	0.312	0.327	0.429	0.530
LCB from zero pt. (+ve fwd) m	51.191	51.193	51.185	51.187	51.175	51.180	51.185	51.196	51.202	51.216	51.233	51.242	51.245	51.229	51.212	51.167	51.089	51.089	51.049	51.032	51.024	51.015
LCF from zero pt. (+ve fwd) m	49.856	48.522	47.710	47.642	47.702	48.515	49.852	49.458	48.552	50.333	52.719	54.596	55.393	54.274	51.934	50.264	49.192	47.814	46.315	44.531	44.092	44.147
Max deck inclination deg	30.0614	20.0956	10.1818	1.8776	10.1613	20.0954	30.0613	40.0422	50.0320	60.0241	70.0169	80.0091	90.0000	99.9899	109.9813	119.9770	129.9772	139.9815	149.9880	159.9933	169.9929	179.8718
Trim angle (+ve by stem) deg	-2.3281	-2.1279	-1.9551	-1.8776	-1.9523	-2.1247	-2.3265	-2.6297	-3.2528	-4.3689	-6.7189	-13.7728	n/a	-14.4302	-7.0558	-4.2691	-2.7434	-1.7424	-1.0271	-0.5615	-0.3853	-0.3282

Εικόνα 231: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 98.081 m)		30.4	n/a	5.165	3.527	1.779	0.057	-1.560	-3.141	-4.675	-6.139	-7.490	-8.689	-9.560	-10.077	-10.192	-9.943	-9.342	-8.426	-7.148	-5.739	-4.750
Deck Edge (immersion pos = 98.081 m)		30.7	n/a	5.261	3.597	1.843	0.116	-1.511	-3.100	-4.646	-6.119	-7.466	-8.670	-9.583	-10.112	-10.238	-9.998	-9.413	-8.510	-7.232	-5.821	-4.828
Υποπόδια Fore PS point	Υποπόδια point	36.6	0	6.652	4.898	3.017	1.164	-0.598	-2.353	-4.094	-5.707	-7.388	-8.922	-9.982	-10.711	-11.032	-10.980	-10.478	-9.557	-8.216	-6.683	-5.068
Υποπόδια Fore SB point	Υποπόδια point	148	0	6.652	6.152	9.426	10.533	11.448	12.000	12.132	11.818	11.000	9.910	8.484	6.893	5.195	3.396	1.571	-0.163	-1.803	-3.427	-5.068
Υποπόδια Mid PS point	Υποπόδια point	48.3	0	6.992	7.240	5.347	3.414	1.531	-0.318	-2.160	-3.953	-5.693	-7.213	-8.535	-9.555	-10.234	-10.559	-10.488	-9.961	-8.929	-7.532	-5.956
Υποπόδια Mid SB point	Υποπόδια point	147.6	0	6.992	10.519	11.803	12.852	13.664	14.142	14.186	13.782	12.926	11.659	10.047	8.178	6.112	3.903	1.650	-0.518	-2.469	-4.252	-5.956
Υποπόδια Att PS point	Υποπόδια point	57.1	0	10.221	6.514	6.699	4.807	2.999	1.220	-0.490	-2.124	-3.693	-5.060	-6.307	-7.379	-8.244	-8.833	-9.081	-8.894	-8.142	-6.853	-5.314
Υποπόδια Att SB point	Υποπόδια point	152.5	0	10.221	11.794	13.159	14.251	15.101	15.689	15.866	15.621	14.938	13.822	12.287	10.365	8.113	5.638	3.065	0.555	-1.678	-3.571	-5.314

Εικόνα 232: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 9-10-11

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

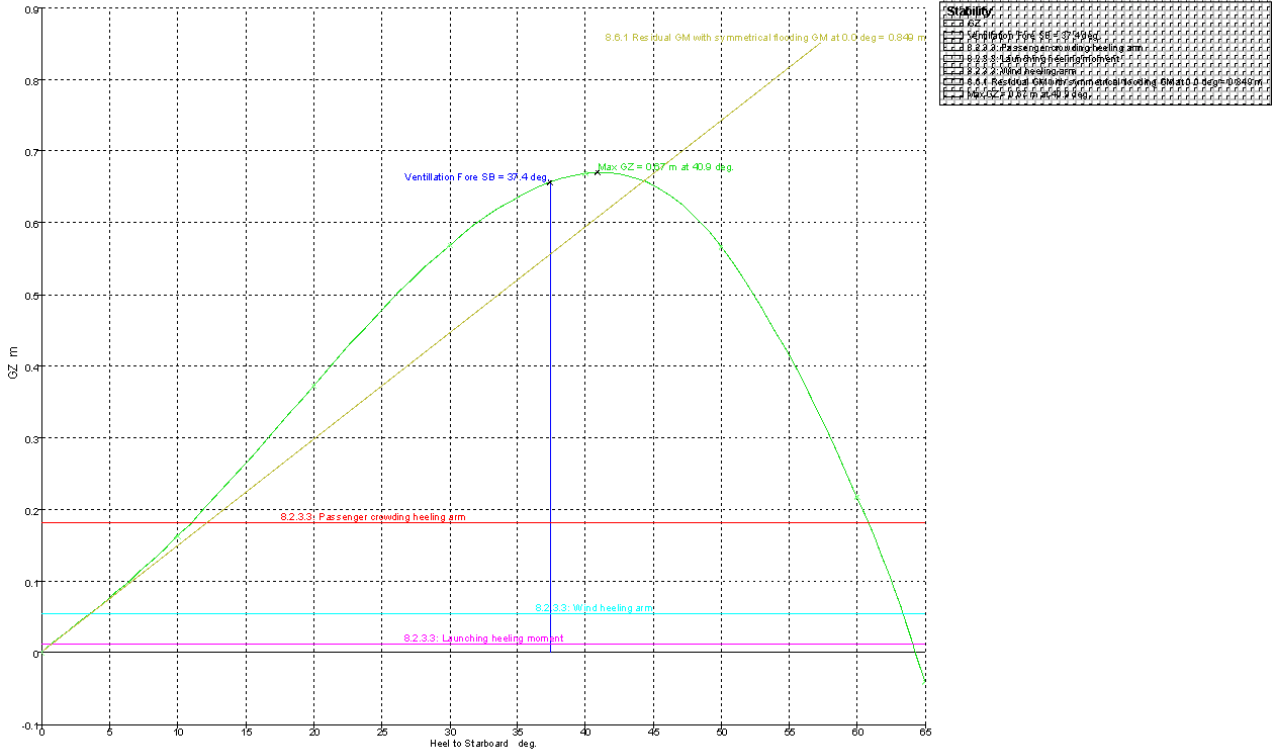
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
GREY WATER TANK[]	Fully flooded	95		
FW ROOM 1,2[]	Fully flooded	95		
AC PLANT ROOM[]	Fully flooded	95		
SEWAGE TRMNT[]	Fully flooded	95		
ABV FW ROOM 1,2[]	Fully flooded	95		
ABV AC PLANT ROOM[]	Fully flooded	95		
ABV SEWAGE TRMNT[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass [000]	Total Mass [000]	Unit Volume m³	Total Volume m³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM [000]	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lugs	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars topside platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.849	-2.612	0.036	30.879	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	69.630	2.311	3.750	101.461	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	74.373	-1.400	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.718	-4.200	2.004	5.282	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.738	-1.500	1.737	10.315	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.739	4.200	4.924	4.581	Maximum
TOTAL FUEL	12.83%	416.868	53.740	430.488	56.362	60.595	-0.378	2.865	152.518	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.720	0.000	3.784	15.560	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.372	-1.500	3.785	10.806	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.372	1.500	3.785	10.806	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.488	0.000	3.785	37.172	
WATER BALLAST										
WBT No1	100%	119.245	119.245	116.337	116.337	101.380	0.000	2.149	94.797	User Specified
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	15%	50.570	7.586	49.337	7.401	59.115	8.420	2.578	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	75.04%	725.449	544.366	707.755	531.069	34.682	0.117	3.753	97.287	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.022	3.150	1.360	4.315	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.487	3.150	1.361	8.630	Maximum
LO RNV'T'G	35%	5.540	1.939	6.156	2.155	51.625	-0.750	1.515	0.608	Maximum
LO RNV'T'D	35%	5.540	1.939	6.156	2.155	51.625	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	42.843	-5.204	0.663	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.241	-0.900	1.986	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.241	0.900	1.986	0.700	Maximum
Topside oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	35.052	0.000	0.067	39.980	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	49.086	0.915	1.245	57.049	
MISC.										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.219	-2.700	0.420	31.510	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.723	0.000	0.457	4.346	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.328	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.328	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.602	0.000	0.480	84.026	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	54.014	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.016	-2.550	0.480	1.853	Maximum
TOTAL MISC	74.57%	56.499	42.132	56.499	42.132	46.684	-1.354	0.465	123.270	
Total Loadcase			5751.847	1463.188	657.367	50.314	-0.001	8.650	467.296	
FS correction								0.081		
VCG fluid								8.731		

Εικόνα 233: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 234: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.568	-0.372	-0.182	-0.001	0.161	0.371	0.587	0.668	0.565	0.217	-0.329	-0.940	-1.549	-2.129	-2.643	-3.036	-3.239	-3.212	-2.906	-2.171	-1.045	0.001
Area under GZ curve from zero heel (m ² deg)	8.1541	3.4343	0.7801	-0.0010	0.7709	3.4089	8.1451	14.4457	20.8085	24.9193	24.4681	18.1406	5.6610	-12.7408	-36.6831	-65.2071	-86.7623	-129.2201	-160.1002	-185.8927	-202.0863	-207.1987
Displacement t	5752	5752	5752	5752	5752	5752	5751	5752	5752	5751	5752	5752	5752	5751	5752	5752	5752	5752	5752	5752	5752	5752
Draft at FP m	7.409	7.430	7.326	7.268	7.323	7.426	7.409	7.153	6.810	6.487	6.139	5.690	n/a	-6.968	-7.043	-7.292	-7.513	-7.755	-8.048	-8.390	-8.595	-8.657
Draft at AP m	2.642	3.195	3.535	3.654	3.538	3.197	2.642	1.723	0.129	-2.615	-8.001	-23.799	n/a	-37.791	-21.784	-16.177	-13.236	-11.421	-10.279	-9.694	-9.577	-9.546
WL Length m	119.528	119.542	117.232	112.301	117.291	119.538	119.528	119.468	121.000	123.013	123.828	124.239	124.365	124.167	123.740	122.997	121.473	120.044	120.038	119.776	118.886	117.689
Beam max extents on WL m	19.679	19.737	19.192	18.900	19.192	19.737	19.678	19.142	16.254	14.378	13.250	12.784	13.061	12.643	13.250	14.175	15.198	16.194	17.537	20.113	19.192	18.911
Wetted Area m ²	2806.768	2567.975	2520.430	2490.659	2520.464	2568.392	2606.223	2647.965	2679.181	2670.999	2663.356	2658.988	2656.955	2648.856	2629.516	2646.480	2686.980	2757.022	2871.795	3082.007	3128.246	3126.085
Wetted Area m ²	1498.630	1483.162	1447.288	1427.540	1447.441	1483.189	1498.581	1478.788	1389.232	1242.921	1171.554	1143.995	1131.562	1113.707	1109.210	1158.437	1240.335	1343.386	1470.703	1670.635	1653.584	1629.512
Prismatic coeff. (Cp)	0.516	0.503	0.503	0.522	0.503	0.504	0.516	0.537	0.543	0.550	0.555	0.560	0.566	0.577	0.594	0.618	0.644	0.665	0.683	0.698	0.698	0.707
Block coeff. (Cb)	0.314	0.340	0.350	0.368	0.350	0.340	0.314	0.311	0.361	0.410	0.458	0.480	0.406	0.380	0.345	0.320	0.309	0.311	0.317	0.324	0.424	0.521
LCB from zero pt. (x _{LCB}) (m)	50.528	50.524	50.513	50.502	50.503	50.515	50.530	50.529	50.538	50.564	50.572	50.586	50.590	50.575	50.548	50.503	50.457	50.406	50.372	50.343	50.335	50.335
LCF from zero pt. (x _{LCF}) (m)	48.505	47.240	46.868	46.968	46.855	47.233	48.506	48.675	47.670	49.225	51.309	52.999	53.652	52.340	49.896	48.774	47.909	46.923	45.780	44.282	43.324	43.282
Max deck inclination deg	30.0675	20.0994	10.1794	1.8519	10.1788	20.0991	30.0675	40.0472	50.0254	60.0274	70.0195	80.0106	90.0000	99.9884	109.9788	119.9739	129.9740	139.9785	149.9852	159.9905	169.9878	179.9448
Trim angle (x _{trim} by stem) deg	-2.4415	-2.1691	-1.9421	-1.8519	-1.9388	-2.1682	-2.4420	-2.7803	-3.4199	-4.6544	-7.2085	-14.7763	n/a	-15.4131	-7.5112	-4.5438	-2.9300	-1.8780	-1.1429	-0.6883	-0.5033	-0.4552

Εικόνα 235: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (immersion pos = 98.001 m)		31.3	n/a	5.469	3.788	1.950	0.210	-1.421	-2.983	-4.516	-5.976	-7.327	-8.503	-9.389	-9.896	-10.014	-9.774	-9.211	-8.333	-7.095	-5.716	-4.767
Deck Edge (immersion pos = 98.708 m)		31.6	n/a	5.548	3.868	2.054	0.289	-1.370	-2.941	-4.468	-5.959	-7.323	-8.510	-9.411	-9.931	-10.090	-9.830	-9.203	-8.414	-7.170	-5.707	-4.843
Υεύλιον Fore PS	Δυνατότητα point	37.4	0	6.930	5.168	3.229	1.311	-0.485	-2.203	-3.540	-5.039	-6.740	-8.670	-9.804	-10.542	-10.884	-10.802	-10.337	-9.450	-8.152	-6.644	-5.042
Υεύλιον Fore SB	Δυνατότητα point	146.6	0	6.938	8.422	6.937	10.680	11.579	12.150	12.270	11.864	11.206	10.058	8.640	7.060	5.361	3.553	1.712	-0.076	-1.739	-3.388	-5.042
Υεύλιον Mid PS	Δυνατότητα point	45.5	0	9.290	7.502	5.584	3.627	1.741	-0.099	-1.917	-3.684	-6.307	-8.938	-11.257	-13.091	-14.922	-16.278	-16.707	-14.798	-12.417	-9.546	
Υεύλιον Mid SB	Δυνατότητα point	148.4	0	9.290	10.780	12.040	13.064	13.873	14.382	14.428	14.039	13.194	11.931	10.323	8.420	6.370	4.139	1.859	-0.345	-2.339	-4.137	-5.846
Υεύλιον Aft PS	Δυνατότητα point	99.2	0	10.468	8.764	6.989	5.105	3.287	1.533	-0.128	-1.721	-3.231	-4.621	-6.074	-7.689	-8.494	-8.763	-8.638	-7.928	-6.638	-5.087	
Υεύλιον Aft SB	Δυνατότητα point	153.6	0	10.468	12.044	13.429	14.540	15.407	16.000	16.229	16.022	15.363	14.258	12.717	10.770	8.467	5.976	3.382	0.813	-1.483	-3.358	-5.087

Εικόνα 236: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%

Damage Case - 10-11-12

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

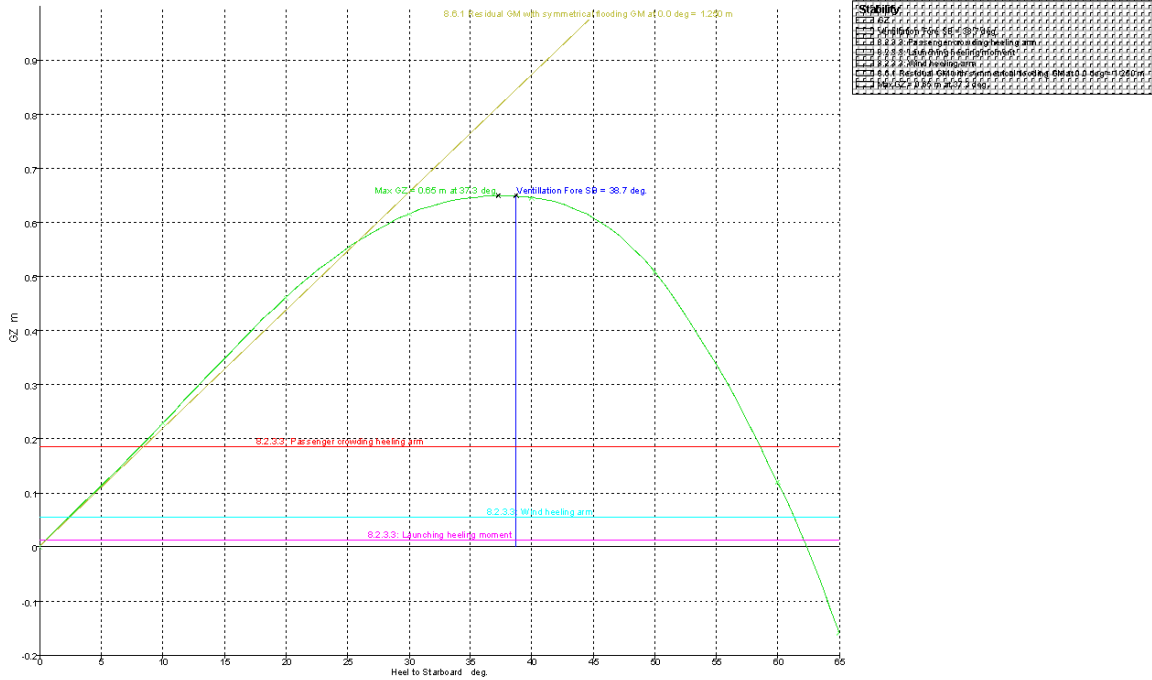
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
WBT No1[]	Fully flooded	95		
GREY WATER TANK[]	Fully flooded	95		
AC PLANT ROOM[]	Fully flooded	95		
SEWAGE TRMNT[]	Fully flooded	95		
BOW THRUSTER[]	Fully flooded	95		
ABV AC PLANT ROOM[]	Fully flooded	95		
ABV SEWAGE TRMNT[]	Fully flooded	95		
ABV BOW THRUSTER[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m³	Total Volume m³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lug	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			66.600	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars lower platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.845	-2.612	0.036	30.879	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	69.809	2.312	3.750	101.459	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	74.373	-1.460	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.714	-4.200	2.002	5.281	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.733	-1.500	1.735	10.315	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.735	4.200	4.923	4.581	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.488	56.362	60.586	-0.377	2.864	152.516	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.718	0.000	3.784	15.580	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.370	-1.500	3.785	10.806	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.370	1.500	3.785	10.806	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.486	0.000	3.785	37.171	
WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT	0%	87.528	0.000	85.393	0.000	109.823	0.000	0.000	0.000	Maximum
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Stb	15%	50.570	7.586	49.337	7.401	59.113	8.420	2.578	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.823	0.000	1.813	0.000	Maximum
TOTAL BALLAST	70.13%	606.204	425.121	591.418	414.752	15.974	0.150	4.203	2.499	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.022	3.150	1.360	4.315	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.486	3.150	1.361	8.629	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.625	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.625	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	42.830	-5.203	0.662	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.241	-0.900	1.986	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.241	0.900	1.986	0.700	Maximum
Storage oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	35.050	0.000	0.067	39.979	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	118.649	12.804	49.085	0.915	1.245	57.049	
MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.218	-2.700	0.420	31.509	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.721	0.000	0.457	4.346	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.894	2.155	2.894	2.155	37.328	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.894	2.155	2.894	2.155	37.328	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.602	0.000	0.480	84.025	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	54.014	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.016	-2.550	0.480	1.853	Maximum
TOTAL MISC	74.57%	56.499	42.132	56.499	42.132	46.883	-1.354	0.465	123.288	
Total Loadcase			5632.602	1346.851	541.030	49.233	-0.001	8.767	372.493	
FS correction								0.066		
VCG fluid								8.853		

Εικόνα 237: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 238: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	
GZ m	-0.615	-0.460	-0.227	-0.001	0.226	0.459	0.614	0.645	0.507	0.119	-0.470	-1.134	-1.803	-2.426	-2.961	-3.360	-3.560	-3.521	-3.201	-2.416	-1.187	0.001	
Area under GZ curve from zero heel m ² /deg	10.0191	4.5931	1.1226	-0.0010	1.1150	4.5701	10.0262	16.4348	22.3765	25.7108	24.0876	16.0721	1.3671	-19.8329	-46.8605	-78.6067	-113.3913	-148.9960	-182.9090	-211.4454	-229.6194	-235.4577	
Displacement t	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5632	5633	5633	5632	5633	5633	5633	5633	5633	5633	5633	5633	5633
Draft at FP m	6.950	6.783	6.547	6.447	6.537	6.773	6.949	6.866	6.601	6.412	6.240	6.026	n/a	-6.455	-6.595	-6.842	-7.032	-7.215	-7.403	-7.693	-7.844	-7.873	
Draft at AP m	2.511	3.191	3.619	3.768	3.625	3.198	2.511	1.450	-0.272	-3.290	-9.173	-26.296	n/a	-40.364	-23.121	-17.092	-13.945	-12.018	-10.824	-10.192	-10.063	-10.042	
WL Length m	119.096	118.970	118.675	111.649	118.667	118.961	119.096	119.077	120.656	123.011	123.882	124.286	124.395	124.173	123.689	122.800	120.773	119.357	119.391	118.782	117.915	116.841	
Beam max extents on WL m	19.329	19.586	19.189	18.900	19.189	19.586	19.329	18.816	16.254	14.376	13.250	12.748	13.092	12.643	13.242	14.118	15.103	16.161	17.732	20.113	19.192	18.902	
Wetted Area m ²	2524.597	2480.064	2430.390	2398.077	2430.301	2479.736	2524.581	2570.196	2608.011	2614.318	2615.099	2613.366	2611.655	2608.090	2599.205	2614.691	2665.340	2748.571	2863.335	3094.353	3160.934	3163.570	
Wetted Area m ²	1442.333	1457.101	1452.757	1433.511	1453.147	1457.217	1442.334	1427.806	1352.427	1210.554	1129.198	1089.185	1076.252	1074.492	1067.521	1137.862	1221.314	1318.855	1437.340	1640.674	1860.314	1638.770	
Prismatic coeff. (Cp)	0.536	0.529	0.523	0.553	0.523	0.530	0.536	0.545	0.546	0.551	0.556	0.560	0.565	0.574	0.586	0.604	0.619	0.618	0.614	0.614	0.614	0.615	
Block coeff. (Cb)	0.324	0.350	0.378	0.408	0.379	0.350	0.324	0.320	0.364	0.411	0.459	0.473	0.397	0.372	0.336	0.311	0.300	0.295	0.291	0.296	0.374	0.437	
LCB from zero pt. (+ve fwd) m	49.440	49.429	49.400	49.386	49.380	49.408	49.439	49.465	49.486	49.511	49.537	49.544	49.548	49.532	49.505	49.454	49.404	49.350	49.316	49.289	49.276	49.280	
LCF from zero pt. (+ve fwd) m	45.288	44.626	44.444	44.831	44.423	44.611	45.287	45.848	45.135	45.993	47.354	48.457	49.141	48.594	47.030	45.990	45.366	44.426	43.511	42.842	41.550	41.503	
Max deck inclination deg	30.0596	20.0716	10.1075	1.3728	10.1063	20.0709	30.0595	40.0470	50.0375	60.0311	70.0231	80.0127	90.0000	99.9860	109.9734	119.9653	129.9621	139.9631	149.9652	159.9653	169.9391	178.8889	
Trim angle (+ve by stem) deg	-2.2738	-1.8400	-1.5003	-1.3728	-1.4921	-1.8317	-2.2733	-2.7737	-3.5177	-4.9594	-7.8499	-16.1108	n/a	-16.8724	-8.4084	-5.2384	-3.5380	-2.4600	-1.7523	-1.2802	-1.1372	-1.1111	

Εικόνα 239: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immersion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (Immersion pos + 85.457 m)		33.2	n/a	6.200	4.464	2.533	0.566	-1.203	-3.029	-4.433	-5.944	-7.310	-8.488	-9.364	-9.954	-10.132	-9.972	-9.569	-8.928	-8.065	-6.436	-5.628
Deck Edge (Immersion pos + 86.081 m)		33.5	n/a	6.276	4.555	2.598	0.627	-1.152	-2.768	-4.403	-5.926	-7.306	-8.497	-9.416	-9.989	-10.176	-10.030	-9.648	-8.912	-7.769	-6.491	-5.704
Verification Fore PS	Overboarding	38.7	0	7.658	5.840	3.774	1.676	-0.247	-2.055	-3.675	-5.624	-7.242	-8.675	-9.831	-10.623	-11.039	-11.023	-10.650	-9.890	-8.679	-7.246	-6.601
Verification Fore SB	Overboarding	147.3	0	7.658	9.101	10.164	11.047	11.797	12.297	12.348	11.976	11.200	10.050	8.608	6.974	5.212	3.329	1.365	-0.510	-2.267	-3.991	-6.601
Verification Mid PS	Overboarding	50.5	0	9.663	7.880	5.922	3.867	1.959	0.093	-1.745	-3.532	-5.225	-6.771	-8.103	-9.157	-9.890	-10.294	-10.297	-9.879	-8.946	-7.607	-6.052
Verification Mid SB	Overboarding	146.1	0	9.663	11.168	12.379	13.335	14.088	14.551	14.597	14.198	13.353	12.091	10.473	8.586	6.451	4.174	1.837	-0.439	-2.467	-4.327	-6.052
Verification AR PS	Overboarding	61.1	0	10.482	8.776	7.040	5.251	3.470	1.776	0.177	-1.370	-2.858	-4.238	-5.488	-6.583	-7.486	-8.134	-8.423	-8.260	-7.596	-6.300	-4.748
Verification AR SB	Overboarding	155.1	0	10.482	12.059	13.501	14.695	15.618	16.240	16.529	16.370	15.732	14.638	13.098	11.195	8.984	6.340	3.176	1.167	-1.123	-3.018	-4.748

Εικόνα 240: Προσδιορισμός της θέσης των Key Points

Loadcase - Arrival 10%
Damage Case - 11-12-13

Free to Trim

Specific gravity = 1.025; (Density = 1.025 tonne/m³)

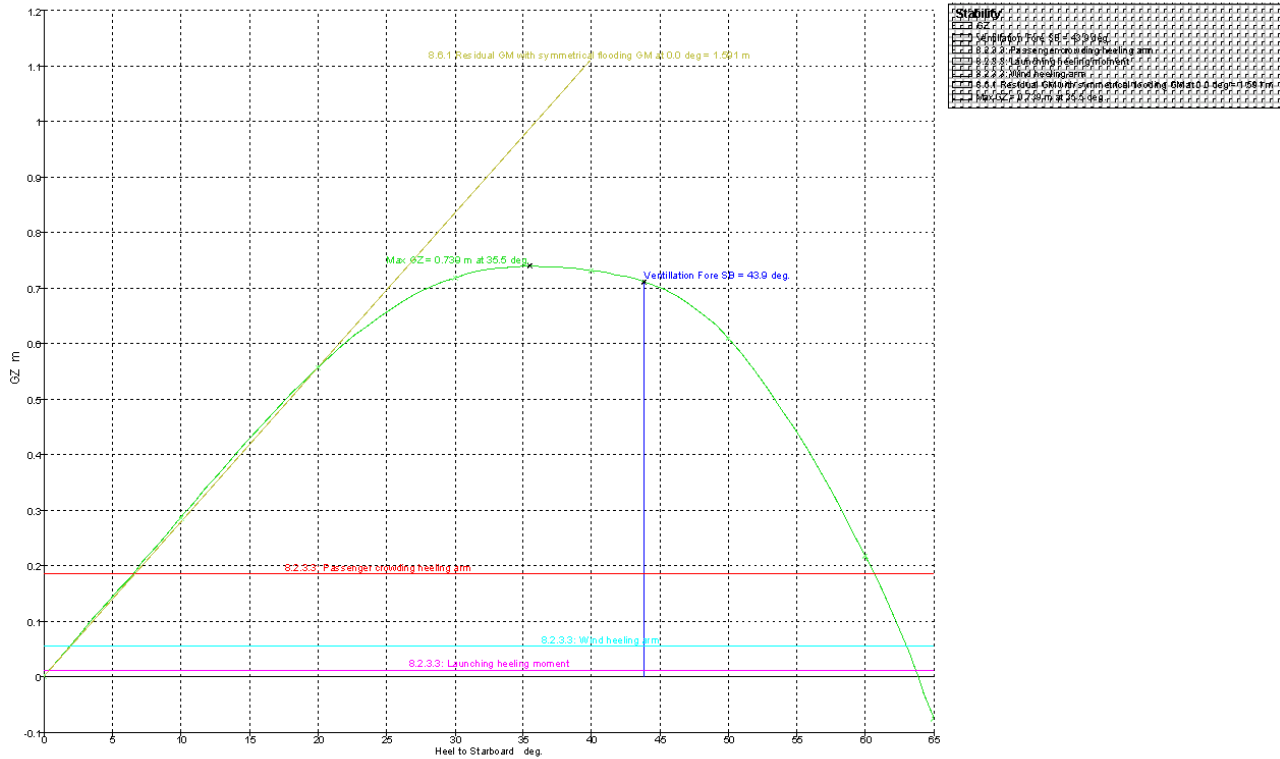
Compartments Damaged -

Compartment or Tank	Status	Perm.%	PartFlood.%	PartFlood.WL
WBT No1[]	Fully flooded	95		
FPT[]	Fully flooded	95		
GREY WATER TANK[]	Fully flooded	95		
SEWAGE TRMNT[]	Fully flooded	95		
BOW THRUSTER[]	Fully flooded	95		
FORE[]	Fully flooded	95		
ABV SEWAGE TRMNT[]	Fully flooded	95		
ABV BOW THRUSTER[]	Fully flooded	95		

Fluid analysis method: Use corrected VCG

Item Name	Quantity	Unit Mass tonne	Total Mass tonne	Unit Volume m ³	Total Volume m ³	Long. Arm m	Trans. Arm m	Vert. Arm m	Total FSM tonne.m	FSM Type
Lightship	1	4690.000	4690.000			51.700	0.000	9.130	0.000	User Specified
Passengers & lugg	1474	0.115	169.510			51.700	0.000	15.200	0.000	User Specified
Cars Upper	48	1.100	52.800			86.800	0.000	12.450	0.000	User Specified
Cars Main deck	104	1.100	114.400			48.800	0.000	7.250	0.000	User Specified
Cars lower platform	52	1.100	57.200			41.600	0.000	9.750	0.000	User Specified
Provisions	0.1	15.000	1.500			54.350	0.000	15.200	0.000	User Specified
total			5085.410			51.884	0.000	9.333	0.000	
FUEL OIL										
FO OVFL	5%	14.451	0.723	14.745	0.737	51.778	-2.612	0.034	30.672	Maximum
No 1 HFO STOR SB	10%	130.737	13.074	133.405	13.341	69.415	2.320	3.739	101.435	Maximum
No 2 HFO STOR PS	0%	130.737	0.000	133.405	0.000	74.373	-1.400	3.600	0.000	Maximum
HFO Settling	30%	54.849	16.455	55.968	16.790	57.700	-4.200	2.000	5.280	Maximum
HFO SVCE	20%	68.561	13.712	69.960	13.992	57.714	-1.500	1.734	10.313	Maximum
MGO SERVICE	50%	19.554	9.777	23.004	11.502	57.715	4.200	4.921	4.580	Maximum
TOTAL FUEL	12.83%	418.888	53.740	430.488	56.362	60.477	-0.375	2.860	152.480	
FRESH WATER TANKS										
No 3 FWT	10%	49.932	4.993	49.932	4.993	19.688	0.000	3.784	15.556	Maximum
No 1 FWT	10%	49.932	4.993	49.932	4.993	79.326	-1.500	3.784	10.803	Maximum
No 2 FWT	10%	49.932	4.993	49.932	4.993	79.326	1.500	3.784	10.803	Maximum
TOTAL FRESH	10%	149.796	14.980	149.796	14.980	59.447	0.000	3.784	37.163	
WATER BALLAST										
WBT No1 (Damaged)	Damaged									
No 4 WBT	100%	107.295	107.295	104.678	104.678	5.439	0.000	5.489	0.000	Maximum
No 3 WBT	100%	189.972	189.972	185.338	185.338	12.067	0.000	5.056	0.000	Maximum
FPT (Damaged)	Damaged									
Heeling Port	0%	50.570	0.000	49.337	0.000	62.384	-5.422	2.050	0.000	Maximum
Heeling Starboard	15%	50.570	7.586	49.337	7.401	59.079	8.421	2.577	2.489	Maximum
No 2 WBT	100%	120.268	120.268	117.335	117.335	28.623	0.000	1.813	0.000	Maximum
TOTAL BALLAST	81.96%	516.676	425.121	506.025	414.752	15.973	0.150	4.203	2.489	
LUBRICATING OIL										
CPP&RG LO STOR	10%	14.446	1.445	16.051	1.605	56.016	3.150	1.360	4.314	Maximum
ME&AE LO STORAGE	10%	28.892	2.889	32.102	3.210	58.464	3.150	1.361	8.627	Maximum
LO RNVT'G	35%	5.540	1.939	6.156	2.155	51.618	-0.750	1.515	0.608	Maximum
LO RNVT'D	35%	5.540	1.939	6.156	2.155	51.618	0.750	1.515	0.608	Maximum
No 1 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	3.482	0.600	0.000	Maximum
No 2 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	1.449	0.600	0.000	Maximum
No 3 LO Circ	0%	6.416	0.000	7.129	0.000	44.613	-1.449	0.600	0.000	Maximum
No 4 LO Circ	10%	6.512	0.651	7.235	0.724	42.520	-5.212	0.655	1.509	Maximum
ST LO STOR	10%	4.186	0.419	4.651	0.465	23.230	-0.900	1.985	0.700	Maximum
ST LO DRAIN	10%	4.186	0.419	4.651	0.465	23.230	0.900	1.985	0.700	Maximum
Lower oil Storage & Dr Tk	10%	15.195	1.519	20.260	2.026	35.014	0.000	0.066	39.970	Maximum
TOTAL LUBE OIL	10.81%	103.745	11.220	116.649	12.804	49.052	0.914	1.244	57.035	
MISC										
GREY WATER TANK (Damaged)	Damaged									
SLUDGE TANK	70%	14.773	10.341	14.773	10.341	49.214	-2.700	0.420	31.502	Maximum
DIRTY OIL	70%	15.903	11.132	15.903	11.132	41.690	0.000	0.456	4.345	Maximum
No 1 FO DRAIN DIRTY OIL	80%	2.694	2.155	2.694	2.155	37.325	0.503	0.520	0.184	Maximum
No2 FO DRAIN CLEAN OIL	80%	2.694	2.155	2.694	2.155	37.325	-0.503	0.520	0.184	Maximum
CW DRAIN	80%	9.849	7.879	9.849	7.879	47.601	0.000	0.480	84.005	Maximum
Bilge Dirty	80%	4.842	3.873	4.842	3.873	54.009	-4.491	0.492	1.167	Maximum
Bilge Clean	80%	5.745	4.596	5.745	4.596	54.012	-2.550	0.480	1.853	Maximum
TOTAL MISC	74.57%	56.499	42.132	56.499	42.132	46.672	-1.354	0.464	123.239	
Total Loadcase			5632.602	1261.457	541.030	49.231	-0.001	8.787	372.407	
FS correction									0.066	
VCG fluid									8.853	

Εικόνα 241: Κατάσταση φόρτωσης, πληρότητα 10%



Εικόνα 242: Διάγραμμα μοχλοβραχίονα επαναφοράς, GZ.

Heel to Port deg	-30.0	-20.0	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0
GZ m	-0.718	-0.555	-0.285	-0.001	0.284	0.555	0.717	0.730	0.608	0.217	-0.402	-1.108	-1.828	-2.508	-3.087	-3.523	-3.756	-3.742	-3.418	-2.955	-1.292	0.001
Area under GZ curve from zero heel	12.1197	5.8834	1.4213	-0.0010	1.4142	5.6551	12.1374	19.4781	26.3324	30.8932	29.8908	22.3719	7.6785	-14.0522	-42.1149	-75.3045	-111.8878	-149.5987	-185.7250	-216.2844	-235.8859	-242.2708
Displacement t	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633	5633
Draft at FP m	5.678	5.683	5.587	5.490	5.582	5.676	5.677	5.408	4.900	4.462	3.896	2.283	n/a	-8.181	-7.588	-7.122	-6.976	-7.003	-7.191	-7.550	-7.734	-7.772
Draft at AP m	2.934	3.565	3.957	4.112	3.960	3.570	2.935	1.912	0.208	-2.826	-8.780	-25.968	n/a	-40.597	-23.405	-17.444	-14.316	-12.380	-11.135	-10.432	-10.270	-10.248
WL Length m	123.401	123.413	123.399	116.728	123.399	123.413	123.401	123.398	123.395	123.410	123.433	124.082	124.367	124.270	123.851	122.943	120.685	119.126	119.018	118.511	117.686	116.394
Beam max extents on WL m	18.884	19.441	19.187	18.900	19.187	19.441	18.884	18.037	16.254	14.378	13.250	13.232	12.613	12.643	13.234	14.056	15.005	16.078	17.714	20.113	19.192	18.902
Wetted Area m ²	2412.712	2389.147	2362.786	2335.239	2362.743	2388.928	2412.832	2436.847	2464.135	2472.215	2498.716	2515.671	2520.279	2516.525	2527.215	2570.294	2635.421	2728.476	2864.626	3055.689	3147.516	3149.997
Wetted Area m ²	1509.286	1543.116	1556.319	1541.352	1556.477	1543.238	1509.302	1486.711	1415.640	1248.077	1148.042	1090.196	1062.601	1064.067	1095.625	1155.836	1242.611	1349.945	1488.750	1705.140	1750.675	1730.220
Prismatic coeff (Cp)	0.589	0.551	0.534	0.558	0.534	0.551	0.589	0.584	0.588	0.591	0.592	0.590	0.591	0.593	0.597	0.602	0.612	0.616	0.613	0.609	0.609	0.610
Block coeff (Cb)	0.334	0.354	0.411	0.456	0.411	0.354	0.334	0.335	0.371	0.429	0.483	0.490	0.436	0.388	0.346	0.317	0.302	0.293	0.287	0.292	0.288	0.429
LCB from zero pt. (+ve to bow) m	49.359	49.352	49.327	49.311	49.315	49.334	49.357	49.378	49.405	49.440	49.488	49.510	49.524	49.514	49.498	49.496	49.416	49.371	49.330	49.299	49.287	49.285
LCF from zero pt. (+ve to bow) m	46.282	45.960	45.676	46.058	45.688	45.951	46.281	46.475	45.106	45.894	46.371	46.545	46.425	46.138	45.801	45.484	45.241	45.140	45.444	45.099	43.621	43.648
Max deck inclination deg	30.0224	20.0249	10.0326	0.7061	10.0323	20.0246	30.0224	40.0196	50.0175	60.0176	70.0157	80.0097	90.0000	99.9880	109.9756	119.9648	129.9573	139.9537	149.9537	159.9539	169.9193	176.7327
Trim angle (+ve by stern) deg	-1.4056	-1.0658	-0.8250	-0.7081	-0.8208	-1.0792	-1.4047	-1.7509	-2.4044	-3.7295	-6.4687	-14.1719	n/a	-15.6953	-8.0524	-5.2749	-3.7584	-2.7535	-2.0204	-1.4787	-1.2994	-1.2673

Εικόνα 243: Μοχλοβραχίονας Επαναφοράς GZ

Key point	Type	Immercion angle deg	Emergence angle deg	Freeboard at 0.0 deg m	Freeboard at 10.0 deg m	Freeboard at 20.0 deg m	Freeboard at 30.0 deg m	Freeboard at 40.0 deg m	Freeboard at 50.0 deg m	Freeboard at 60.0 deg m	Freeboard at 70.0 deg m	Freeboard at 80.0 deg m	Freeboard at 90.0 deg m	Freeboard at 100.0 deg m	Freeboard at 110.0 deg m	Freeboard at 120.0 deg m	Freeboard at 130.0 deg m	Freeboard at 140.0 deg m	Freeboard at 150.0 deg m	Freeboard at 160.0 deg m	Freeboard at 170.0 deg m	Freeboard at 180.0 deg m
Margin Line (Immersion pos = 94.208 m)		38.2	n/a	7.025	5.305	3.374	1.452	-0.311	-1.654	-3.648	-5.287	-6.767	-8.016	-8.989	-9.653	-9.998	-9.990	-9.702	-9.165	-7.798	-6.509	-5.747
Deck Edge (Immersion pos = 94.208 m)		38.5	n/a	7.101	5.378	3.442	1.513	-0.259	-1.911	-3.815	-5.295	-6.763	-8.027	-9.011	-9.698	-10.032	-10.000	-9.782	-9.098	-7.882	-6.591	-5.823
Vertical Fore PS	Δορυλλίδα	43.9	0	6.467	6.682	4.653	2.815	0.704	-1.121	-3.038	-4.930	-6.670	-8.184	-9.409	-10.313	-10.865	-11.027	-10.782	-10.021	-8.772	-7.338	-6.748
Vertical Fore SB	Δορυλλίδα	148.6	0	6.467	9.918	11.062	11.987	12.753	13.238	13.192	12.676	11.777	10.546	9.035	7.286	5.358	3.324	1.282	-0.651	-2.381	-4.063	-5.748
Vertical Mid PS	Δορυλλίδα	53	0	10.035	8.270	6.332	4.338	2.410	0.555	-1.315	-3.153	-4.891	-6.467	-7.828	-8.920	-9.703	-10.195	-10.280	-9.857	-8.917	-7.574	-6.038
Vertical Mid SB	Δορυλλίδα	148.2	0	10.035	11.550	12.794	13.780	14.548	15.019	15.034	14.582	13.692	12.400	10.753	8.800	6.607	4.281	1.873	-0.418	-2.458	-4.284	-6.038
Vertical Aft PS	Δορυλλίδα	60.6	0	10.288	8.588	6.658	5.054	3.283	1.630	0.083	-1.368	-2.938	-4.175	-5.088	-6.459	-7.314	-7.918	-8.195	-8.061	-7.401	-6.131	-4.577
Vertical Aft SB	Δορυλλίδα	158	0	10.288	11.880	13.313	14.501	15.438	16.103	16.442	16.348	15.788	14.704	13.192	11.280	9.038	6.550	3.945	1.365	-0.938	-2.650	-4.577

Εικόνα 244: Προσδιορισμός της θέσης των Key Points

ΣΧΕΔΙΟ ΔΕΞΑΜΕΝΩΝ – CAPACITY PLAN