



**REPUBLIC OF TURKEY**  
**MINISTRY OF TRANSPORT AND INFRASTRUCTURE**  
**Accident Investigation Board**

**Accident Investigation Report On**  
**The Foundering of TINAZTEPE S**

**Bay of Sirte / Libya**  
**16<sup>th</sup> of March 2017**

**04/DNZ-01/2018**

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This report is prepared by the Accident Investigation Board.

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## **PURPOSE**

This marine accident was investigated in accordance with the Bylaw on the Investigation of Marine Accidents and Incidents which came into force after being published at the Official Gazette No.29056 on 10th July 2014.

Investigation procedures and principles are further applied by considering Resolutions of International Maritime Organization concerning International Standards and Recommended Applications for Safety Investigations Directed to MSC 255(84) (Accident Investigation Code) and Resolution A.1075(28) Sea Accidents or Incidents, and European Union Directive 2009/18/EC.

Marine accident investigation shall be inadmissible in any judicial and administrative proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame.

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## **ABBREVIATIONS**

*GMT* : *Greenwich Mean Time*

*MT* : *Metric Ton*

*VHF* : *Very High Frequency*

*DSC* : *Digital Selective Call*

*STCW Code* : *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*

*BLU Code* : *Code of Practice for the Safe Loading and Unloading of Bulk Carriers*

*IMO* : *International Maritime Organization*

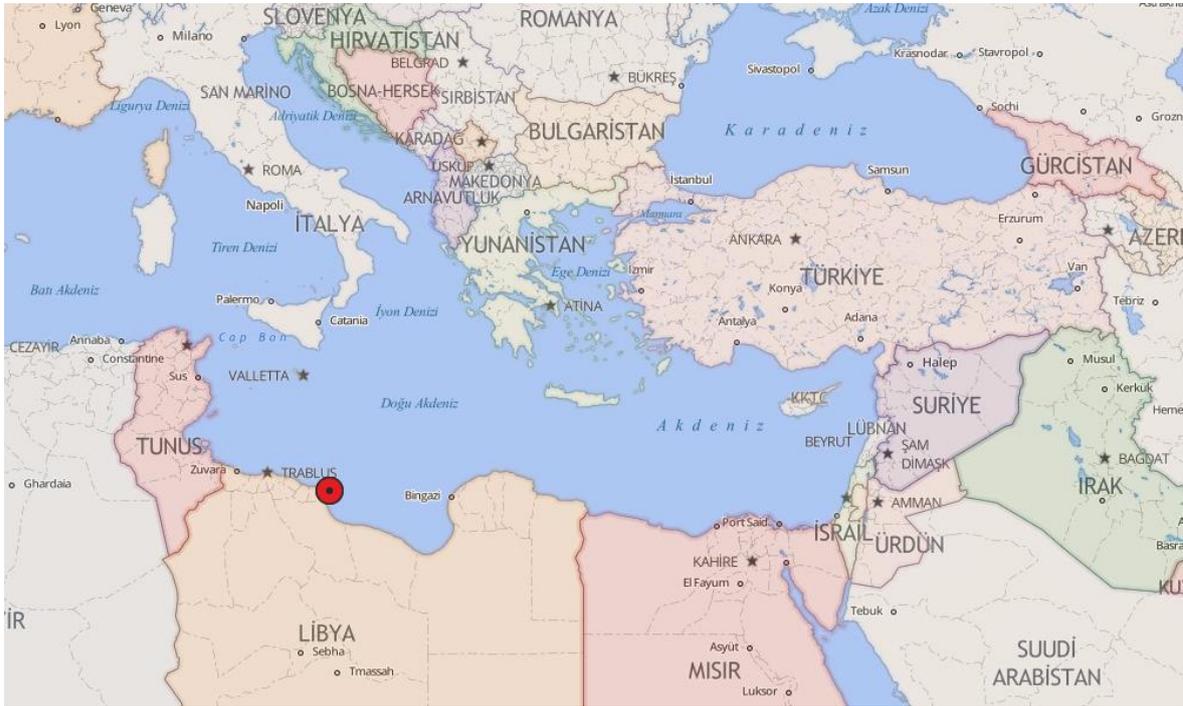
*IMSBC Code* : *International Maritime Solid Bulk Cargoes Code*

*VTS* : *Vessel Traffic Services*

*ISM Code* : *International Safety Management Code*

*SAR* : *Search And Rescue*

## SUMMARY



**Figure 1:** Location of the Accident

Note: All times used in this report are local (GMT +2).

General cargo ship TINAZTEPE S, while carrying 3120 MT Dolomite<sup>1</sup> that was loaded at ERS pier on Marmara Island and waiting for order to come alongside to port on Misurata port anchorage area, with the effect of heavy seas prevailing in the region, foundered by broken from the mastory on 16<sup>th</sup> of March 2017 at 11.40.

As a result of the accident investigation it was assessed that; ERS pier, where the dolomite loading operation to ship was carried out, was not in compliance with the revised By-law on Ports, loading operation had deficiencies according to the By-law on Safe Loading and Unloading of Bulk Carriers, emergency drills and inspection of lifesaving appliances, that are required according to the International Safety Management policies was not carried out effectively and the ship, which is considered as completed her economic life and was loaded unsafely, foundered as a result of staying at anchor at heavy sea conditions and experiencing hard oscillations and failure of her structural integrity from a point close to her mastory.

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<sup>1</sup> See page 9

## **SECTION 1 – FINDINGS**

### **1.1 Factual Information**

Name of the Ship	: TINAZTEPE S
Flag	: Turkish
Classification Society	: Bulgarian Register of Shipping
IMO Number	: 7505798
Type of Ship	: General Cargo Ship
Owner	: Batu Shipping Ltd. Co.
Manager	: Batu Shipping Ltd. Co.
Place and Year of Build	: İzmir/Turkey – 19 <sup>th</sup> of September 1979
Gross Tonnage	: 1900
Length over all (LOA)	: 80,15 meters
Main Engine	: SKODA –1244 Kw (1670 bhp)
Last Port of Call	: Marmara Island/Turkey
Next Port of Call	: Misurata/Libya
Carfo Information	: 3120 MT Dolomite (Mosaic Marble)
Number of Crew	: 13
Type of Navigation	: Restricted Voyage
Date and Time of Accident	: 16 <sup>th</sup> of March 2017 / 11:40
Type of Accident	: Very serious marine accident

Place of the Accident : 2 miles off the Misurata Port / Libya

Casualties : 5 dead, 1 missing

Damage : Total Loss

Pollution : Not reported



*Figure 2: TINAZTEPE S*

## **1.2 Environmental Conditions**

According to the data received from the Turkish Meteorological Service, on the day that accident happened, weather and sea state at Gulf of Libya/Sirte and Gabes<sup>2</sup> region was stated as; weather as showers, wind from north-northeast with a beaufort scale of 5-7, up to 8 (gale), estimated wave height to be 2-4 meters, up to reach 5 meters, visibility to decrease from 10 km to 1-3 km in case of rain.

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<sup>2</sup> Weather forecast region including the accident scene

## METU3 - Rüzgar Yön ve Hızı | Batı Akdeniz

Deniz

Tüm Denizler | **Batı Akdeniz** | Doğu Akdeniz | Hazar Denizi

Hareket Kontrolü

Başlat - Durdur << Önceki Sonraki >> Hız: 1 2 3 4 5 **1/24**



### WMEDIT

10m Wind (knot) Run: 16.03.2017 12:00GMT (T+3) Valid: 16.03.2017 15:00GMT (Thursday)

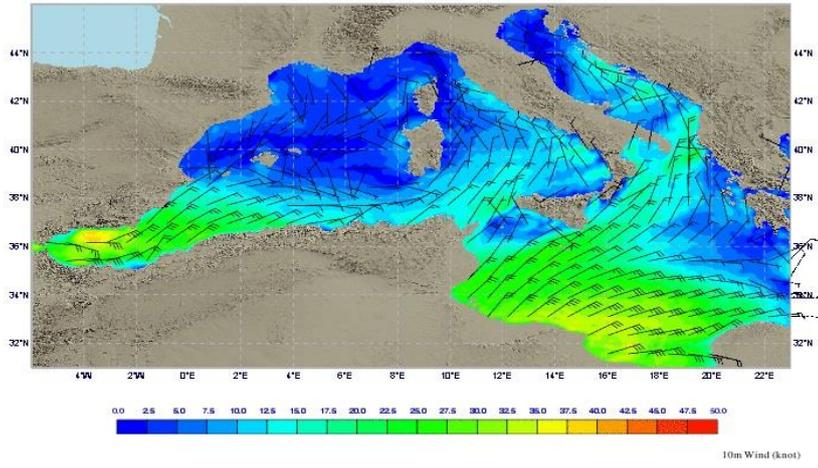


Figure 3: Wind Model Derived for the Accident Day

## METU3 - Dalga Yüksekliği | Batı Akdeniz

Deniz

Tüm Denizler | **Batı Akdeniz** | Doğu Akdeniz | Hazar Denizi

Hareket Kontrolü

Başlat - Durdur << Önceki Sonraki >> Hız: 1 2 3 4 5 **1/24**



### WMEDIT

Wave Height (meter) Run: 17.03.2017 00:00GMT (T+3) Valid: 17.03.2017 03:00GMT (Friday)

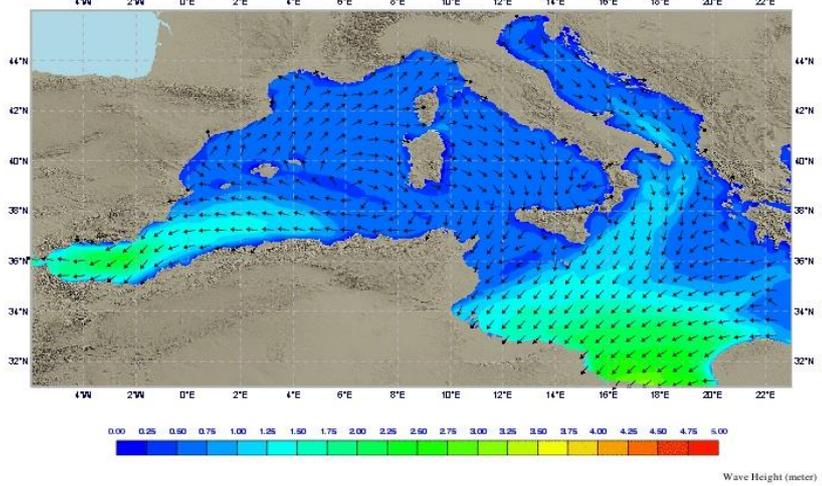


Figure 4: Wave Model Derived for the Accident Day

Wind and wave models derived from the internet site of Turkish Meteorological Service for the day that incident happened is shown on Figure 3 and 4. As it is seen from the figures, on 16<sup>th</sup> of March 2017, on accident scene within the Gulf of Sidra, wind was blowing as 30 knots and above and the wave height was 2 meters and above.

### **1.3 Sequence of the Events**

TINAZTEPE S, after unloading gypsum at Canakkale Akcansa port which it loaded from Crete Island, berthed to ERS port which was inside Marmara Island, Gulf of Badalan in order to load mosaic marble also known as dolomite on 6<sup>th</sup> of March 2017. After loading 3120 MT dolomite, the ship left the port on 8<sup>th</sup> of March 2017 and started navigation towards Misurata port of Libya as unloading port. Meanwhile, Master re-assigned at the loading port.

During the email correspondences between the management company of the ship and Misurata agent, it was asked whether the ship could able to berth as the ship would arrive on 15<sup>th</sup> of March 2017 at late hours and on 16<sup>th</sup> of March 2017 the weather would get worse. The agent replied that the ship could berth on 18<sup>th</sup> of March 2017 as the set loading commencement, in case of early berthing they would be obliged to pay 3000 USD per day. TINAZTEPE S arrived to Misurata port on 16<sup>th</sup> of March 2017 and anchored on 08:30 by dropping 7 shackles. Although the ship requested to berth from port authority several times because of difficulty to stay on anchor as a result of severe weather, it could not receive a positive response. Afterwards, the master heaved up the anchor by his own initiative and ordered the crew to berth the port. Meanwhile the ship was broken by sagging from the mastory with the effect of heavy waves. (*Figure 5*)



*Figure 5: Snapshot of the Moment of the Ship While Broken*

#### **1.4 Events Aftermath of the Accident and Search and Rescue Operations**

Master and deck cadet were on the bridge during the accident. After the ship was broken, the master was in repose for a while and deck cadet pushed the general alarm button and ordered to abandon ship. Additionally, he made distress call from the VHF Channel 16 and used the DSC Distress button. Afterwards when observing that the windlass was breaking apart from its' position, he took a life vest and left the bridge to reach muster station. It was learned that the master stood still and did not leave his place.

Other crewmembers, following the alarm that they heard at various compartments of the ship, proceeded towards muster station by taking their life vests. Crewmembers, who gathered at the muster station, got ready to abandon the ship by fulfilling their duties properly for abandoning the ship. Meanwhile, it was observed that Chief Engineer did not arrive to muster station. While the crewmembers were trying to lower the life raft to abandon the ship, the ship listed with a sudden noise and the crewmembers hastily abandoned the ship. It was observed that Chief Mate held the guard rails tightly without moving and stood in repose. After the crewmembers abandoned the ship sporadically, one of the crewmember cut the line that bind the life raft to ship. The ship foundered

approximately 2 nautical miles off the Misurata port around 11.50 after a short while following the crew abandoning the ship. (**Figure 6 - 7**)



*Figure 6: Snapshot of the Sinking After the Ship Broken*



*Figure 7: Position Where the Ship Foundered*

Agent of the ship communicated with the company and informed them that the ship had foundered and rescue assistance had started. Meanwhile, among the crew that abandoned the ship, 2<sup>nd</sup> Engineer, deck cadet and steward reached the life raft and climbed, other crew continued to swim sporadically and tried to move away from the ship.

Although the crew on the life raft reflected their positions by using flare and smoke signal, they swam approximately for 3 hours and afterwards a military boat came alongside and rescued the casualties. Among the other crew who were in the sea, three of them were recovered alive by a tug within 3 hours. The Fitter succeeded to swim up to coast with the effect of waves and was rescued by the locals. All the rescued crewmembers were transferred to hospital and kept under observation.

Chief mate, who had succeeded to abandon the ship before it foundered, two oiler and chief cook's dead bodies were found in the following hours. Assistance was taken from the rescued other crew for the identification of the casualties who lost their lives. Search&Rescue efforts were commenced for the master and chief engineer, whom thought not to be able to abandon the ship after the accident, by the diver at the region where the ship foundered. The chief engineer's dead body was found in the engine room, but the master could not be found despite all the efforts.

As a result of the accident, from among 13 crew, 7 of them as alive and 5 of them as dead were recovered but the master could not be found. Crew rescued as alive returned to Turkey next day.

### **1.5 Key Crew and Manning of the Ship**

It was observed that TINAZTEPE S was manned with adequate personnel according to Minimum Safe Manning Certificate (**Annex-1**). There were 13 crewmember onboard including master on the day that accident happened. Competency of the crew were in compliance with the mentioned voyage region and tonnage class of the ship.

The master of the ship is 67 years old. He has a certificate of competency as master on ships below 3000 gross tonnage navigating in all waters. It was observed that he had all the certificates required according to the STCW Code and the certificates were valid. The master attended TINAZTEPE S at the last port of loading on 6<sup>th</sup> of March 2017. He did not

work onboard TINAZTEPE S before and it was determined that he has been onboard for 10 days. Total service time of the master could not be learned as there could not be an opportunity for an interview.

Radio officer of the ship is 24 years old. He had the General Operator Certificate (GOC) required according to STCW Section A-IV/2 and he has been working as a radio officer onboard the ship. Additionally he is the deck cadet. It was observed that he had all the certificates required according to the STCW Code and the certificates were valid. He joined the ship on 6<sup>th</sup> of March 2017 and he had 10 days of service onboard. He had total 15 months of sea service. He was with the master on the bridge at the time of the accident. He has been communicating with the port control and the company with the order of the master.

### **1.6 More Info Related to The Ship and The Cargo**

Dolomite, which was loaded to TINAZTEPE S at Marmara island, can be defined as the mineral generated as a result of calcium (Ca) being together with magnesium (Mg) inside the limestone. Specific weights of these rocks differ depending on their Mg ratio. Especially in Turkey, iron and steel industry comes at the forefront of the sectors that dolomite rocks are used. Additionally they are used at so many different fields such as ceramic, paint, fertilizer, glass, cement, brick and construction industry and soil reclamation in agriculture.



*Figure 8: Dolomite*

The question of what is dolomite and the classification of these rocks are determined according to their physical and chemical properties and it spreads to 30 different fields. Because of its physical properties it is used mostly for making cement and road construction. For its chemical properties, it is used heavily on fertilizer production. Dolomite, which can also be used in brick, cement, glass, soda industry forms as the most important component of paint in chemistry industry. Dolomite is a material that has a specific weight of between 0.56 and 0.65 meters cube/ton and its angle of repose while loading changes between 35 and 40 degrees.<sup>3</sup>



**Figure 9:** A View of Dolomite Rock from the Port Cargo Handling Area

TINAZTEPE-S is navigating within near coastal voyage region according to the Certificate of Seaworthiness issued by Harbour Master of Istanbul on 5<sup>th</sup> of June 2015. Meetings were done regarding a need for an extensive repair as a result of intermediate survey carried out by Turkish Lloyd. Upon the manager of the ship stated that because of the conditions surrounding them, a such repair would not be possible for them, Turkish Lloyd suspended the ships' class status. Last underwater and sea survey was carried out on 22<sup>nd</sup> of May 2015 and shaft survey on 4<sup>th</sup> of April 2013. The ship was classed by Bulgarian Register until the day of the accident. As a result of inspections carried out by classification society surveyor, on 20<sup>th</sup> of February 2016, it was noted that during the first docking that the intermediate survey would be carried out, time was given for the periodic bottom survey.

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<sup>3</sup> Thomas' Stowage see: Dolomite

## SECTION 2 - ANALYSIS

### 2.1 Loading

#### 2.1.1 Port of Loading

TINAZTEPE S berthed to ERS pier on Marmara Island, Badalan Bay for the loading of dolomite (**Figure 10**). There are 3 piers in the region including ERS pier. These piers are also used for dolomite loading like ERS pier.



**Figure 10:** A View of Badalan Bay and the Piers

ERS pier and the other two piers' operation permits expired and were not renewed. The reason for the piers' operation permits not being renewed was non conformity with the safe loading operations and revised legislation of pier structures. It is stipulated on By-law on Ports which was published on 8<sup>th</sup> of April 2017, Article 20, first paragraph and subparagraph (ğ) that: *“Wharf or pier length shall be at least 10% longer than the ship and sea craft that will berth coastal facility for loading/unloading. Water depth at these facilities shall be at least 0,5 meters more than the loaded draft of the ships that will berth. Ships that are not complying with the length and other conditions, can berth according to harbour master's written approval. Ships which will berth these facilities, shall be in compliance with additional measures that will be determined by the harbour master, such as not creating an obstacle to maritime traffic and maneuver and permitting safe mooring*

*and safe entry and exit.*” Taking into account that, operation permits will be cancelled if not renewed in 1 year according to the provision above, operation permits was extended of ERS pier until 12<sup>th</sup> of June 2018 and of TUNA Mining pier until 26<sup>th</sup> of May 2018 temporarily.

### **2.1.2 Safe Loading Operations**

The master of the ship is responsible for safe loading and unloading of the bulk carrier under his command. Terminal representative is dutied and responsible for reporting the deficiencies that may jeopardise safe loading and unloading of the solid bulk cargoes that are detected on the bu carrier without delay to master and to the administration.

By-law on Safe Loading and Unloading of Bulk Carriers Article 10, titled as cooperation between bulk carriers and terminals stipulates that:

*“a) Master and terminal representative, prior to loading or unloading of solid bulk cargoes, shall agree on loading or unloading plan according to the provisions of SOLAS 2018 Consolidated Edition Chapter VI Regulation 7.3. Loading or unloading plan shall be prepared in compliance with the BLU Code (Code of Practice for the Safe Loading and Unloading of Bulk Carriers) Appendix 2 and contains the IMO number of the related bulk carrier. The master and the terminal representative confirms the agreed plan by signing...*

*b) Before starting loading or unloading, ship/shore safety checklist shall be filled by the master and the terminal representative jointly and signed according to the provisions of BLU Code Appendix 4.*

*e) On completion of loading or unloading, the master and the terminal representative, shall agree in writing that the ship has been loaded or unloaded in accordance with the loading or unloading plan, including any agreed variations...”*

When loading operation is assessed in the context of mentioned provisions, the following findings has been reached:

- Loading plan was not prepared and not signed according to BLU Code Appendix 2 as mentioned in paragraph a above. (*Annex - 2*)
- Necessary safety checklist according to paragraph b above, was not prepared prior to loading.
- Necessary certificate of completion was not issued according to paragraph c above after the completion of loading.

Again it is stipulated on the same by-law under article 6, titled provisions of suitability of terminals that;

*“Terminal operators shall abide the provisions below with regard to the terminals operated by themselves.*

*a) Complies with the provisions regarding Operational Suitability for Solid Bulk Cargo Loading and Unloading of Terminals as mentioned in Annex 2.”*

In Annex 2, Article 4 it is stipulated that;

*“Terminal personnel having a duty on loading and unloading operations shall be equipped with personal protective equipment”*

And when taking this provision into account, it was detected that terminal personnel who was on duty at loading operation at the terminal was not equipped with appropriate personal protective equipment (*Figure 11*).



*Figure 11: Terminal Personnel Having a Duty on Loading Operation*

## **2.2 Internal and External Forces Affecting to the Ship**

The most significant forces affecting the ship are the forces originating from the difference between ships own weight distribution and the buoyancy forces. As the merchant ships navigate with varying hold loads and distribution of buoyancy force will change for every draft and trim conditions, shear forces and bending moments originating from distribution of two forces will also be varied as well.

### **2.2.1 Effect of the Loading Operations**

Bulk cargoes are loaded fastly with regard to operation and this process frequently creates stress on ships' hull structure. Additionally, structural deformations can happen on paint and steel plates inside the hold while loading. International Maritime Solid Bulk Cargoes (IMSBC) Code, under Section 2 General loading, carriage and unloading precaution it is stipulated that;

*“2.1.2 ...When loading a high-density solid bulk cargo, particular attention shall be paid to the distribution of weights to avoid excessive stresses, taking into account that the loading conditions may be different from those found normally and that improper distribution of such cargo may be capable of stressing either the structure under the load or the entire hull... .”*

and according to this provision, the master must take into account before every loading and special precautions must be taken for every cargo hold that, especially while free fall of cargo from height, impact forces can occur on hold's specific points and this condition can rise the stresses on the ships' hull structure.

It is assessed from casualties' statements that, the cargo was loaded by lifting the truck dumper suddenly instead of loading with a conveyor extending over a period of time in order to speed up the loading but the master and the terminal representative did not take any measure against this situation. It is assessed that this kind of loading can result in stress and fatigue over the ships' structure and can increase the effects of possible external forces while navigating.



**Figure 12: Cargo Dispersion in Another Ships' Hold While Loading 2.2.2 Effect of Trimming (Cargo Dispersion)**

There is a fixed conveyor at ERS Pier and the cargo is loaded to ship with this conveyor (*Figure 13-14*). Under IMSBC Code Section 5 Trimming<sup>4</sup> procedures it is stipulated that;

*“5.1.2 ...Due consideration shall be given to the amount of a solid bulk cargo in each cargo space, taking into account the possibility of shifting and longitudinal moments and forces of the ship. Cargo shall be spread as widely as practicable to the boundary of the cargo space...”*

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<sup>4</sup> Process of dispersing the cargo homogenously inside the holds



**Figure 13:** Fixed Conveyor at ERS Pier



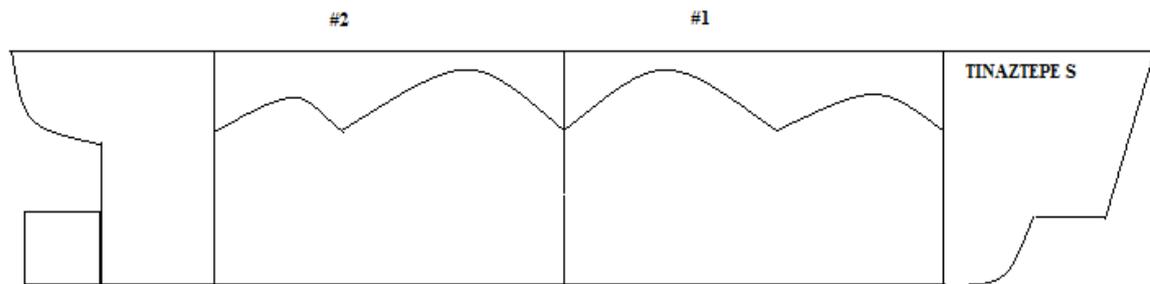
**Figure 14:** A Snapshot of Loading With a Fixed Conveyor

The status of conveyor as being fixed creates the risk of cargo not being dispersed homogenously inside the holds. It is known that when the cargo is not dispersed homogenously inside the hold, this will create non-uniform effects on longitudinal forces affecting on ship while enroute. In order to prevent this situation, the masters must act

according to the provision of IMSBC Code Section 5 Trimming Procedures which reads as follows:

*“5.1.3 The master has the right to require that the cargo be trimmed level, where there is any concern regarding stability based upon the information available, taking into account the characteristics of the ship and the intended voyage.”*

As a result of the statements received from the witnesses it was determined that, the cargo was dispersed nonuniformly towards completion of the loading of TINAZTEPE S (**Figure 15**) and the master did not request the cargo to be dispersed inside the hold in the context of above mentioned provision from the terminal representative. Terminal representative stated that they had dispersed the cargo via the shore winch shown in **Figure 16** after the loading operation.



**Figure 15:** An Illustration of Cargo Dispersion Inside the Holds Post-Loading



**Figure 16:** *Shore Winch Used for Trimming Operations*

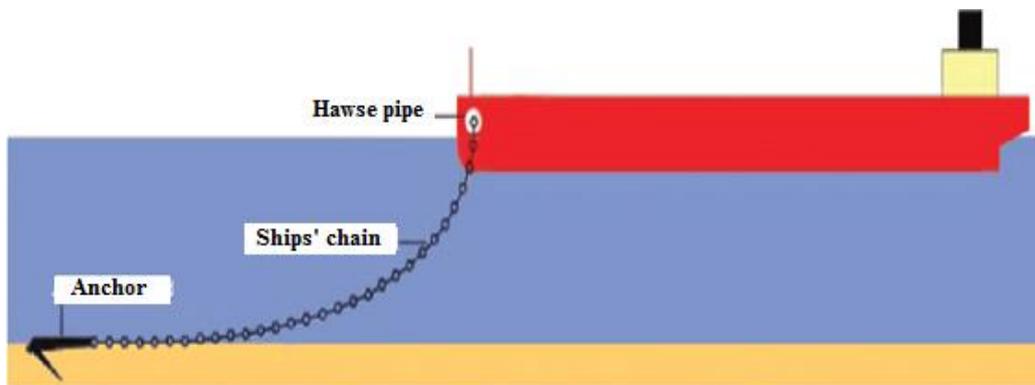
Assuming that cargo distribution inside the holds of TINAZTEPE S is at the condition observed in **Figure 15**, as a result of ships' hull form to be regenerated according to the new software used by Turkish Lloyd and taking the allowable maximum longitudinal strength values from the "Bulk Cargo Loading Booklet", it was observed that inside hold number 1 between frame number 68 and 111, 1300 tons of dolomite and inside hold number 2 between frame number 23 and 68, 1820 tons of dolomite was loaded and under these loading conditions, the ship was inside the limits of allowable shearing force and bending moments. (*Annex-3*)

However it is assessed that, the cargo was dispersed near midship section and when taking into account the condition and age of the ship, the weather conditions forced the ship to experience structural stresses and created additional stresses on ships' structural integrity and consequently ship was deformed close to the midship section and was broken.

### 2.2.3 Effect of Anchoring at Heavy Sea State

When anchoring approach is planned, the master should consult the maps and reference books in the following subjects; appropriateness of the anchoring ground, maritime traffic density and ship motions, current oscillation area, characteristics of foothold ground, protection from weather conditions, wind, tide and the length of the period that the ship will stay on anchor.

The master should not accept immediately the fact that the “authorities” directed the ship to a specific anchorage area. Especially there are many inappropriate anchoring areas due to the special conditions such as; start of the heavy weather conditions, closeness to the shore line, traffic density, wind exposure, water depth and / or loose foothold ground. If a specific anchoring order was given, the master must determine that anchoring is safe at the current conditions by himself. The master must get prepared in order to inform the Vessel Traffic Services (VTS) or the port authority that the prevailing conditions is not appropriate for anchoring.



*Figure 17: An Illustration of a Ship at Anchor*

It is required to calculate the correct length of a chain in order for the anchor to be held effectively. There are two rules which are often used and accepted: (the length of one shackle is 27.5 meters)

- The number of shackles:  $1.5 \times \sqrt{D}$  ( $D$ = water depth in meters)
- The length of the chain in meters =  $6 - 10 \times$  (water depth in meters) or if the number of slack is between 6 and 10, the number of slack is equal to the length of the chain released divided by the depth of water.

In addition, when taking into account the status of the ship (loaded or on ballast), the effect of the weather conditions affecting the current weather conditions or the anchoring area, it may be required to release more shackles.

Every passage plan should include provision for anchoring. If this is not done at the commencement of the voyage, the passage plan should be amended when anchoring is known to be a requirement. It is too late to read the pilot book when the vessel is already yawing 30 degrees.

- The Master to take charge of the anchoring plan in good time
- The Master to pick the time of day and location with due regard to safety of vessel
- The Master to consider the abort parameters and contingency planning
- Use all the known chart and pilot book information, regarding holding ground, water depths, proximity to shore, dangers, etc.
- Use local agent's information, including designated anchorage areas/restrictions, numbers of vessels at anchor, traffic density and movements, other local navigational information
- Study weather forecasts – not only the immediate weather but seasonal weather patterns
- Understand local tides and currents
- Take security precautions (for example, anchorages can be in areas where piracy is prevalent)
- Ensure the bridge team is trained.

On the other hand, there is considerable commercial pressure on Masters. This has been exacerbated in the recent past by many factors, including;

- The need for quick turnaround times
- Having to be prepared at a moment's notice when the port advises that a berth is ready
- Easy communication access and hence immediate pressure from managers / owners / agents / charterers and terminal operators
- Having the vessel available to take stores and crew changes

- Trying to comply with shore-side instructions when few of those issuing the instructions appreciate the scope of problems the Master has to contend with, and few are concerned with the safety of the ship or crew.



**Figure 18:** TINAZTEPE S's Anchored Position at Misurata Port Anchorage

As there was no navigation plan prepared by the ship and could be understood from the correspondences between the ship manager and Misurata agent, the receiver of the cargo would be ready on 18th of March 2017, that's why anchoring plan was made taking into account the factor that the ship would arrive the destination port earlier. Later on at correspondences, storm is expected at the region, therefore it was informed that berthing would be appropriate by the ship manager.

The ship anchored on 16th of March 2017 at 07.00 hours at Misurata port anchorage area with starboard chain while 7 shackles were within the water because of the commercial concerns such as cargo receiver not being ready and the port charges (**Figure 18**). The ship dropped the anchor. As the depth of the water where the ship dropped anchor was below 25 meters contour, it is calculated from the above formulation that 7 shackles were enough for that water depth.

The number of shackles:  $1.5 \times \sqrt{D}$  (D= water depth in meters)

The number of shackles:  $1.5 \times \sqrt{25} = 7.5$  (7-8 shackles)

It was understood from the casualty statements that it was discussed whether it would be right to stay on engine or to stay on anchor for the ship also known as traverse<sup>5</sup> sailing while waiting on heavy sea conditions. Although Misurata ports' anchoring area was not so sheltered for the heavy sea conditions. It was understood that anchoring option was decided since, traverse sailing would increase the fuel consumption. Additionally it was learned from the crew statements that weather and sea conditions were becoming violent after anchoring, the ship started to make heavy pitching, consequently the ship was prepared for the port approach maneuver by heaving the anchor. Especially it is a stubborn fact that the heavy pitching while at anchor affect the ships' structural strength. It is known that, in similar cases the ships' chain might be cut, further when the chain was not cut, damage or extra stress on structural integrity of the windlass can occur.

It is considered that stand on anchor at severe sea conditions affected the structural integrity deterioration of the TINAZTEPE S near the amidship.

### **2.3 Emergency Management**

International Safety Management (ISM) Certificate of the ship was issued on 10<sup>th</sup> of December 2015 by the Harbour Master of Istanbul and it is valid until 30<sup>th</sup> of July 2018. Document of Compliance of the ship was issued on 28<sup>th</sup> of September 2015 by the Harbour Master of Istanbul and it is valid until 23<sup>rd</sup> of July 2018. It is stipulated under Chapter 8 Emergency Preparedness title of the International Safety Management Code (ISM Code) that;

*8.1 The Company should identify potential emergency shipboard situations, and establish procedures to respond to them.*

*8.2 The Company should establish programmes for drills and exercises to prepare for emergency actions.*

*8.3 The SMS should provide for measures ensuring that the Company's organization can respond at any time to hazards, accidents and emergency situations involving its ships.*

---

<sup>5</sup> Zigzag sailing on different directions by changing counter against the wind

### **2.3.1 Responsibilities of the Master**

It is known that, according to Safety Management System policy, in case of emergency, emergency drills carried out at specific periods increase the awareness, decrease disorder and provides competency in using life saving appliances. When the last abandon ship drills reviewed in pursuant of ISM, it is noted that scenarios was complied with and the drills were successful.

Yet, events aftermath of the accident, indicate against of the above. The first notable issue is that the Master's ineffectiveness, accordingly the deck cadet takes the initiative and gives order to abandoning ship activating the general alarm.. Afterwards, gathering the crew at muster station dispersedly and with incomplete equipment and some of the crewmembers being late or even not coming are the signs that emergency situation was not managed effectively.

Additionally, when the last ISM internal audit was reviewed it was seen that the necessity of drills to be carried out without delay was emphasized especially.

In the light of the aforementioned , it is considered that emergency drills were not carried out effectively according to Safety Management System policies and consequently anticipated awareness did not happen on crew.

Keeping lifesaving appliances appropriate for use is so important both according to Safety Management System and with regard to safety of life. When the last ISM internal audit was reviewed, it was seen that all lifesaving appliances and equipments were in working order and compliant to standards.

But, the statements of crew who were rescued alive from the accident was reviewed, it was learned that lifevest appliances were neither working nor working as intended.

It is considered that Safety Management policies are not taken into account satisfactory by crew and the company, therefore intended awareness did not adequate according to Safety Management System.

### **2.3.2 Responsibilities of the Owner**

It is stipulated under the Part A – Implementation, 3 “Company Responsibilities and Authority” heading of the International Safety Management Code (ISM Code) that;

*3.3 The Company is responsible for ensuring that adequate resources and shore based support are provided to enable the designated person or persons to carry out their functions.*

Main responsibility of the master is to ensure the safety of the ship and crew. The persons in charge of technical and commercial management of the ships must be sure that this responsibility is fully and definitely given. This condition is the biggest contribution that the company can make to safety culture and this requires active participation of the company managers.

When the correspondences between the company and Misurata agent on the day of the incident was reviewed, it was detected that the company representative warned the agency that the prevailing weather conditions in the region would get heavier for that day and gave order for the ship to be berthed immediately. In response agency contacted port and the consignee, and relayed that the port was waiting letter from the company for the emergency berthing as the consignee was not ready.

Meanwhile in the conversations between the ship and the coastal radio station, it was stated that the ship waited permission for emergency berthing but could not receive a positive response.

As can be understood from the above stated conditions, it was identified that in response to ships’ request for emergency berthing because of the weather conditions encompassing the ship, conversations between the company and coastal state representatives to overcome some technical and commercial problems resulted in time loss. Although it is thought that it was not the affecting factor for the accident, it is considered that in case of emergency commercial problems must not be an arguing subject.

### **2.3.3 Responsibilities of the Coastal State**

Recent studies towards minimising the level of accidents occurring at the sea and resultant losses and saving life acquired pace and became international.

With the 1979 Convention, accepted at a conference held in Hamburg, it was aimed to be developed an international search and rescue plan. By this way, regardless of a place of a marine accident, rescuing of a life in distress would be coordinated by a search and rescue organization and in case of a need, cooperation between neighbouring search and rescue organizations would be benefited from.

In Chapter 2 of the Convention, responsibilities of the states are set forth clearly. In order to establish primary elements of a search and rescue service, states must either by themselves or cooperate with other states by including the following items:

- Legal basis
- Identification of a responsible authority
- Organization of current sources
- Communication facilities
- Coordination and operational functions
- Ways for improvement of search and rescue service including planning, domestic and foreign bilateral relations and education

The parties, with the mutual understanding of related parties must establish a search and rescue zone in every sea area. Parties later accept the responsibility of providing search and rescue services for a specific area.

Chapter 2 sets forth how the search and rescue services be arranged and requirements for developing the national competencies. It is requested from parties to establish rescue coordination centers and to operate these centers for 24 hours a day basis with educated and English proficient personnel.

Additionally, it is requested from parties to “provide coordination between sea and air search and rescue services”.

Libya acting as coastal state, signed the International Convention on Maritime Search and Rescue, 1979 (SAR Convention) and put it into force on 28th of May 2005 (SAR.1/Circ.77). After the accident Turkish Main Search and Rescue Coordination Center tried to reach Libya Search and Rescue Coordination Center by current communication

ways but could not succeed. It was tried to communicate with the authorities at the accident scene over consulate general.

Coastal state authorities informed that as soon as the accident happened, they received the distress signal and started search and rescue operation. Casualties stated that, after abandoning the ship they saw first a tugboat and then a military boat, but these crafts could not reach them in a short time, after staying approximately for 3 hours in the sea, the crafts reached and rescued them. It was also understood from the correspondences of the company that a search and rescue operation was commenced by the port authority, the ships around was contacted but any rescue assistance was not carried out.

In the light of these statements, it is understood that following the distress signal that was given by the ship and consulate general authorities communicating with them, the authorities of the coastal state started search and rescue operation with a tugboat and a military boat and rescued the casualties within 3 hours. It was observed that other ships anchored around did not attend the operation actively.

On the other hand, on the GISIS/Global SAR Plan module of the IMO website, where the party states' search and rescue capabilities are published, there was no search and rescue sub heading for Libya.

According to the statements above, it was determined that primary elements of search and rescue service that would be established by the coastal state pursuant to Chapter 2 of the SAR Convention was not provided fully. It is considered that this condition is an important deficiency with regard to the safety of the sea crafts navigating in the region and also for the marine environment.

## **2.4 Similar Accidents**

Turkish flagged general cargo ship MURAT HACİBEKİROĞLU II, while under way 35 nautical miles off the coast of Port of Alanya and carrying 1964,520 MT iron slag (raw material of cement) loaded from İskenderun İSDEMİR port, to be unloaded to İzmit Derince Aslan Cement port, flooded and subsequently foundered on 19th of September 2016. Crew consisting of 10 personnel abandoned the ship and saved their lives. After the

investigation of the accident it was assessed that bottom plate under the engine room was likely fractured. MURAT HACIBEKİROĞLU was constructed in 1984.

LEONARDO, Mongolian flagged dry cargo ship, while on ballast and anchored at Istanbul Türkeli anchorage area, first sagged from the mastory and then broke into two on 27<sup>th</sup> of August 2017. All crewmembers were rescued by Search and Rescue means.. Investigation of the accident still continues. LEONARDO was constructed in 1975.

Turkish flagged dry cargo ship BILAL BAL, while carrying 3150 MT oxide layer from Gemlik RODA port to Black Sea Eregli port and navigating off the coast of Istanbul Şile, foundered on 1st of November 2017. 11 personnel who were onboard, all lost their lives. Accident investigation is still ongoing. BILAL BAL was built in 1974.

Especially aged ships which have low condition, pose important risks both with regard to safety of life and the marine environment. Additionally, it is known that shipowners face difficulties in making these ships compatible with the changing legislation.

Increasing number of accidents of the type mentioned above including TINAZTEPE S, opened the discussion of the seaworthiness of the low condition aged ships belonging to Turkish merchant fleet. Although seaworthiness for these ships are given taking into account the plate thickness measurement reports, it is seen that common characteristics of these accidents is the deformation of the plate of the ship structure.

If a comparison made, it is observed that these type of ships' average age is 28 inside the Turkish merchant fleet, which is known as coaster and this average age is 18 in Europe. It is considered that, while issuing Certificate of Seaworthiness to these type of ships, which carry important risks with regard to safety of life and security of marine environment, the criteria taken into account should be reviewed again.

### SECTION 3 - CONCLUSIONS

1. The piers located in Badalan Bay are not compatible with the provisions of the paragraph 1 and subparagraph (ğ) of Article 20 of the amended ports regulation .
2. Loading plan was not prepared and signed according to BLU Code Appendix 2. Safety control list, which was required to be prepared according to subparagraph (b) prior to loading. Work completion certificate, which was required to be prepared after loading according to subparagraph (c), was not prepared.
3. The terminal personnel, was not equipped with appropriate personel protective equipment.
4. The cargo that would be loaded within a period with the conveyor, was loaded suddenly by raising the truck dumper in order to expetide the loading but the master and terminal representative did not take any proper action.
5. The cargo was not dispersed homogenously inside the hold and the master did not request for trimming from the terminal representative, but the terminal representative stated that they had dispersed the cargo with the mobile shore winch.
6. The ship was within the allowable shearing force and bending moment limits for the calm water on the specified loading conditions.
7. The aggregation of the cargo near mastory and stand on anchor at heavy seas affected the deterioration of the structural integrity of TINAZTEPE S from the mastory.
8. Emergency drills were not carried out effectively and according to Safety Management System policies and therefore anticipated awareness was not comprised oncrew.
9. The appliances of lifevests were neither working fully nor properly.

- 10.** In response to ships' request for emergency berthing because of the weather conditions encompassing the ship, conversations between the company and coastal state representatives to overcome some technical and commercial problems resulted in time loss.
  
- 11.** After the accident Turkish Main Search and Rescue Coordination Center tried to communicate Libyan Search and Rescue Coordination Center by current communication means but could not succeed. It was tried to communicate with the authorities at the accident scene over consulate general.
  
- 12.** SAR Capabilities of the Libyan State do not exist in the GISIS / Global SAR Plan module on the IMO website
  
- 13.** The common feature of similar accidents in recent years is the deterioration of the structural integrity of aged ships.

## **SECTION 4 – ACTIONS TAKEN**

- 4.1** It is stipulated by adding (ğ) subparagraph to by-law on ports with the by-law on revising the by-law on ports which was promulgated on the official gazette on 8th of April 2017 that; “Pier or wharf length, which the ship and water crafts will berth with the aim of loading/unloading, shall be at least 10% longer than the ships’ length. Water depths at these facilities shall be at least 0,5 metres more than the ships’ loaded draft that will berth. Ships not meeting the length requirements and not carrying the required conditions stated above, can berth with respect to harbour masters’ written approval. The ships that will berth these facilities shall be in compliance with additional measures that will be defined by the harbour master such as; not posing an obstacle to maritime traffic and maneuver, providing a safe mooring and making the entry and exit safely.”
- 4.2** The instruction of sending the snapshot of the final condition of the cargo state in holds of the all ships that the loading operation completed at the piers in Badalan Bay and also final situation of the load line, to the Harbour Master of Marmara Island was forwarded to the terminal representatives.
- 4.3** A new nonscheduled inspection regime was started with the official letter of Directorate General for Regulation of Maritime and Inland Waters dated 19<sup>th</sup> of January 2018 and numbered as 80368960-105.01.01-E.789.
- 4.4** The Libyan State Authorities re-established RCC Libya and submitted their SAR Capabilities into Global SAR Plan Module.

## **SECTION 5 - RECOMMENDATIONS**

**Directorate General for Regulation of Maritime and Inland Waters is recommended to:**

**01/01-18** Follow the inspection of terminals and masters with regard to compliance with the provisions of By-law on Safe Loading and Unloading of Bulk Carriers

**ERS Terminal is recommended to:**

**02/01-18** Take appropriate action that criteria defined in articles 9 and 10 of the By-law on Safe Loading and Unloading of Bulk Carriers is complied with in order to ensure safe loading of ships which berthed at the piers under your management,

**03/01-18** Ensure the terminal personnel involved in the loading operations are equipped with personal protective equipment and used properly,

**BATU Shipping Ltd. Co. is recommended to:**

**04/01-18** Take appropriate actions to comply with IMSBC and BLU Code criteria for safe loading/unloading of the ships in the fleet,

**05/01-18** Review internal audit methods in order to ensure that emergency drills are carried out appropriately,

**06/01-18** Review maintenance and inspection methods in order to ensure that lifesaving appliances and equipments should be available in all circumstances,

Certificate No: DM14S0443001763  
Page 1 of 2

**Türkiye Cumhuriyeti**  
Ulaştırma, Denizcilik ve Haberleşme Bakanlığı  
**Gemiadamı Donatımında Asgari Emniyet Belgesi**  
Republic of Turkey, Ministry of Transport, Maritime Affairs and Communications  
Minimum Safe Manning Document



Bu belge Denizde Can ve Mal Güvenliği Uluslararası Sözleşmesi SOLAS-74 (değişiklikleri ile beraber) kural V/14.2.2 uyarınca ve res. A.1047(27)'da belirtilen prensiplere uygun olarak, Türkiye Cumhuriyeti tarafından düzenlenmiştir.  
This document is issued under the provisions of regulation V/14.2.2 of the International Convention For The Safety Of Life At Sea, 1974, as amended, in accordance with principles set out in Assembly Resolution A.1047(27), under the authority of the Government of Republic of Turkey.

Gemi Adı Name of Ship	TINAZTEPE-S		Çağrı veya tanıma işareti Distinctive number or letters	TCRV
Sicil Limanı Port of Registry	İSTANBUL		IMO Numarası IMO Number	7505798
Gros Tonnajı Gross Tonnage	Ulusal National	Uluslararası Tonnaj International Tonnage Convention, 1989	Ana Makine Gücü (kW) Main Propulsion Power (kW)	1246
	1597,75	1900		
Periyodik olarak insansız bırakılan makine dairesi Periodically unattended machinery space	Hayır No		Gemi Tipi Type of Ship	Other
İşleten Operating Company	BATU DENİZCİLİK LTD. ŞTİ.			

Bu belgede adı geçen gemi, aşağıdaki tabloda verilen sayı ve yeterlik/kapasitedeki gemiadamları ile donatıldığında, ulusal ve uluslararası mevzuata göre emniyetli donatılmış sayılır.

The ship named in this document is considered to be safely manned if, when it proceeds to sea, it carries not less than the number and grades / capacities of personnel specified in the table below.

Yeterlilik / Kapasite Grade / Capacity	Sertifika (STCW Kuralı) Certificate (STCW Regulation)	Kişi Sayısı Number of Persons
Kaptan Master	II/2	1
1. Zabit Chief Officer	III/2	1
Vardiya Zabiti Officer in Charge of Navigational Watch	III/1	0
Güverte Tayfası (Grup-1) Deck Rating (Group-1)	III/4	2
Güverte Tayfası (Grup-2) Deck Rating (Group-2)	-	1
Telsiz Zabiti Radio Officer	IV/2	1
Baş Mühendis Chief Engineer	III/3	1
İkinci Mühendis Second Engineer	III/3	1
Vardiya Mühendisi / Makinisti Officer in Charge of Engineer Watch	III/1	0
Makine Tayfası (Grup-1) Engine Rating (Group-1)	III/4	1
Makine Tayfası (Grup-2) Engine Rating (Group-2)	-	

Sefer Bölgesi / Trading Area: Yakın Kıyosal Sefer / Near Coastal Voyage

Düzenlenme Tarihi ve Yeri  
Date and Place of Issue: 30.09.2014 / İSTANBUL

Geçerlilik Tarihi  
Date of Expire: 28.02.2018

Mustafa KIRAN  
İSTANBUL LİMAN BAŞKANLIĞI  
HARBOUR MASTER OF İSTANBUL

## Özel Gereksinim ve Koşullar / Special Requirements and Conditions

Certificate No: DM14S0443001763

Page 2 of 2

Yakın Kıyusal Sefer; kabotaj sefer bölgesi sınırları aşarak, Karadenizde, Akdenizde ve İspanya'nın Fransa sınırlarına kadar kuzey kıyıları da kapsayan Finistre Burnu ile Moritanya'nın Dakhla Limanı güney sınırnı birleştiren çizginin doğusunda kalan deniz alanına yapılır.

The Near Coastal Voyages are the voyage made beyond the Cabotage boundaries, in the Black Sea, Mediterranean and Red Sea and the sea area between the eastern part of the line combining the southern boundary of the port of Dacha of Mauritania and Cape of Finisterre and the northern coast of Spain until the French boundaries

Zabitan sınıfı gemiadamları sahip oldukları yetelik bölgesinin "Uygulanan Sınırlamalar" bölümünde belirtilen görevleri yaparlar. Ayrıca Kaptan ve Baş Mühendisler dahil olmak üzere, kazanılmış haklara sahip zabitan sınıfı gemiadamları "Uygulanan Sınırlamalar" bölümündeki görevlerini Yakın Kıyusal Seferde geçeri olmak üzere "düzey" bölümüne bakılmaksızın yapabilirler.

Masters, officers and engineers has vested rights to work on ships as it is written in the "Limitations Applying" section of his/her Certificate of Competency. Furthermore, All seafarers include masters and Chief Engineers that have additional rights written in the "Limitations Applying" section can serve the ships at near coastal voyage regardless of "Level" section.

On (10) veya daha fazla mürettebat taşıyan gemilerde MLC 2006 A 3.2.5 gereği tam kalifiye aşçı olmak zorundadır.

Ships carrying ten (10) or more persons shall require a fully qualified cook according to MLC 2006 A.3.2.5

Grup-1 Güverte Tayfası Gemici, Usta Gemici ve Güverte Lostromosunu, Grup-2 Güverte Tayfası İse Miçoyu kapsamaktadır.

Ordinary Seaman, Able Seaman and Boatswain are assigned under Group-1 Deck Rating and Deck Boy is assigned under Group-2 Deck Rating.

Grup-1 Makine Tayfası Yağcı ve Makine Lostromosunu, Grup-2 Makine Tayfası İse Siliciyi kapsamaktadır.

Oiler and Donkeyman are assigned under Group-1 Engine Rating and Wiper is assigned under Group-2 Engine Rating.

\* Periyodik olarak insanazı biralınan makine daireesi özelliği olması halinde, 3000 kW'den büyük makine gücü olan gemilerde Vardiya Mühendisi, Grup-1 ve Grup-2 Makine Tayfasından birer kişi olmak üzere toplam 3 kişi, 3000 kW'den küçük gemiler (3000 kW dahil değil), bir Başmühendis/ Başmakiniist ve bir Makine Zabiti ile donatılır ve Grup-2 Makine Tayfasından bir kişi eksiltilir.

\* If periodically unattended machinery space is provided, one Officer in Charge of Engineer Watch and one from each Group-1 and 2 Engine Rating is no longer required on ships powered by more than 3000 kW. On ships which have less than 3000 kW are manned with only one Chief Engineer and one Watchkeeping Engineer Officer, and also one of the Group-2 Engine Ratings in charge may be reduced.

\*\* A-1 seyir alanlarında bir Tahditli Telsiz Operatörü (ROC) veya persohelden iki kişide ROC bulunmalıdır. A-2-3-4 seyir alanlarında ise, en az bir Genel Telsiz Operatörü (GOC) bulunmalı veya kaptan ya da güverte zabıtları ile birlikte (güverte zabıtlarından birinin yerine Güverte Stajyeri olabilir) toplam 2 adet GOC yeterliği olmalıdır.

\*\* In sea areas A1, either one Operator with Restricted Operator's Certificate (ROC) or two crewmembers holders of (ROC) will be provided. In sea areas A-2-3-4, vessel must carry one Operator with at least General Operator's Certificate (GOC) or, either two deck officers or captain (one may be Deck Cadet instead of one of the deck officers) should hold at least 2 GOC in total.

\*\*\* Geçerli STCW sertifikaları bulunan güverte veya makine stajyerleri istihdam edilen gemilerde, kendi branşlarındaki Grup-1 güverte/makine tayfasından sadece bir kişi indirim yapılabilir.

\*\*\* Ships in which deck or engine cadet with valid STCW certificates is employed, only one of Group-1 rating with the same department can be reduced with the cadet.

## Yetelikler & Sınırlamalar / Competencies & Limitations

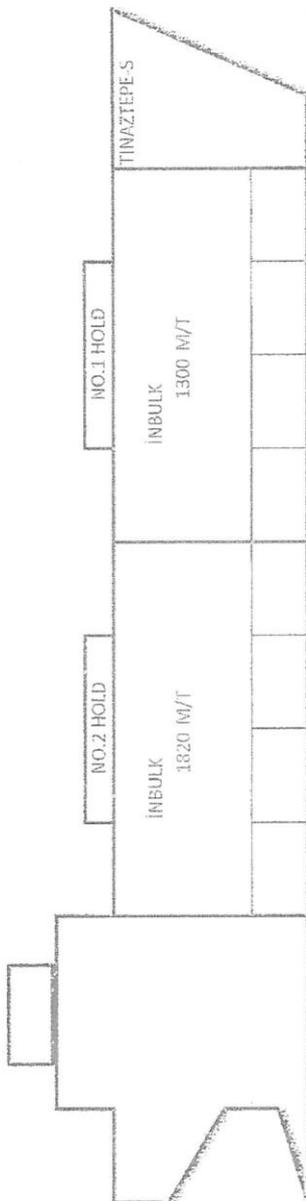
Yetelik / Competency	Referans / Reference	Sınırlamalar / Limitations
Kaptan / Master	II / 2	3000 GT ve üzeri / More than 3000 GT
Kazan / Master	II / 2	500 GT - 3000 GT arası / Between 500 GT and 3000 GT
Sınırlı Kaptan / Restricted Master	II / 3	500 GT altı (Yakın Kıyusal Seferde) / Less than 500GT (At Near Coastal Voyages)
Birinci Zabiti / Chief Officer	II / 2	3000 GT ve üzeri / More than 3000 GT
Birinci Zabiti / Chief Officer	II / 2	500 GT - 3000 GT arası / Between 500 GT and 3000 GT
Vardiya Zabiti / Watchkeeping Officer	II / 1	3000 GT ve üzeri / More than 3000 GT
Vardiya Zabiti / Watchkeeping Officer	II / 1	3000 GT altı / Less than 3000 GT
Sınırlı Vardiya Zabiti / Restricted Watchkeeping Officer	II / 3	500 GT altı (Yakın Kıyusal Seferde) / Less than 500GT (At Near Coastal Voyages)
Güverte Tayfası (Grup - 1) / Deck Rating (Group - 1)	II / 4	Gv Lostromosunu, Usta Gemici, Gemici / Boatswain, Able Seaman, Seaman
Güverte Tayfası (Grup - 2) / Deck Rating (Group - 2)	-	Miço / Deckboy
Telsiz Zabiti / Radio Officer	IV / 2	-
Baş Mühendis/Makiniist / Chief Engineer	III / 2	3000 KW ve üzeri / More than 3000 KW
Baş Mühendis/Makiniist / Chief Engineer	III / 3	750 KW - 3000 KW arası / Between 750 KW - 3000 KW
Sınırlı Baş Makiniist / Restricted Chief Engineer	SEC. A III / 2 PARA.8	750 KW altı (Yakın Kıyusal Seferde) / Less than 750 KW (At Near Coastal Voyages)
İkinci Mühendis/Makiniist / Second Engineer	III / 2	3000 KW ve üzeri / More than 3000 KW
İkinci Mühendis/Makiniist / Second Engineer	III / 3	750 KW - 3000 KW arası / Between 750 KW end 3000 KW
Vardiya Mühendis/Makiniist / Watchkeeping Engineer Officer	III / 1	3000 KW ve üzeri / More than 3000 KW
Vardiya Mühendis/Makiniist / Watchkeeping Engineer Officer	III / 1	750 KW - 3000 KW arası / Between 750 KW end 3000 KW
Sınırlı Vardiya Makiniist / Restricted Watchkeeping Eng. Officer	SEC. A. III / 1 PARA.9	750 KW altı (Yakın Kıyusal Seferde) / Less than 750 KW (At Near Coastal Voyages)
Makine Tayfası (Grup -1) / Engine Rating (Group -1)	III / 4	Mk. Lostromosunu, Yağcı / Donkeyman, Oiler
Makine Tayfası (Grup -2) / Engine Rating (Group -2)	-	Silici / Wiper

Form No: S0004 Rev.01

CARGO PLAN

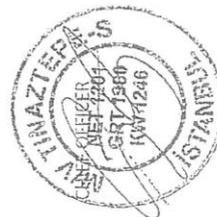
DATE : 08.03.2017

VESSEL NAME	M/V TINAZTEPE - 5
IMO NO	750 57 98
VOYAGE NO	Mar.17
LOADING PORT	BADALAN/TURKEY
DISCHARGING PORT	MISRATA/LIBYA
CARGO	DOLOMIT GRANULES



TOTAL: 3120 M/T

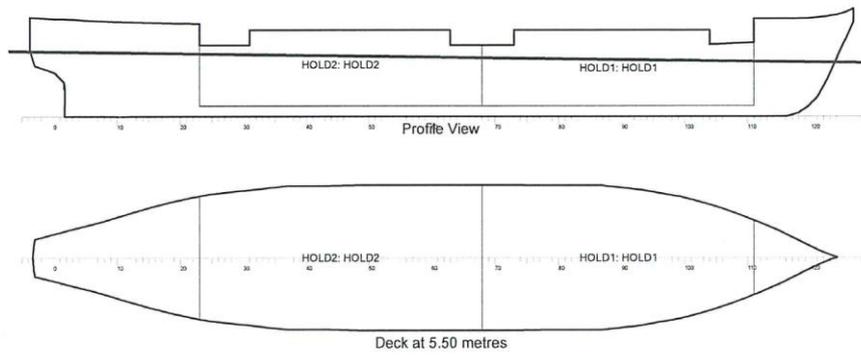
	HOLD NO 2	HOLD NO 1
STEP 1		
STEP 2		
STEP 3		
STEP 4		
STEP 5		



*Loading Condition*

*Loading Conditions*

*Intact State*



*Intact State*

## Drafts at equilibrium angle

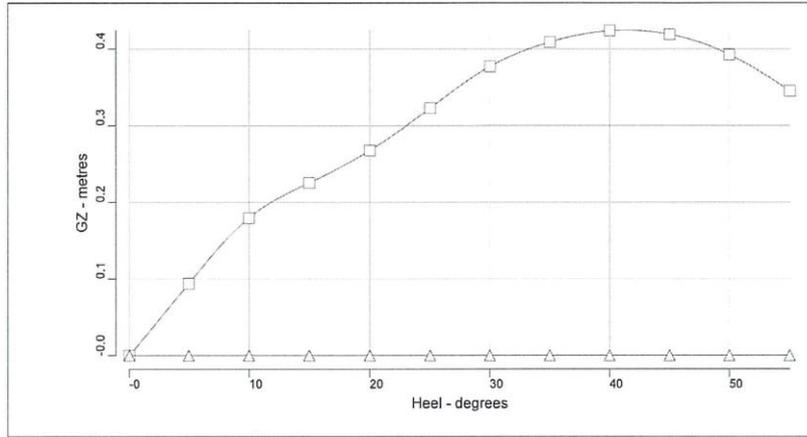
	Moulded	Extreme	
Draft at LCF	5.656	5.656	metres
Draft aft at marks	6.140	6.140	metres
Draft fwd at marks	5.103	5.103	metres
Draft at AP	6.140	6.140	metres
Draft at FP	5.103	5.103	metres
Mean draft at midships	5.622	5.622	metres

## Hydrostatics at equilibrium angle

Density of water	1.0180	tonnes/cu.m
Heel	No heel	
Trim by the stern	1.037	metres
KG	4.618	metres
FSC	0.000	metres
KGf	4.618	metres
GMt	1.059	metres
BMt	2.671	metres
BMI	74.098	metres
Waterplane area	845.67	sq.metres
LCG	36.352	metres
LCB	36.330	metres
TCB	0.000	metres
LCF	34.716	metres
TCF	0.000	metres
TPC	8.609	tonnes/cm
MTC	40.927	tonnes-m/cm
Shell thickness	7.000	mm

Intact State

Loading Condition: Intact State



Righting Lever (GZ) Curve

Heel to Stbd (deg)	GZ (m)	Slope (m/rad)	Trim (m)	WLrad (m)	Freeboard (m)	Grain heeling (m)
0.00	0.0000	1.0594	-1.037	5.621	0.98[0]	0.0000
5.00	0.0937	1.0930	-1.022	5.596	0.38[0]	0.0000
10.00	0.1795	0.7139	-1.003	5.530	-0.22[0]	0.0000
15.00	0.2251	0.4529	-0.949	5.457	-0.86[0]	0.0000
20.00	0.2675	0.5744	-0.833	5.353	-1.50[0]	0.0000
25.00	0.3230	0.7500	-0.672	5.209	-2.13[0]	0.0000
30.00	0.3772	0.5279	-0.507	5.039	-2.76[0]	0.0000
35.00	0.4089	0.2910	-0.348	4.866	-3.40[0]	0.0000
40.00	0.4239	0.0804	-0.227	4.684	-4.05[0]	0.0000
45.00	0.4191	-0.1739	-0.139	4.487	-4.68[0]	0.0000
50.00	0.3927	-0.4244	-0.070	4.270	-5.29[0]	0.0000
55.00	0.3454	-0.6483	-0.013	4.029	-5.87[0]	0.0000

**Intact State**

**Immersion Particulars**

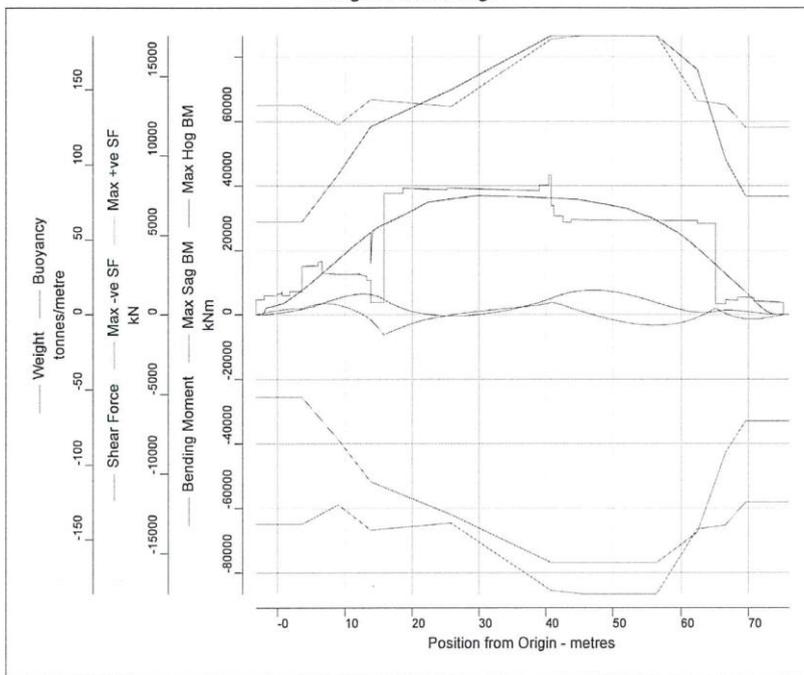
State of Openings = X-ray: Normal condition

**Intact**

Type	Point #	X position (m)	Y position (m)	Z position (m)	Ht. above WL (m)	Flood Angle (deg)	Downflood Comp.
Deck Edge imm.angle	0	37.250	6.875	6.600		8.181	
-- Lowest point	0	37.250	6.875	6.600	0.978		

Intact State

Longitudinal Strength



Shearing Force and Bending Moments

Distance from Origin (m)		Shearing Force (kN)	% of Max allowed	Bending Moment (kNm)	% of Max allowed
3.60	BHD	397.2	3.0	1741.3	6.0
9.00	BHD	614.1	5.1	5150.5	11.8
13.80	BHD	-314.5	2.3	6275.9	10.8
25.80	BHD	-21.2	0.2	-391.3	0.6
40.80	BHD	780.9	4.5	5063.1	5.8
45.60	BHD	178.2	1.0	7494.0	8.7
56.40	BHD	-665.0	3.8	3747.8	4.3
62.40	BHD	-170.8	1.3	752.6	1.0
66.60	BHD	68.4	0.5	1371.2	2.8
69.60	BHD	-246.0	2.1	1004.7	2.7
<b>Maximum BM and Maximum Percentage of Limit</b>					
47.03				7631.0	8.8
10.80				6064.9	12.3
<b>Maximum SF and Maximum Percentage of Limit</b>					
15.80		-1260.5	9.4		
15.80		-1260.5	9.4		