The International Maritime Transport and Logistics Conference

"Marlog 10"

Digitalization

in Ports & Maritime Industry

10 Marlog 2021

DIGITAL METHOD FOR REFLOATING A SHIP STRANDING DURING TRANSIT SUEZ CANAL USING ITS OWN MEANS

Abd Elfattah Mohamed Swidan ,

Mohamed Walid Abd Elhamed Ahmed,

Prof.Mohamed Abass Kotb.

OBJECTIVES.

DIGITAL METHOD
FOR REFLOATING A SHIP STRANDING DURING TRANSIT SUEZ CANAL USING ITS OWN MEANS

USED COMPUTER CODE (SCERS)in POSTIVE ACTIVE MOODE

TO SIMULATE OF STRANDED SHIP

SALVAGE PLAN TO

1-REFLOATING USING OWN MEANS

2-REFLOATING USING EXTERNAL MEANS

THE CONTENTS

1-SUEZ CANAL (SC) INFFORMATION.

A- SC importance.

B-Operation in Suez Canal.

C-Effect of ACCIDENT on Convoy Sailing

2- Calculating of Ground Reaction.

3-Digital Ship Emergency Response System (ERS).

4- Case study.

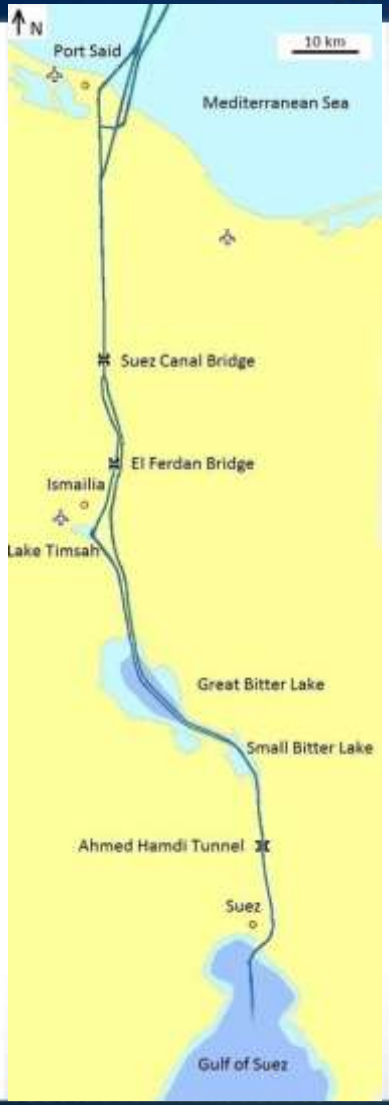
5-Conclusion

A-The Suez Canal importance

The Suez Canal considers one of the main navigation ways 12 % from international trading pass through it

B-OPERATION IN SUEZ CANAL

The new Suez Canal increased the standard ships ability from 76 to 97 can pass the canal in 24 hours , the double passes are increased in all length (50%) and also decrease the ship normally transits the canal form18 to 11 hours.
all ships transit regularly in convoy lines.



C-EFFECT OF ACCIDENT ON CONVOY SAILING:

According to Suez Canal characteristics any kind of accident (Fire-Collision /Grounding with Major leakage or spillage of oil cargo) during the Convoy sailing especially at a single lane of traffic can stop the navigation partially or completely so the time become very important factor for dealing with the accident.

3-SHIPPING ACCIDENTS in SUEZ CANAL WITH HUGE BAD IMPACT :

1- ALSAMIDOON INCIDENT.
(2004 OIL TANKER)

2- GRIGOROUSSA INCIDENT.
(2006 OIL TANKER)

3- EVER GIVEN INCIDENT.
(March 23, 2021,
Container ship)

1-SHIPPING ACCIDENTS in SUEZ CANAL:

IN 2004, THE GROUNDING CASE OIL TANKER ALSAMIDOON INCIDENT. AS A RESULT, OIL SPILL CONTAINING ABOUT **9,000** TONS OF CRUDE OIL.

2-SHIPPING ACCIDENTS in SUEZ CANAL:

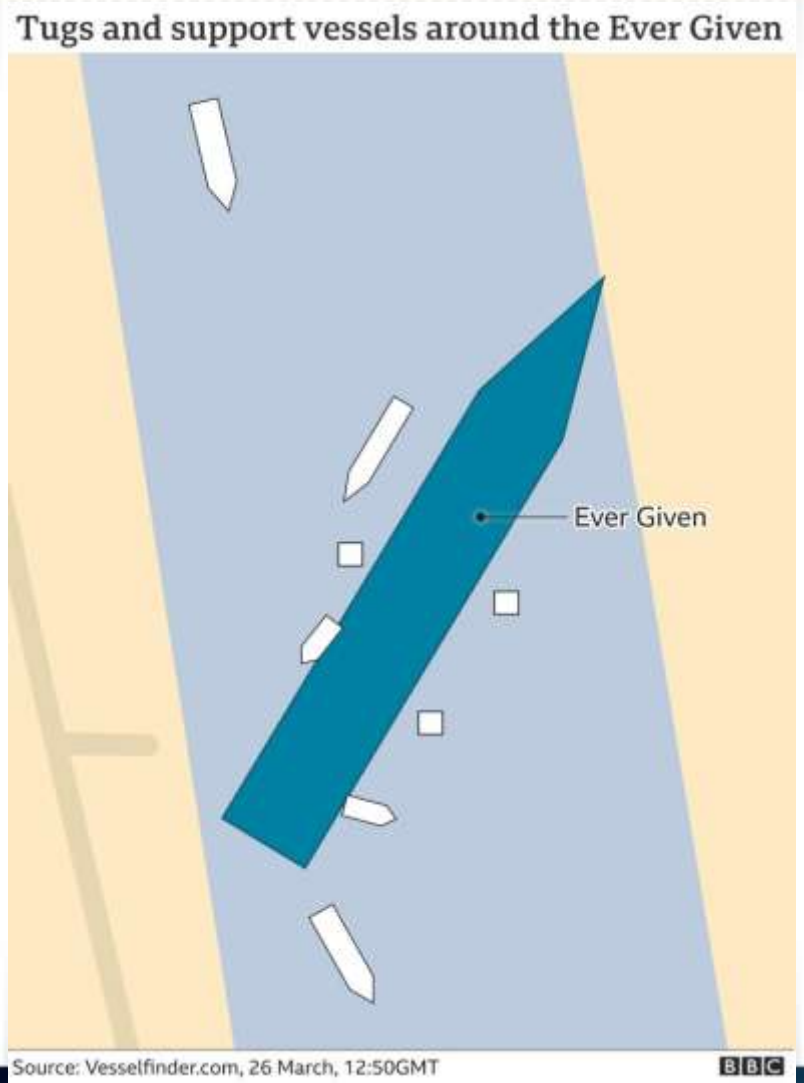
On February 26, 2006, the oil tanker "GRIGOROUSSA" ran aground at Suez Canal, leaked **2,700** tons of oil and polluted 8 miles of coastline.

3- SHIPPING ACCIDENTS in SUEZ CANAL:

March 23, 2021, the Container ship "EVER GIVEN" ran aground at Suez Canal, lodging herself against both banks of the waterway..

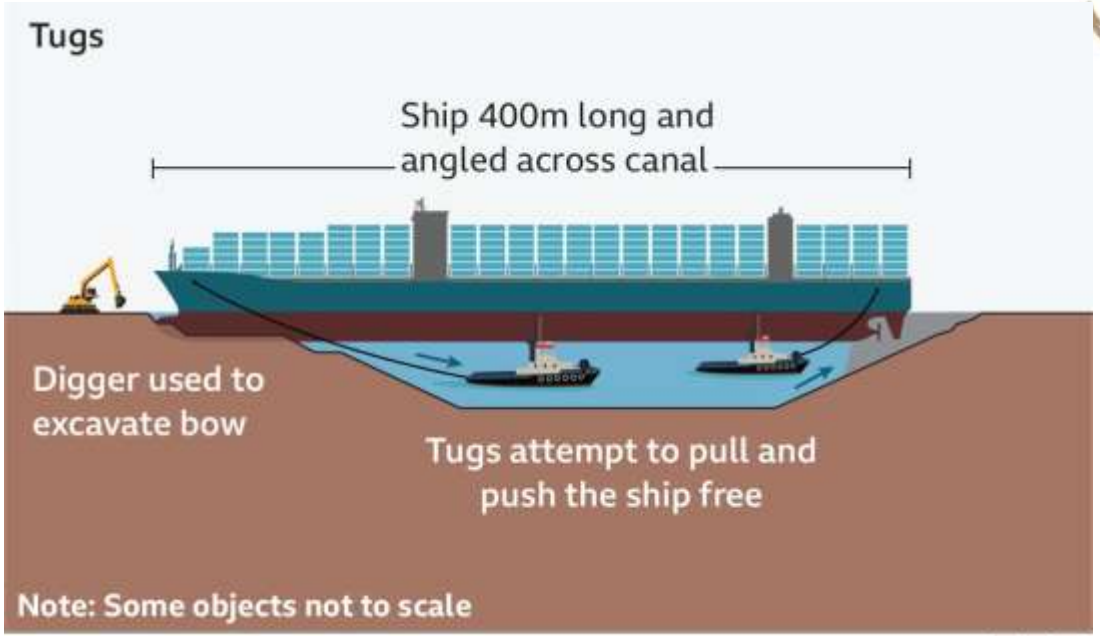
3- "EVER GIVEN" :

The period of six days, the salvage team from Suez Canal Authority (SCA) consists of more than 11 tugs and 2 dredgers cooperate with international salvage company to start salvage plan



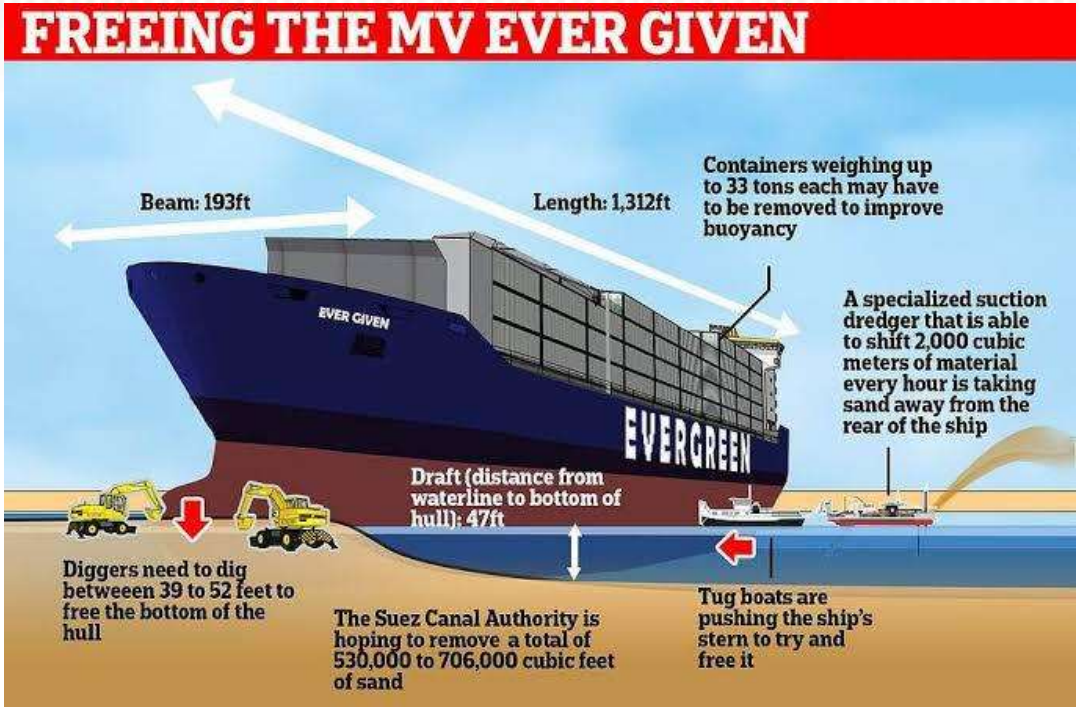
3- "EVER GIVEN" :

start salvage plan as a combined of dredging and using the tugs bollard pull to return the ship to the deep water.



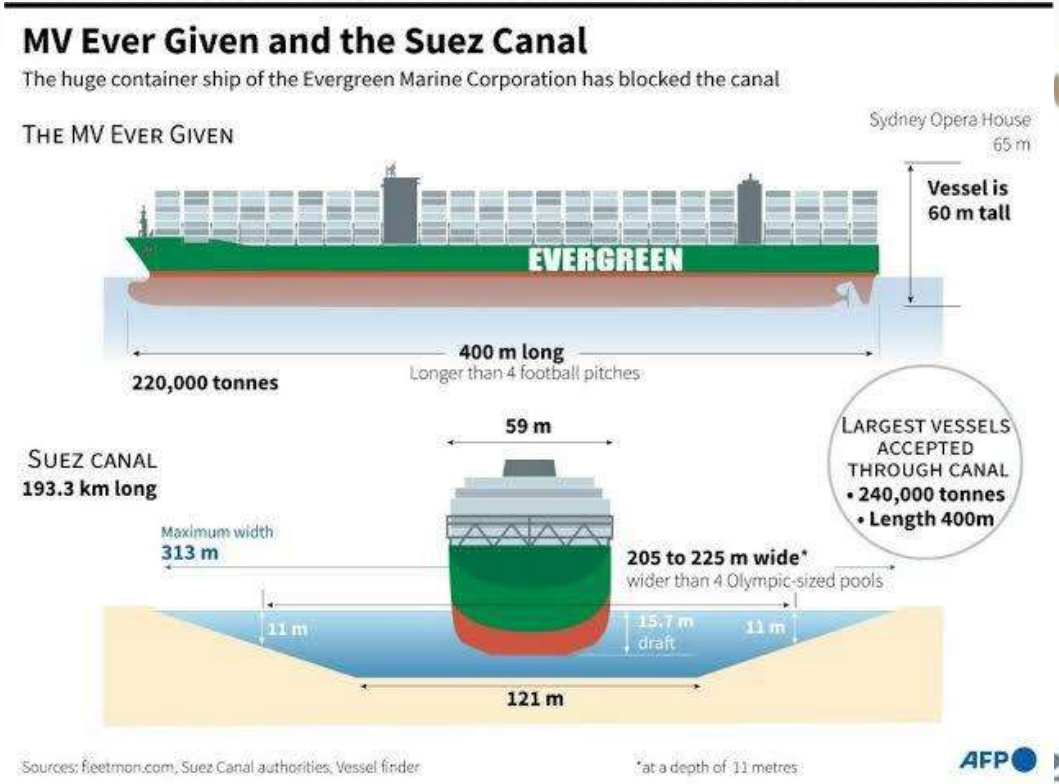
3- "EVER GIVEN" :

start salvage plan as a combined of dredging and using the tugs bollard pull to return the ship to the deep water.



3- "EVER GIVEN

Future study after SCA investigation team salvage report released for the estimated
factors caused the incident
(Bank effect, shallow water effect and squat)



2- CALCULATING OF GROUND REACTION

A. Nomenclature	
R	The ground reaction force
W_i	Total ship weight before grounding
W_a	Total ship weight. After grounding
T fa	forward Draft before grounding
T fs	forward Draft after grounding
D_f	Distance.from. the.forward perpendicular.to. the.center.of.flotation
d_r	Distance. Between. the centers .of ground reaction.and . flotation
L	Length.between perpendicular
$T_{m.bs}$	Draft at midship before grounding.
$T_{m.as}$	Draft at midship after grounding.
TPI	The mass in tons. Required for immersion 1 inch.
t	total trim in inches.

2- CALCULATING OF GROUND REACTION

A. Nomenclature	
MTI	Moment required to increase trim one inch.
LCF	The center of ship area at waterline.
dr	The Distance between centers. of ground reaction.and LCF
Dn	Distance from the LCF to the NP
Dnr	The Distance between NP and dr
B	Buoyancy
NP	The Neutral Loading Point
SCERS	Suez Canal emergency response system
VLCC	Ship type very large crude oil carrier.

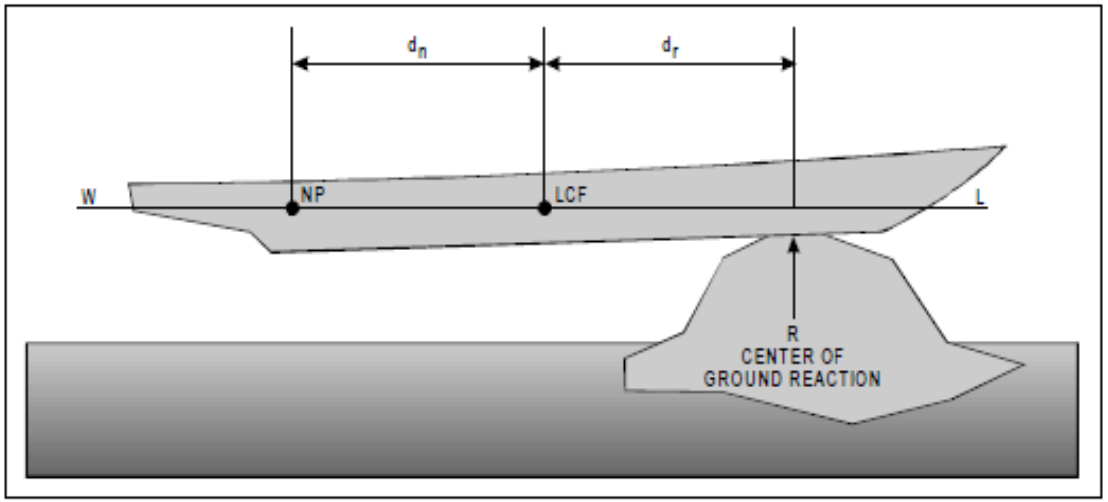
2- CALCULATING OF GROUND REACTION

No.	Method	Formula
1-	Change.of Displacement Method	$R = W_i - W_a$
2-	Change.of. Forward Draft Method	$R = \frac{(TPI)\times(MTI)\times(L)\times(Tfa-Tfs)}{(MTI\times L)+(dr\times df\times TPI)}$
3-	Tons.per.Inch.Immersion Method.	$R = (T_{m.bs} - T_{m.as}) \times TPI$
4-	The change of trim method	$R = \frac{MTI\times t}{dr}$

2- CALCULATING OF GROUND REACTION

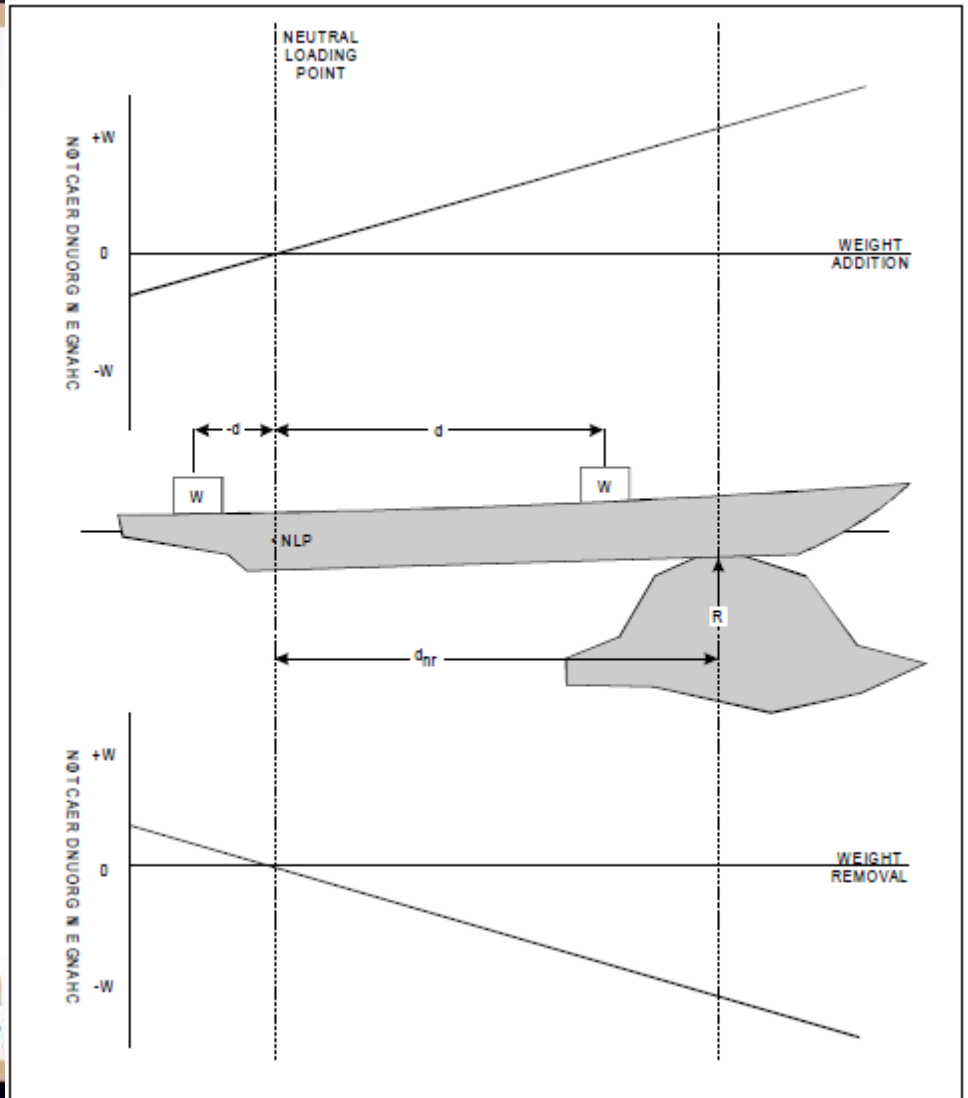
2-1.The Neutral Loading Point.

is a point in the stranded ship at which adding or removing weight without any change in the ground reaction;



2- 2.CALCULATING OF GROUND REACTION

Effects of Weight Changes on Ground Reactionis



2- CALCULATING OF GROUND REACTION

2-3 .The tug Bollard bull

The tug Bollard bull (F) is the puling force needed to free the ship from shallow water

$$F = 1.12 \times \mu \times R$$

(μ): coefficient of friction

(R): ground reaction

3- DIGITAL SHIP EMERGENCY RESPONSE SYSTEM (ERS)

A. ERS OVERVIEW. (activate after stranding)

After the "Exxon Valdez" accident a service like ERS became mandatory for oil tankers sailing in US waters.

ERS ensures compliance with mandatory requirement of MARPOL Annex I, Ch.5, Reg.37(4), requiring "prompt access to shore-based damage stability and residual structural strength calculation programs".OPA'90

3- DIGITAL SHIP EMERGENCY RESPONSE SYSTEM (ERS)

B. ERS OPERATION.

1-data base contain electronic ship model.

2- 24 hours a day, 7 days a week.

3- After stranding ship master send data sheet contain ship loading case before and after stranding.

4- ERS simulate the grounding case and send advice to the ship master to safe the vessel and start salvage plan.

3- DIGITAL SHIP EMERGENCY RESPONSE SYSTEM

c. ERS introduced by :.

1-classification societies:(Example)

-DNVGL (ERS)have over 3,700 vessels enrolled in the service

- ABS (RRDA) - BV (ERS)

2- International salvage co. :(Example)

-Smit salvage -TITAN - Svitzer

D. Software Tools : -HECSALV. -GHS - NABA

ABS Rapid Response Damage Assessment

4- CASE STUDY

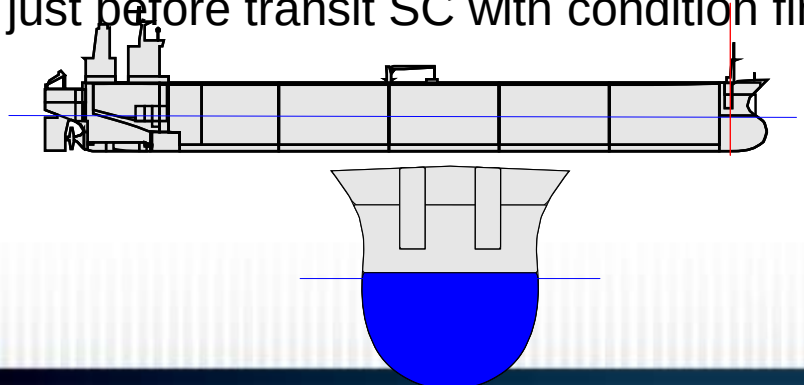
REFLOATING VLCC Stranding during transit Suze Canal with its own means

Assumption that;

1-Suez Canal (SC) using Emergency Response system (ERS) and already have prepared model for all tanker transit SC using HECSALV commercial software.

2- SC using ERS in the active mood by enter the actual loading condition for the tanker before enter SC using HECSALV model. (Tidal and current positive or negative effect are not considered in this case study)

3- SC using ERS in the active Positive Action mood for tanker by ballast fore peak water ballast tank just before transit SC with condition final trim aft .



4- CASE STUDY

Ship particular

LOA	m	333.227	LBP	m	318.000
Depth	m	31.250	Beam	m	58.000

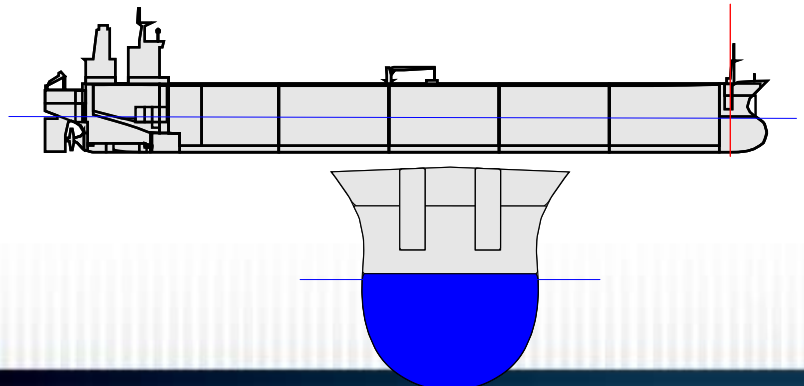
Initial Loading case before stranding

TFP 16.012m TAP 16.795m Light ship 40,853tons

Displacement 245,383 tons Cargo Oil 194,577 tons

fore peak tank (4,855tons, LCG 152.867 f M.S.)

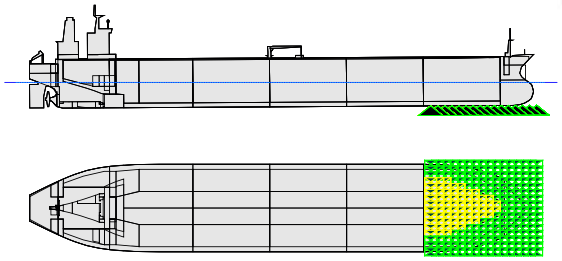
TPC 165.2 Ton MMIC 3500 t .m LCF 6.293 m M.S.



4- CASE STUDY

Case 1 Stranding as typical SC Stranding case (stranding fore part at side bank)

Summary	Value
T M.S before Stranding	16.403m
T M.S after Stranding	16.179m
Total reaction (R)	3699 MT
LCR	48.7A m.FP
TCR	0.47S m.CL
Force to free	5,549 MT
Friction Coeff.	1.5



In this case deballast fore peak tank is enough to refloat the ship with condition:

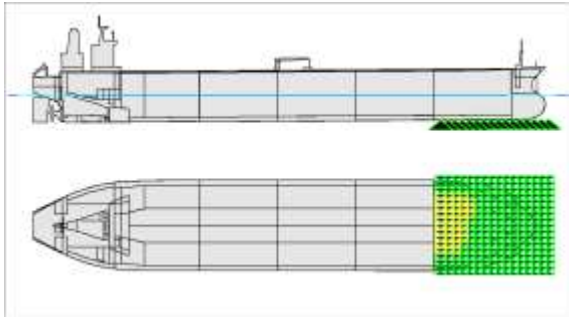
TFP 14.728 m TAP 17.557 m Trim 2.828 m

Shear force (SF) 31% Bending Moment (BM) 38% GMt 10.182 m

4- CASE STUDY

Case 2 Stranding as typical SC Stranding case (stranding fore part at side bank)

Summary	Value
T M.S before Stranding	16.406m
T M.S after Stranding	16.101m
Total reaction (R)	5136 MT
LCR	56.67A m.FP
TCR	2.95P m.CL
Force to free	7,704 MT
Friction Coeff.	1.5



In this case debalast fore peak tank is enough to refloat the ship.

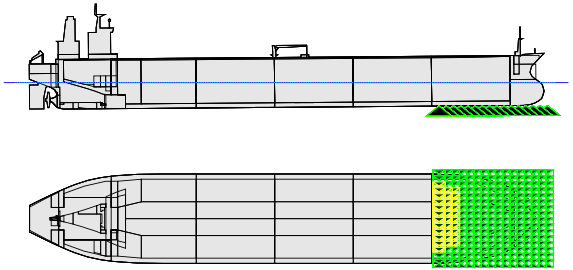
TFP 14.728 m TAP 17.557 m Trim 2.828 m

Shear force (SF) 31% Bending Moment (BM) 38% GMt 10.182 m

4- CASE STUDY

Case 3 Stranding as typical SC Stranding case (stranding fore part at side bank)

Summary	Value
T M.S before Stranding	16.406m
T M.S after Stranding	16.044m
Total reaction (R)	6506 MT
LCR	56.950 m.FP
TCR	0.264S m.CL
Force to free	9,759 MT
Friction Coeff.	1.5



Step 1: DE ballast fore peak tank reduce ground reaction from (6506) MT to (343) MT (trial by using main engine power at Astern dead slow speed to free from the ground)

Step 2 : Ballast aft peak tank 50% (1033) MT the ship is free floating wih final drafts:

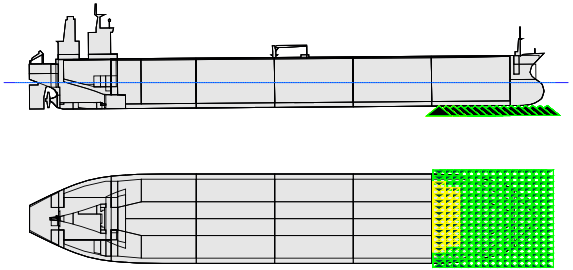
TFP 14.570 m TAP 17.852 m Trim 3.282 m

SF 32% BM 48% GMt 12.183 m

4- CASE STUDY

Case 4 Stranding as typical SC Stranding case (stranding fore part at side bank)

Summary	Value
T M.S before Stranding	16.406m
T M.S after Stranding	15.818m
Total reaction (R)	10,569 MT
LCR	58.026 m.FP
TCR	4.393P m.CL
Force to free	15,854 MT
Friction Coeff.	1.5

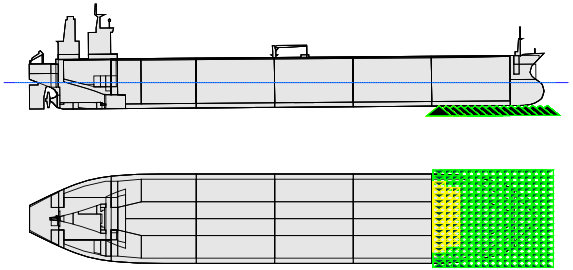


Step 1: DE ballast fore peak tank reduces ground reaction from (10,569) MT to (4,423) MT
Step 2: Ballast aft peak tank 100% (2066) MT reduce ground reaction from (4,423) MT to (3,475) MT.
Step 3: Transfer cargo oil from NO 1 COC tank (4880) MT LCG (118.723 F m-M. S) to slope tank P& slope tank SB each (2440) MT LCG (100.288 A m-M. S). Reducing ground reaction from (3,475) MT to (68) MT. (trial by using main engine power at Astern dead slow speed to free from the ground)

4- CASE STUDY

Case 4 Stranding as typical SC Stranding case (stranding fore part at side bank)

Summary	Value
T M.S before Stranding	16.406m
T M.S after Stranding	15.818m
Total reaction (R)	10,569 MT
LCR	58.026 m.FP
TCR	4.393P m.CL
Force to free	15,854 MT
Friction Coeff.	1.5



TFP 12.998 m TAP 19.614 m Trim 6.615 m
SF 29% BM 53% GMt 11.9 m

Step 4: Ballast NO.5 WBT P&SB tank (2100) MT each with total amount (2100) MT to free the ship from grounding with final:

TFP 12.998 m TAP 19.614 m Trim 6.615 m
SF 29% BM 53% GMt 11.9 m

5.CONCLUSION

Predict a system for emergency response in Suez Canal become A necessary step to keep the safe navigation all the time against unexpected action. Enable Suez Canal authority from containment of any kind of crisis in a shortest period. SCERS work in operational positive active mode with proactive action through the following steps:

1- Data base consists of digital model for all Ships transit SC approved from classification societies linked with shore-based damage stability and residual structural strength calculation programs with operational team work around the clock (HECSALV program Software Tools was an example in case study).

5. CONCLUSION

2- SCERS in the active mood by enter the actual loading condition for all ships before enter SC and define the ship position during transit SC to enable the SCERS team to identify the type of seafloor and values of current, wind, tide according to the ship position.

3- SCERS in the positive active mood with proactive step by ballasting fore peak tank before transit SC with always trim aft this technic in the typical Suez Canal stranding case with the fore part stranded on the side bank when de-ballasting 1000 ton from fore peak tank after stranding for example that equivalent to use tug with bollard pull 1500 ton in case rock seafloor or 330 ton in case of clay seafloor ready to use without losses.

5. CONCLUSION

4-In case of bad impact action act to stop the navigation in SC in both side due to terrorist operation or huge impact stranding ship as the case of EVER GIVEN stranding which stop the navigation for 6 days at 23, march,2021 and the situation is needed to share with international salvage companies or others partner SCERS enable to share the information and start accurate salvage plan to return the navigation in SC in shortest period.

Thank you For Your Attention