Časopis Pomorskog fakulteta Kotor – Journal of Maritime Sciences (JMS)
god. 23, br. 2/2022. Vol. 23, No. 2/2022; November 2022

DOI: https://doi.org/10.56080/jms221107 UDC: 629.5.017:629.528(496.5)
Short report

Some Considerations Regarding the Safety of Touristic Vessels Operating in the Albanian Bays*

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Abstract: Ship's stability is one among the foremost important and complicated concept regarding ship and navigation's safety and it's governed by maritime law as well as maritime codes. In Albanian bays, there has been considerable maritime tourism development in recent years, which has consequently brought about an increasing demand for passenger ships offering mainly one day cruises. The ships intended for this type of service are of different typologies: tourist vessels built especially for this destination, but there are many vessels which have changed the destination mainly from fishing vessel to tourist vessel. From the field observations along with contacts with the port authorities and Albanian maritime administration, it is revealed that these ships bare problems related to meeting service and security standards that they offer. Considering existence of such problems and the absence of technical data related to the safety of ships, it is required that geometric and stability calculations are performed with the view meeting the norms of stability. In this paper we will be presenting the causes that lead to ship stability failure and their impact on navigation safety. A case study of the calculation of the ship stability is going to be presented, the causes are going to be analysed and the possible ways of stability failures are going to be assessed. Vessel's intact stability is a fundamental component of seaworthiness so it's in the interest of all owners/operators to be aware of this subject and make sure that their vessel has a satisfactory level of stability in order to ensure its safety as well as that of people on board.

Keywords: Ship stability, Maritime tourism, Passenger ship, Stability booklet.

1. Introduction

The safety of a ship depends on its structure, equipment, shape, disposition and its specific purpose, which varies from one ship to another. The safety of a ship also depends on the nature of the cargo, the

* An earlier version of this paper was presented at the 1st Kotor International Maritime Conference – KIMC 2021, Kotor, Montenegro.

composition of its crew, working conditions, the education and level of communication between its members, as well as on other related factors. Stability has always been the main safety issue for all marine vessels.

Ships should ensure safe navigation by meeting the stability norms defined by the International Maritime Organization (IMO) and determined by national maritime administrations. The fulfillment of these norms is becoming increasingly important, especially for passenger ships used for tourist excursions.

When a ship is completed by the builders, certain written stability information must be handed over to the shipowner with the ship. The information includes details of the ship's Lightweight, the Lightweight VCG and LCG, and also the positions of the centers of gravity of cargo and bunker spaces. This gives an initial condition from which the displacement and KG for any condition of loading may be calculated.

There are different reasons for a change in the position of center of gravity G. When the vertical center of gravity VCG rises, there will normally be a loss in the ship's stability. G may even rise above the transverse metacenter M to make the ship unstable. The master and mate onboard ship must be aware of changes in a ship that would cause such a rise in G.

In Albania, more and more sea transport is being given priority, mainly in tourist transport ships for tourists on one-day lines. The vessels intended for this type of service are of different typologies: tourist vessels built especially for this destination, but there are many vessels which have changed the destination mainly from fishing vessel to tourist vessel. These ships, in order to adapt to this new tourist trend, have made constructive changes, which in many cases have brought an impact on the stabilizing behavior of the ships. From the analysis of the stability calculations and from the observations on these boats it has been noticed that the center of gravity of them has undergone changes, mainly in its increase VCG.

2. Maritime tourism in Albania

Globally, tourism and travel combined account for nearly ten percent of GDP and brings in an annual review of approximately USD 7.6 trillion, and thus is an important part of the world economy [1]. For Albania, the tourism economy and tourist sectors account for 8.71 of GDP in 2019. People working in the tourism sector also accounted for 22% of the total number of employed individuals in the country.

Over the last decades, the economy of Albania has undergone a major socio-economic transition. Coastal and marine resources, being valuable economic assets, have underpinned this process.

The maritime sector is rapidly increasing in these last years, leading to further economic development and international cooperation. Data from INSTAT shows that in 2017 compared to 2016, the number of passengers travelling by sea increased by 16.9%.

Albania is located in a quite favourable geographical position. Linking the Adriatic and Ionian Seas and the Central Mediterranean Sea, makes Albania an important country for the development of maritime activities [2].

The tourism industry occupies a key place within the economy and is a crucial source for the development of the country. Tourism can immensely contribute to three dimensions of sustainable development: creating jobs, generating trade opportunities to recognize needs and support tourism activities [3].

Tourism in Albania is a major component of the national economy. It is one of the most important and promising sectors considering the natural and cultural resources that this area holds.

In Albania, there is a long coastline with mainly sandy, but also rocky beaches. In this coastline there are a number of hotels, holiday houses, resorts that tell for a significant increase in sea tourism. Almost in all cases we have to do with customized vehicles (formerly fishing boats, small freight vessels, military vessels), however, there are also cases where the subjects are equipped with new vessels aimed for tourist and entertaining purposes. Not only the number of tourists in the last 2-3 years has increased, but also in their geographic distribution has developed with tendency of tourists coming from northern European countries such as Poland, Russia and Scandinavian countries. The presence of this category of tourists has brought about the demand for sea tourism vehicles of a higher category, according to the requirements that this category of tourists has. So we have a request for tourist marine vessels, to which private entities have responded with a rapid increase in the number of these vehicles. Their choices have been to buy such vessels produced some time ago, or to change the destination of their vessels for example, those of fishing in one-day passenger vessels undergoing constructive changes. But in these cases it is required to pay special attention to meeting the standards for the accommodation of passengers as well as for the safety of the ship navigation.

3. Situation in Albania - findings

In Albania, there has been a considerable maritime tourism development in recent years, which has consequently brought about an

increasing demand for the number of passenger ships mainly for one day cruises in short lines (Tables 1 and 2).

Table 1 – *Number of ships and their transport capacity in the bay of Vlora [4].*

Year	2016	2017	2018	2019	2020	2021
Number of vessels	3	4	10	15	14	16
Daily transport capacity	295	342	1198	1350	920	1026
Number of pax	9150	14546	30843	51815	23197	36150

From the field observations, contacts with the port authorities and the Albanian maritime administration it is revealed that these ships have problems related to the fulfillment of the service standards, but also related to the security that they offer. They operate mainly in the bay of Vlora, Saranda and Koman Lake not in very long distances (1-2 hours).

These ships have problems related to periodic and instant technical services, as they are offered in a very limited way in Albania. The only shipyard which can offer service is that of Pashaliman shipyard, which still remains under the jurisdiction of the Ministry of Defense, but also not equipped with all the tools and specialists to fulfill all their requirements for repairment, remodeling of existing ships or construction of new ships.

With these problems and in the absence of technical data related to the safety of ships, it is required to meet the norms of stability and perform geometric and stability calculations of these ships. This emphasizes the necessity of compilation and having the stability book on board of the ship as an operating manual.

4. The importance of ship stability in ship safety

In the last decade, losing the stability of the ship has created significant problems thanks to various ways in which such a situation happenes. This is why attention is needed to be paid to every way separately.

Even though, from a theoretical point of view, such problems were very well known in the past, but it was only recently that further attention was given to preventing and regulating such situations. The ship needs to have a sufficient margin of metacentric height for any loss of stability situation to have a solution as in maintaining the limit level of safety. Even so, practically before starting the voyage, many situations are identified in which the metacentric height is quite accurately known. Moreover, there are cases during which the metacentric height is more accurately determined, but still no reassurance could also be given about the ship's stability for the entire voyage.

During the voyage, the ship should be verified at all times, because sometimes it might be necessary to commence voyage with a higher metacentric height, in order to counteract conditions which arise at later stages.

Four basic elements are considered to be part of the ship's stability system: ship, environment, cargo and operations [5].

The necessary level of safety may, when it comes to ship's stability, be obtained only by considering all elements whichh contribute to the stability system.

The Albanian Maritime Register [6] has set a series of norms that must be respected in relation of safety and for this we have tried to analyze more deeply the requirements and norms required by the IMO provided not only by the Albanian Maritime Register, but also by other European Registers, mainly by the Croatian Maritime Registry [7], to which we have referred in most cases.

For this purpose we have used an extensive bibliography because:

- The ships operating in Albania, are mainly ships produced a long time ago, so they have been in use for many years.
- They have undergone constructive changes, where it is necessary to see in detail the possible constructive damage that may have occurred to the ship, as most such interventions have been made without the intervention of a naval engineer or a group of engineers.
- Most ships have completely changed their destination, mainly from service ships to one-day passenger ships. Thus, the requirements and norms provide other conditions that these ships must meet.
- Almost all of these ships lack technical documentation, even general, constructive and theoretical technical drawings, so in some cases it was necessary to make measurements on the real ship of all dimensions to create a theoretical drawing of the ship and create a frame of semi-widths (ordinates).

Table 2 – *Ship data for tourist transport in Albania in recent years [8].*

Name	Destination	Year of Construction	Place of Building	VCG Lightship	VCG Full Loaded	LOA	B	T
DRAGOBIA, Koman	46 pax	1982	Durres	1.27	1.45	12.90	4.50	1.25
BERISHA 01, Koman	80 pax + 10 cars	N/A	Koman	1.20	1.588	24.60	6.40	0.55
BERISHA 03, Koman	100 pax + 12 cars	N/A	Koman	1.20	1.55	29.80	7.40	0.65
TEUTA	30 pax	1976	Italy	0.88	1.175	12.75	3.70	1.20
Black Pearl	180 pax	2012	Marmaris, Turkey	1.75	2.088	21.35	6.90	1.43
Teuta I	50 pax	1980	Italy	0.82	1.31	13.60	3.80	0.92
SARDA, VauiDejes	40 pax	N/A	N/A	N/A	0.96	14.50	4.00	1.00
JULKA UNIQUE	200 pax	2018	Vlore	2.66	3.12	24.00	9.00	0.98
TINA TOURIST	150 pax	1984	Greece	1.49	1.648	22.50	4.80	1.255
ESPERANZA	80 pax	1990	SCILLA RC, Italy	1.27	1.58	16.60	4.60	1.46
ROZAFA	30 pax + 10 cars	N/A	N/A	0.99	1.7	20.40	7.40	1.33
AQUAMARINE	225 pax	1997	Marmaris, Turkey	1.67	2.09	30.50	8.00	2.10
DELFINI 23	48 pax	1980	Kalymnos, Greece	1.54	1.52	11.90	3.30	0.79
LIBURNA	120 pax	1963	Greece	2.06	2.21	23.75	6.25	2.40
SEASTAR	50 pax	2017	Italy	1.13	1.67	12.00	5.00	0.40
AVVENTURA II	45 pax	1991	Peschici FG, Italy	1.2	1.3	11.96	2.72	0.95
ANNA ST	33 pax	1984	Durres, Alb	1.056	1.30	13.22	3.58	1.26
MOGILA	286 pax	1955/2002	Montenegro	1.69	1.79	25.50	13.70	1.142
PADAJ	20 pax	1989	Bellaria, Italy	0.82	1.02	11.00	2.82	1.00

5. Case study

In many cases the initial purpose the ship was designed for, has changed. The case under consideration has been changed, from a fishing vessel to a passenger/tourist ship. At the request of the owner the ship must embark a maximum number of 180 passengers.

The Ship:	Tourist Ship
Length Overall:	L_{OA} = 23.75 m
Number of passengers + Crew:	180 = [115 (main deck) + 60 (upper deck) + 5 (crew)]

To the case taken in study (look at Figs. 1, 2 below) two upper decks were added. In such cases a considerable vertical displacement of the centre of gravity (G) is observed, therefore a reassessment of stability is required.

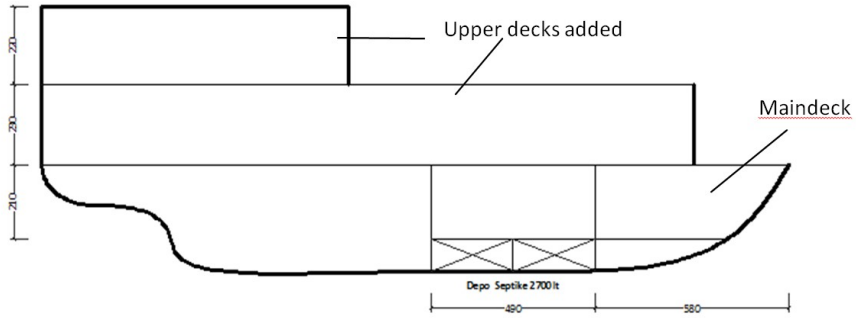

Fig. 1 – *Longitudinal profile of the touristic boat under consideration.*

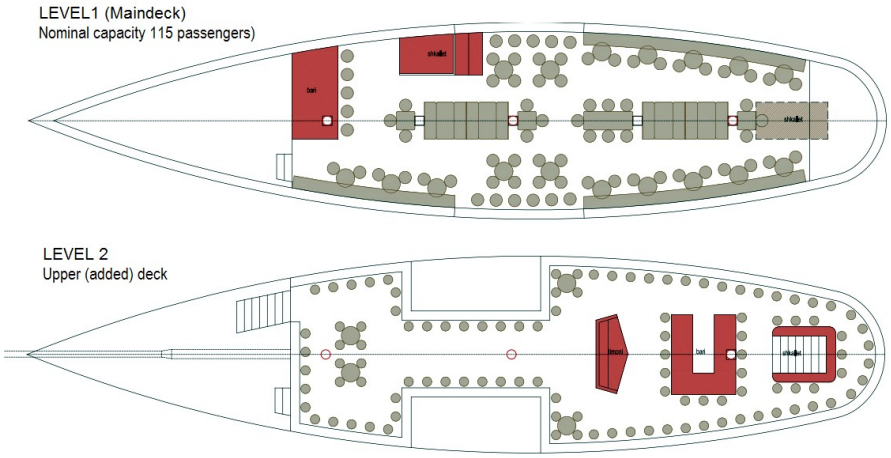

Fig. 2 – *Main and Upper Deck and Passengers Arrangement.*

The significant impact on the outcome of the 3D modelling process of a vessel is the realization of real measurements of the vessel hull that will be modelled [9, 10]. The measurement process is carried out in physical

bulkheads of the vessel, in order to obtain accurate results of the measurement of the semi-breadths of coordinates.

For the tourist boat, taken the data by direct measurement in its physical bulkheads, we have realized the 3D model in MaxSurf software.

Referred to the vessel taken in the study we drafted the Stability Book for the new conditions (Table 3). For the purpose of the assessment, in general, 3 IMO stability criteria (IMO resolution A.267) have not been met [11, 12].

Table 3 –*Verification of general criteria of the vessel in full load departure.*

Code	Criteria	Value	Units	Actual	Status	Margin (%)
	3.1.2.1: Area 30 to 40	1,7189	m.deg	1,6057	Fail	-6,59
	3.1.2.2: Max GZ at 30 or greater	0,200	M	0,197	Fail	-1,50
	3.1.2.3: Angle of maximum GZ	25,0	deg	21,8	Fail	-12,73

5.1. Some recommendation

From the reassessment of the stability of the modified vessel taken into study it was observed a considerable vertical displacement of the centre of gravity (G). This directly affects the stability of the ship therefore the following recommendations are given as possible solutions:

1. The number of passengers required by the ship owner is very large, so it is suggested:
   - To change the loading scheme (Total 130 passengers: Main deck - 130 passengers and the upper deck - 0 passengers);
   - To put a solid/liquid ballast (Put a solid ballast of 4 tons along the length of the keel symmetrically to the longitudinal vertical plane, as well as water and oil deposits must be filled on the vessel departing from the port).
2. The vertical centre of gravity VCG, which is not found in the technical documents of the ship, must be calculated. Alternative methods in calculating VCG, which have emerged and improved in recent years can be used. Some of the alternative methods of calculating VCG of ships are the Graphical method proposed by O.O. Kanifolskyi and M.M. Konotopets in 2016 [13], the Generalized method proposed by R.J. Dunworth in 2013 and improved by R.J. Dunworth and A.C. Smith [14, 15]. Another alternative method, the Polar method was proposed quite recently and refined by K. B. Karolius and D. Vassalos [16, 17, 18].

These alternative methods do not rely on the metacenter. It is observed that these new methods developed have similar results to the classical method. Therefore, these methods may be a good alternative to calculate VCG in the future.

3. During the operation of the ship was seen an uncontrolled movement of passengers, aiming at the upper decks. This is a dangerous situation for stability of the ship, therefore strict measures should be taken to stop and monitor the movement of passengers in this direction.
4. The ship would sail in calm weather conditions and with sea condition up to 2-3 Beaufort scale.

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Submitted: 30/03/2022
Accepted: 01/09/2022

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