REPUBLIC OF SERBIA,
CENTER FOR INVESTIGATION OF ACCIDENTS IN TRAFFIC,
SECTOR FOR INVESTIGATION OF ACCIDENTS IN WATERBORNE TRAFFIC,
NEMANJINA 11, 11000 BELGRADE

No.: 342-00-7/2023-03-34

Date: 28.12.2023.

ANNUAL REPORT
FOR 2022

C O N T E N T:

The Center for Investigation of Accidents in Transport (hereinafter referred to as: the Center) is a special organization, which includes the Sector for Investigation of Accidents in Waterborne Traffic, that carries out professional activites related to the investigation of accidents in waterborne traffic, referring to the investigation of very serious maritime accidents, serious maritime accidents, maritime accidents, serious inland navigation incidents and inland navigation incidents in waterborne traffic.

Pursuant to the Article 7 of the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18), the Sector for Investigation of Accidents in Waterborne Traffic issues this Annual Report for 2022.

1. The Center

The Center has been formed pursuant to the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18).

Within Center, the following basic internal units are established: Sector for Investigation of Accidents in Air Traffic, Sector for Investigation of Accidents in Railway Traffic, Sector for Investigation of Accidents in Waterborne Traffic and General Affairs Department. (the structure of the Center is shown in Fig. 1.1.).

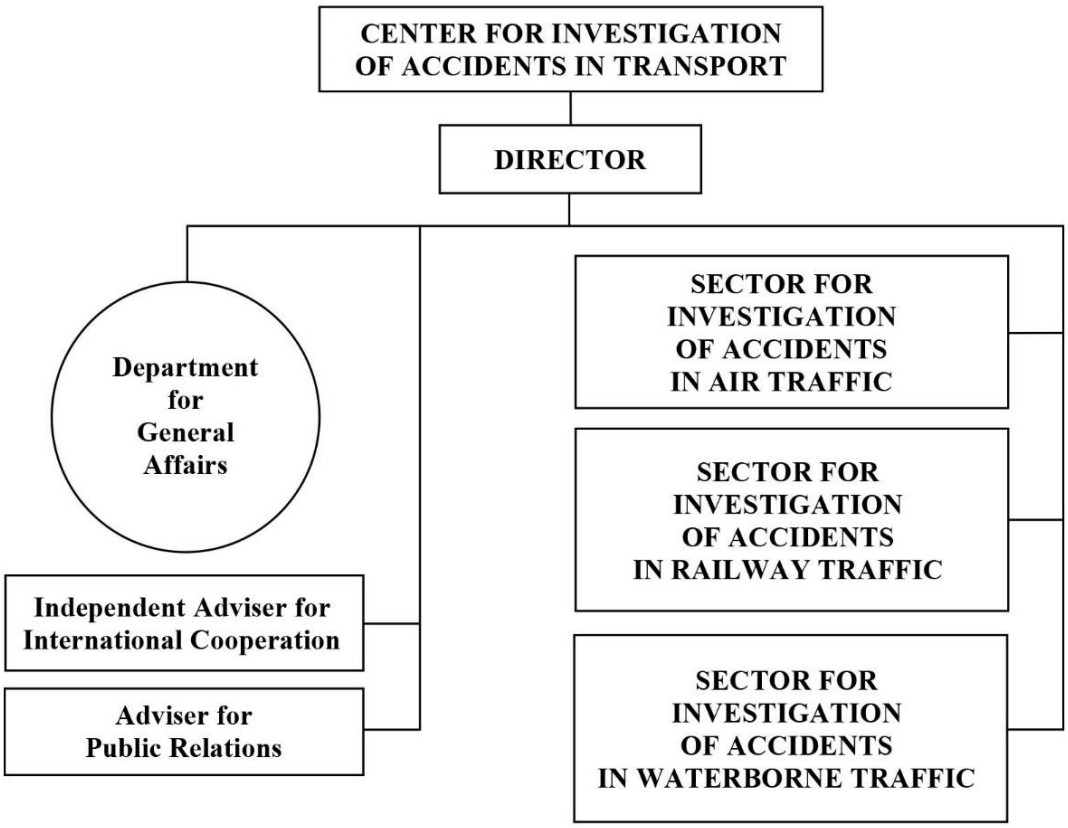


Figure 1.1. The structure of the Center

Sector for Investigation of Accidents in Waterborne Traffic became operational on June 1st, 2017 and it has a Main Investigator for Waterborne Traffic, Senior Adviser for Accident Coordination and Analysis in Waterborne Traffic and Independent Adviser for Accident Coordination and Analysis in Waterborne Traffic.

The Center, Sector for Investigation of Accidents in Waterborne Traffic, is independent in its functioning and independent from all other bodies and organizations competenet for waterborne traffic, as well as all the legal and physical entities whose interest may be in conflict with the tasks and authorities of the Center.

Professional work related to investigation is independent of criminal investigations or other parallel investigations that determine responsibility or the degree of guilt.

The investigation and determining the causes of accidents does not aim to establish criminal, economic, misdemeanour, disciplinary, civil or other liability.

Basic tasks of the Center, Sector for Investigation of Accidents in Waterborne Traffic, are:

- Investigation of very serious maritime accidents, serious maritime accidents, maritime accidents, serious inland navigation incidents and inland navigation incidents;
- Drafting and Publishing of Final reports on conducted specific investigations that may contain safety recommendations aiming to improve safety of waterborne traffic.

The Center performs other tasks stipulated by the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18).

2. Investigative procedure in the field of waterborne traffic

2.1. Types of maritime and inland navigation accidents and incidents

Pursuant to the Law on Investigation of Accidents in Air, Railway and Waterborne Traffic ("Official Gazette of RS" No. 66/15 and 83/18), the accidents and incident in waterborne traffic can be:

1. **Very serious maritime accident** is an accident which has, as a consequence, a total ship loss, fatality or serious pollution of the marine environment caused by the functioning of the vessel.
2. **Serious maritime accident** is a maritime accident which involves a fire, an explosion, a collision, stranding, damage to the hull or freeboard or a defect on them caused by severe weather conditions, ice, fracture of a hull or presumed fault at production which has, as a consequence, the inability to operate the main propulsion devices, major damage to the superstructure or severe structural damage (rupture of the submerged part of the hull) which in turn incapacitates the vessel and pollutes marine environment (serious leakage: when over 50 tons of oil and oil derivatives or similar hazardous substances are released into the sea) or a fault which requires the vessel to be tugged or provided with assistance from the coast;
3. **Maritime accident** is an event or series of events occured as a direct consequence of the vessel management or operation of the vessel, resulting in any of the foillowin consequences: fatality or serious injury of a person, loss or presumed loss or abandonment of the vessel, major damage to the vessel, stranding or incapacitation of the vessel or its participation in a collision, major damage to marine infrastructure which can endanger the vessel, the other vessels or a person, major damage to marine environment caused by damage to a vessel or to vessels.
4. **Maritime incident** is an event or series of events, differentiating from a maritime accident, that have occurred as a direct consequence of the vessel operation which is endangered or which can endanger the vessel safety, persons on the vessel or maritime environment.
5. **Serious inland navigation incident** is an unexpected accident in the inland waterborne traffic or usage of a vessel, waterway or facilities along it which leads to a total loss of the vessel, fatalities or injuries to persons aboard or major damage to the environment caused by leakage of over 50 tons of oil and oil derivatives and other hazardous substances;
6. **Inland navigation incident** is an emergency in internal waters which occurred during navigation or exploitation of an internal navigation vessel, waterway or facilities along it which leads to material damage, pollution of environment fatalities or injuries to persons aboard.

2.2. Registration/Obligation to notify

Authorities and organizations, shipowners, maritime companies, the master of the vessel or the person who replaces him, other members of the vessel's crew, persons who participated in a very serious maritime accident, serious maritime accident, maritime accident, maritime incident, serious inland navigation incident and inland navigation incident, as and all other legal and natural persons who have information about the occurrence, must inform the Center without delay.

2.3. Obligation to investigate

After a very serious maritime accident and a maritime accident, a safety investigation must be conducted if maritime vessels flying the flag of the Republic of Serbia were involved or if the state has an important interest regardless of the location of the very serious maritime accident and maritime accident.

In the case of serious maritime accidents, before making a decision to initiate a safety investigation, the Center performs a preliminary assessment of the need to undertake a safety investigation. If it decides that there is no need to conduct a safety investigation, it must record the reasons for such a decision and submit it to the European Commission. In the case of maritime accidents, the Center makes a decision on the need to undertake a safety investigation.

After every serious inland navigation accident in inland navigation, a safety investigation must be conducted, if it occurs on the waterway of the Republic of Serbia, regardless of the flag of the vessel flying.

In the case of navigation incidents, the Center, before making a decision to initiate a safety investigation, assesses the need to undertake a safety investigation, taking into account the severity of the inland navigation accident, the type of vessel and its cargo, as well as the possibility that the results of the safety investigation may affect the prevention of inland navigation incidents.

2.4. Safety investigation

The safety investigation in waterborne traffic is carried out with the aim of increasing the safety of navigation, preventing pollution of the marine environment, waterways from the vessel and reducing the risk of a very serious maritime accident, serious maritime accident, maritime accident, maritime incident, serious inland navigation accident and inland navigation incident.

The Rulebook on the method of conducting the investigation of accidents and incidents in maritime navigation ("Official Gazette of RS" No. 50/16) prescribes the method of conducting the investigation of very serious maritime accidents, serious maritime accidents, maritime accidents and maritime incidents in maritime navigation, as well as way of monitoring the implementation of safety recommendations. The provisions of the aforementioned Rulebook are also applied to the investigation of serious inland navigation incidents and inland navigation incidents in inland navigation, except for the provisions related to notification and data entry into the European Information Platform for Maritime Accidents (ECIP).

For the purpose of investigating every accident and incident in maritime navigation, every serious inland navigation incident and inland navigation incident in inland navigation, the Director of the Center establishes a Working group, led by the Main Investigator in waterborne traffic. The members of the Working group are other employees of the Center or the Sector for the Investigation of Accidents in Waterborne Traffic who participate in the investigation of accidents and incidents, as well as experts from outside the Center.

2.5. Investigation Report

The Rulebook on the content of the safety investigation report, the content of the notification, the content and the way of keeping the database on the safety investigation of accidents and incidents in waterborne transport ("Official Gazette of RS" No. 26/16) prescribes the content of the safety investigation report in more detail.

After the safety investigation in waterborne traffic, the Center prepares and publishes a report on the investigation, which in particular contains data on the vessel, data on navigation, data on maritime accidents and incidents, data on navigation incidents in inland navigation, the involvement of coastal services and emergency actions in maritime navigation, event description, analysis, conclusions and safety recommendations and appendices. The report does not contain personal data. The investigation report can be: simplified report, final report and interim report.

2.6. Safety recommendations

The Center issues safety recommendations based on data analysis and the overall results of the conducted investigation in waterborne transport.

Safety recommendations are sent to the parties to which they are issued, to competent authorities and organizations in the Republic of Serbia, as well as to competent authorities and organizations of interested countries and international organizations.

Bodies and organizations to which safety recommendations have been sent, except for competent bodies and organizations of other interested states, are obliged to take appropriate measures in order to implement them, and to submit a report to the Center at least once a year on the measures taken or planned to be taken.

Adopting safety recommendations aims at prevention and improvement of all technical and operational elements in the function of navigation safety.

3. Safety investigations initiated in 2022

In 2022 a total of 2 (two) investigations have been opened. Basic data on investigations initiated is given in Table 3.1.

Table 3.1. Review of the opened safety investigations

S. No.	Type	Date	Description	Location	Fatally injured	Seriously injured
1.	Inland navigation incident of the veseel "GAJO II"	6.8.2022.	the impact of the downstream pushed composition into the floating object	Left bank of the Sava River 7 km + 250 m	0	0
2.	Inland navigation incident of the veseel „ROVINARI"	1.10.2022.	the impact of the downstream pushed composition on boats and floating objects	Right bank of the Danube River at about 1145 km	0	0

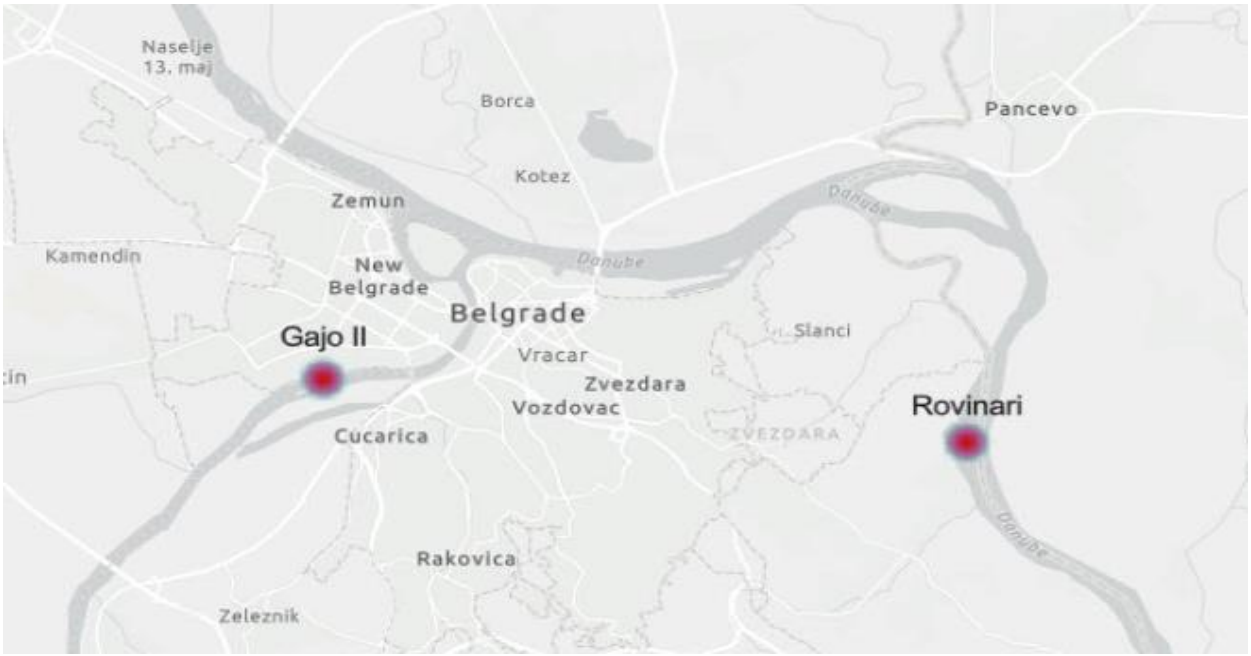
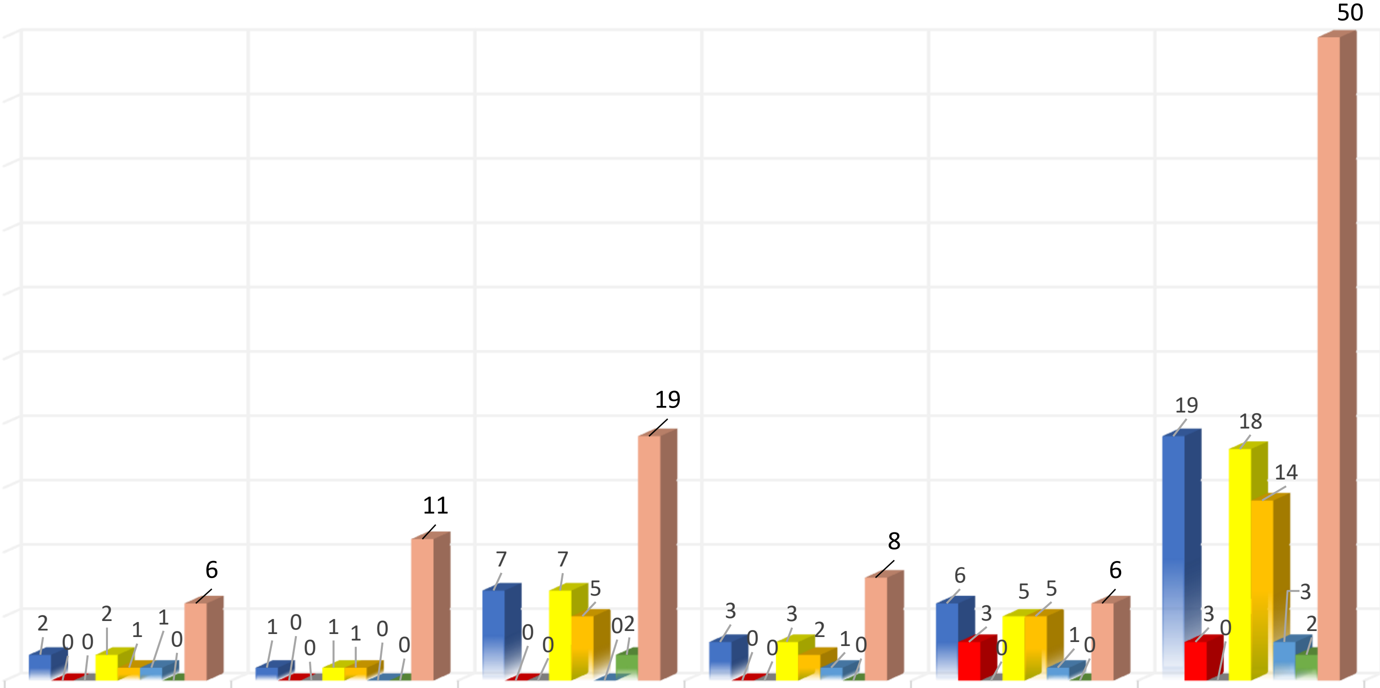


Figure 3.1. Inland navigation incidents location

On graph 3.1. a comparative overview of the initiated safety investigations by year on the Danube, Sava and Tisza rivers with the total number of fatally injured, injured, material damage and issued safety recommendations is given.

Graph 3.1. A comparative overview of the initiated safety investigations for the time interval from 2018 to 2022



	2022	2021	2020	2019	2018	Total
Safety investigation	2	1	7	3	6	19
Fatally injured	0	0	0	0	3	3
Injured	0	0	0	0	0	0
Material damage	2	1	7	3	5	18
Danube River	1	1	5	2	5	14
Sava River	1	0	0	1	1	3
Tisza River	0	0	2	0	0	2
Safety recommendations	6	11	19	8	6	50

3.1. Inland navigation incident of the vessel “GAJO II“

On August 6th, 2022. around 00:50 a.m., a inland navigation incident occurred, the impact of the downstream pushed composition of the vessel "GAJO II" flying the flag of the Republic of Serbia into a floating object (raft), under construction, which was anchored by the left bank of the Sava River at a position of around 7 km + 250 m.

Figure 3.1.1. Pusher boat "GAJO II"

The pusher boat "GAJO II" was sailing in the downstream direction and in its pushed composition had two empty barges with registration marks: "71610" and "71611", in the formation of two barges laterally in one row (2+0).

There is material damage to the barge "71610" from the downstream composition of pusher boat "GAJO II" and to the floating object (raft).

There were no fatalities or injuries. There is no spillage of dangerous substances into the watercourse.

The Center for Investigation of Accidents in Transport of the Republic of Serbia was notified of the inland navigation incident at 8:19 a.m. on August 6th, 2022 by the Head of the Department for Navigation Safety Inspection Affairs.

The investigative team of the Center for Investigation of Accidents in Transport of the Republic of Serbia went to the scene at 11:00 a.m. on August 6th, 2022.

3.2. Inland navigation incident of the vessel “ROVINARI“

On October 1st, 2022 around 4:00 p.m., an inland navigation incident occurred, the impact of the downstream pushed composition of the vessel "ROVINARI" into boats and floating objects (pontoons) without visible registration marks, which were anchored by the right bank of the Danube River at a position of about 1145 km.

Fuigure 3.2.1. Pusher boat “ROVINARI“

The pusher boat "ROVINARI" was sailing in the downstream direction and in its pushed composition had two empty barges with registration marks: "71609" and "71313", in the formation of two barges laterally in one row (2+0).

Material damage to boats and floating objects (pontoons) exists and will be determined later.

There were no fatalities nor injuries. There is no spillage of dangerous substances into the watercourse.

The Center for Investigation of Accidents in Transport of the Republic of Serbia was notified of the navigation accident on October 1st, 2022 by the Head of the Department for Navigation Safety Inspection Affairs.

The investigative team of Center for Investigation of Accidents in Transport of the Republic of Serbia went to the scene on October 2nd, 2022.

4. Safety investigations closed in 2022

4.1. Inland navigation incident of the vessel “GAJO II“

4.1.1. Short description

On August 6th, 2022. around 00:50 a.m., the vessel "GAJO II" in downstream navigation with two empty barges of registration marks “71611“ and “71610“ in one row, has hit the floating object under construction, which was anchored by the left bank of the Sava River at a position of 7 km + 250 m. Due to the impact of the downstream pushed composition of the vessel "GAJO II" a damage to the floating object has occurred.

Figure 4.1.1.1. Pushed composition of the vessel “GAJO II“

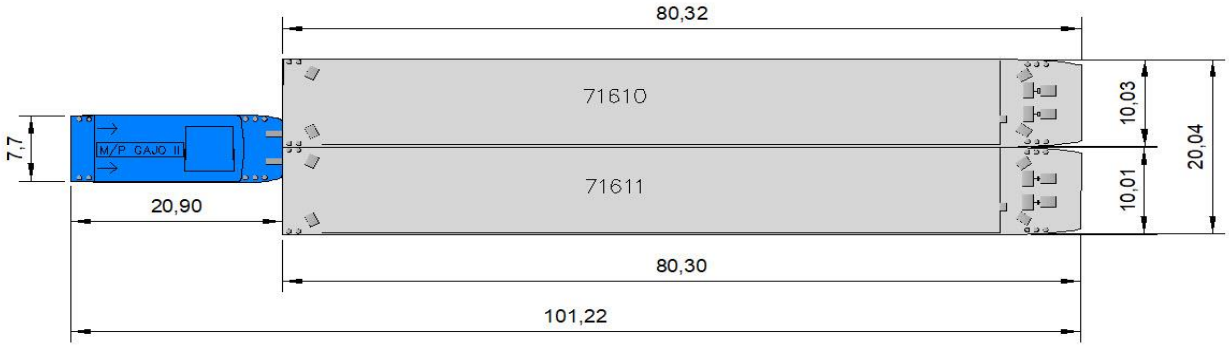


Figure 4.1.1.2. The form of the downstream pushed composition of the vessel "GAJO II"

During the on-site investigation, it was established that as a result of the inland navigation incident, there were no fatalities nor serious injuries, no damage was caused to the environment, no dangerous substances were spilled into the watercourse, as well as other consequences that could affect the regular flow of the vessel traffic in the given sector. As part of the investigative procedure, a detailed analysis of the movement of the pushed composition of the vessel "GAJO II" that led to the inland navigation incident was carried out. On that occasion, the trajectory, change in speed and course of the pushed composition were discussed in detail. The analysis also included the extraordinary event of the interruption of optical cables at 5 km + 900 m, according to the Letter from Telekom Srbija.

On the basis of the available data, obtained from the Directorate for Inland Waterways, the trajectory of the pushed composition "GAJO II" was reconstructed in the section from the

Ostružnica bridge, i.e. from 14 km + 800 m of the waterway of the Sava River, to the position 8 km before the zone in which the inland navigation incident occurred. This sailing period is relevant because it indicates the character of the sailing and the ability to control the sailing of the pushed composition, i.e. the correctness of the control devices and steering system, in the zone immediately preceding the place where the inland navigation incident occurred. It should be noted here that the AIS[1] (Automatic Identification System) transmitter, which is used for tracking the vessel, is located in the wheelhouse area on the pusher boat. This means that the push boats are located in front of the position registered by the AIS transmitter.

In Figure 4.1.1.3. the trajectory of the cargo composition "GAJO II" in the period between 11:45 p.m. and 11:59:37 p.m. is shown, as well as the dimensions of the waterway, which are determined by the left and right borders of the waterway. Having crossed the right border of the waterway at 11:58 p.m., at a speed of 7.22 km/h, relative to the bottom, the downstream pushed composition of the vessel "GAJO II" sailed into the axis of the waterway, gradually increasing its speed.

At 11:59:37 p.m. at a speed of 9 km/h, the pushed composition is sailing downstream along the left border of the waterway, which is shown in Figure 4.1.1.3. Initially, on this section, the vessel "GAJO II" first sails upstream about 100 m, then turns to sail downstream and descends downstream about 30 m at a speed of 3.6 km/h, which is shown in Figure 4.1.1.3. After that, the speed of the pushed composition begins to increase gradually, which indicates the beginning of sailing towards Ada Huja.

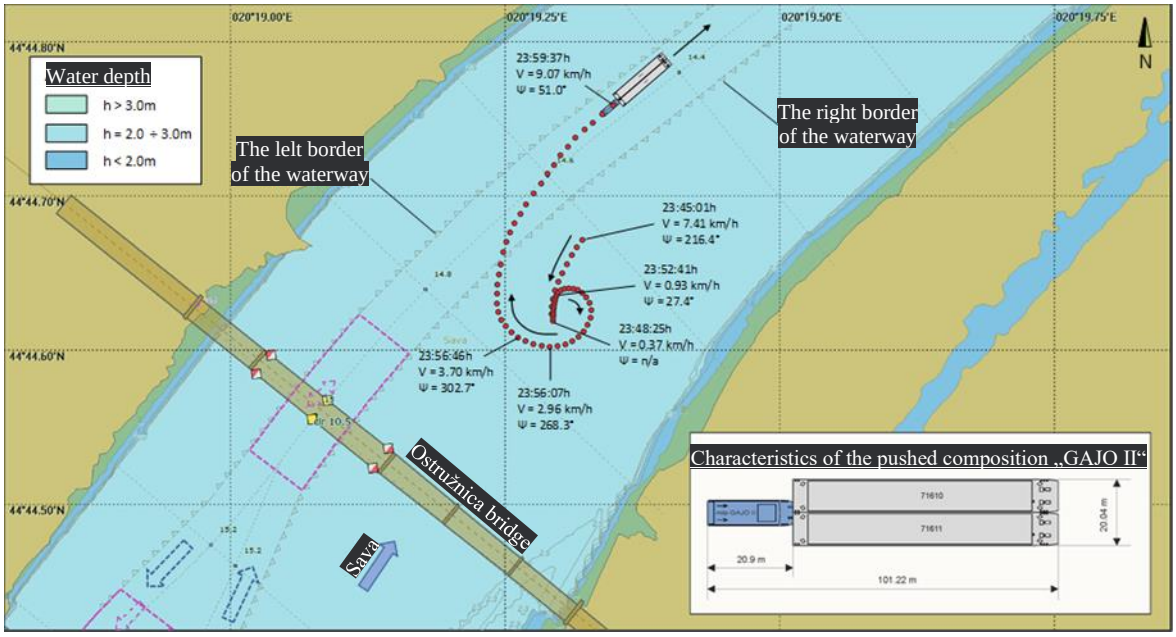


Figure 4.1.1.3. Trajectory of the pushed composition „GAJO II“ immediately after the start of the downstream sail

[1] AIS (Automatic Identification System) transponders identify the current position of the vessel using the global positioning system (GPS).

In Figure 4.1.1.4. the trajectory of the downstream pushed composition "GAJO II" in the next 2.300 m is shown. It is clearly observed that the pushed composition follows the waterway, moving between the left and right borders.

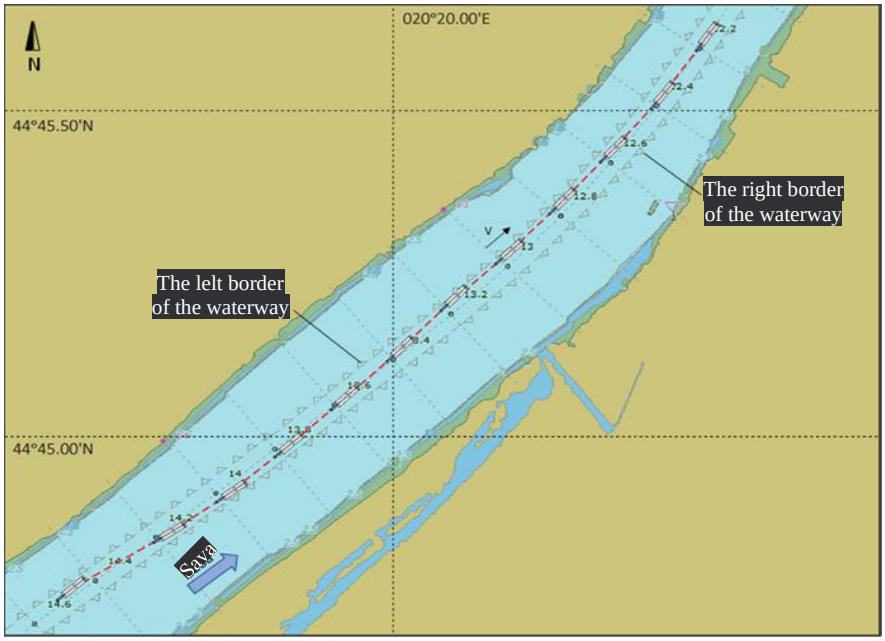


Figure 4.1.1.4. Trajectory of the pushed composition „GAJO II“ in the section between 14 km + 500 m and 12 km + 600 m

The trajectory of the downstream pushed composition "GAJO II" in the next 4 km is shown in Figures 4.1.1.5. and 4.1.1.6. The course and speed of the pushed composition are uniform and range between Ψ=40° and Ψ=50°, that is, around 9.5 - 10.0 km/h.

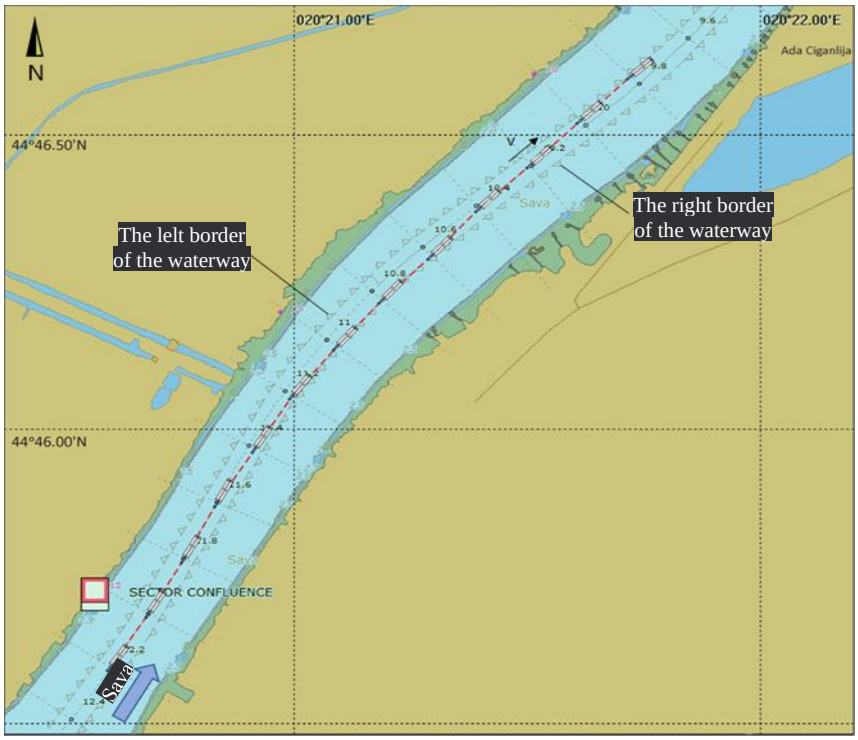


Figure 4.1.1.5. Trajectory of the downstream pushed composition "GAJO II“ on the section between 12 km + 200 m and 9 km + 800 m

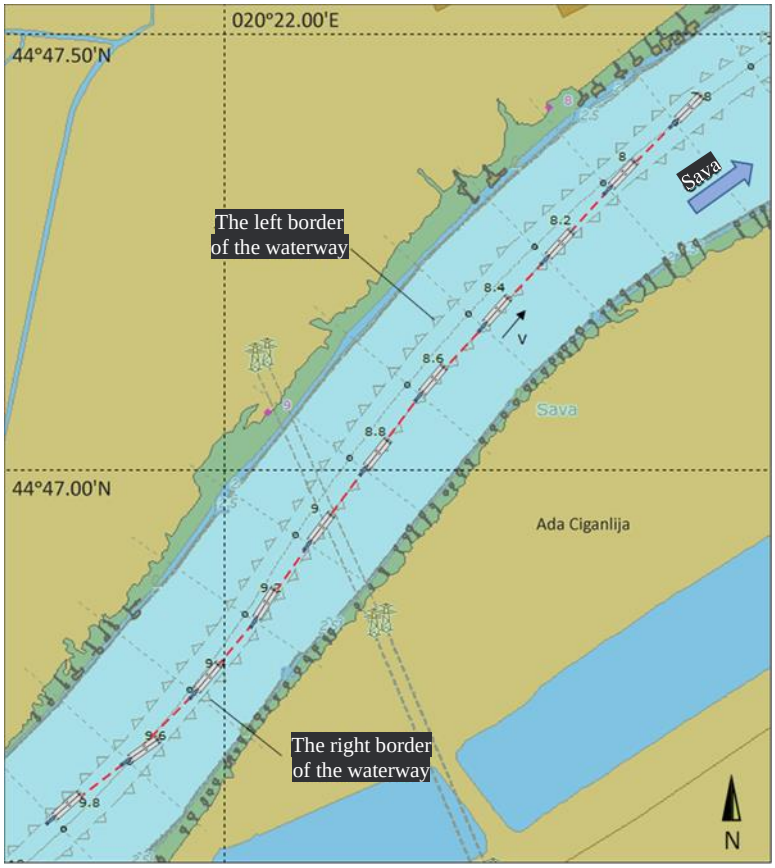


Figure 4.1.1.6. Trajectory of the downstream pushed composition“GAJO II“ on the section between 9 km + 800 m and 7 km + 800 m

From the trajectory shown in Figures 4.1.1.5. and 4.1.1.6. it can be observed that the pushed composition of "GAJO II" always sails within the limits of the waterway, at a uniform speed, which indicates the correctness of the drive, steering device and control devices, as well as the navigation safety algorithm sets.

Bearing in mind that the analyzed inland navigation incident occurred on this section (Fig. 4.1.1.7.) – an impact into a floating object (raft), the listed data below on the navigation of the pushed composition "GAJO II" are presented in more detail. Following the waterway, the pushed composition sails towards the considered section at a uniform speed of about 10 km/h, relative to the bottom, at a course of about Ψ=45°. At the height of Ada Međica, the waterway, following the natural curve of the river flow, meanders to the right. However, the pushed composition of "GAJO II" continues straight navigation and at 00:41:33 a.m., at a speed of 9.81 km/h and a course of Ψ=45°, crosses the left border and leaves the waterway at 7 km + 575 m. The pushed composition thus sails for another 230 m, approaching the left bank. This kind of movement indicates the lack of timely reaction of the master, navigator. It is only at 00:43:03 a.m. that an almost insignificant decrease in speed of 0.2 km/h (v = 9.63 km/h) is observed, while the course remains unchanged. At that moment, the bow of the barge "71610" is already too close to the left bank. This navigation continues until 00:43:51 a.m. when, at a course of Ψ=45.3°, the bow of the barge "71610" hits a floating object (raft) at 7 km + 250 m. Then there is a significant drop in speed to 7.22 km/h.

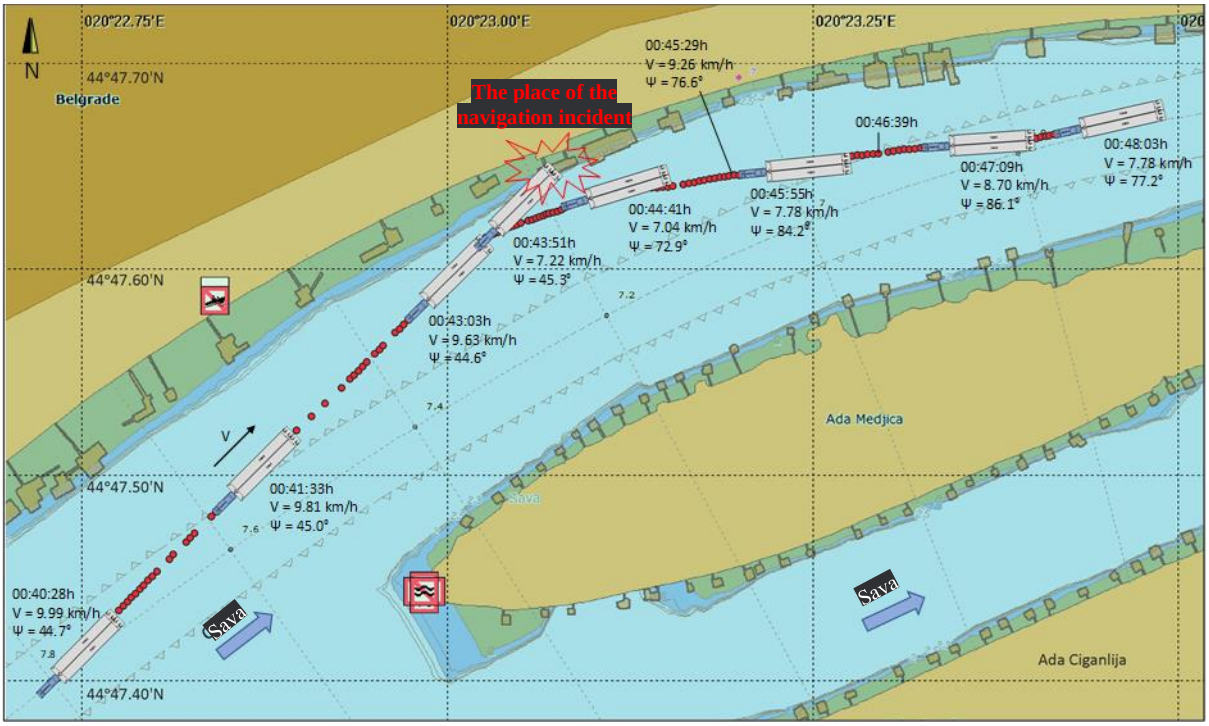


Figure 4.1.1.7. Trajectory of the pushed composition, a change in speed and the course angle in the zone where the impact into a floating object (raft) occured

After the contact, the left part of the bow of the barge "71610" slides down the raft, which, alongwith the rudder deflecting to the right and an additional drop in speed to 7.04 km/h, enables the pushed composition to continue downstream navigation. Less than a minute after the impact on the raft (00:44:41 a.m.), the pushed composition "GAJO II" sailed downstream at a speed of 7.04 km/h on a course of Ψ=72.9°, moving away from the place of the navigational accident. At 00:46:39 a.m., at a speed of 8.51 km/h, the pushed composition returns to the boundaries of the waterway.

After hitting the floating object (raft), the pushed composition "GAJO II" continues downstream navigation at a speed of about 8 km/h, at a course of about Ψ=80°.

Looking at the changes in the speed and course of the pushed composition immediately before the inland navigation incident, it can be concluded that the ship master did not react in time, did not adjust the speed and course of the pushed composition to the conditions on the waterway, which resulted in leaving the waterway and the impact of the pushed composition into a floating object (raft), which caused material damage to the floating object (raft) and to "71610".

The trajectory of the pushed composition of "GAJO II" after returning to the axis of the waterway is shown in Figure 4.1.1.8. In the next few minutes, the pushed composition sails in the middle of the waterway at a speed between 7.8 and 8 km/h. After 00:50:29 a.m., the pushed composition starts approaching the left edge of the waterway again, which it reaches two minutes later. The course angle is then Ψ=80.9°, and the speed relative to the bottom is 7.59 km/h. Keeping that course and without a significant speed correction, the downstream pushed composition sails along the left edge of the waterway for about 150 m.

At 00:54:43 a.m., a significant drop in speed is observed, after which there is a sudden change in the angle of the vessel's course, i.e. the bow of the pushed composition drifts to the right (to the right bank) without further movement in the downstream direction.

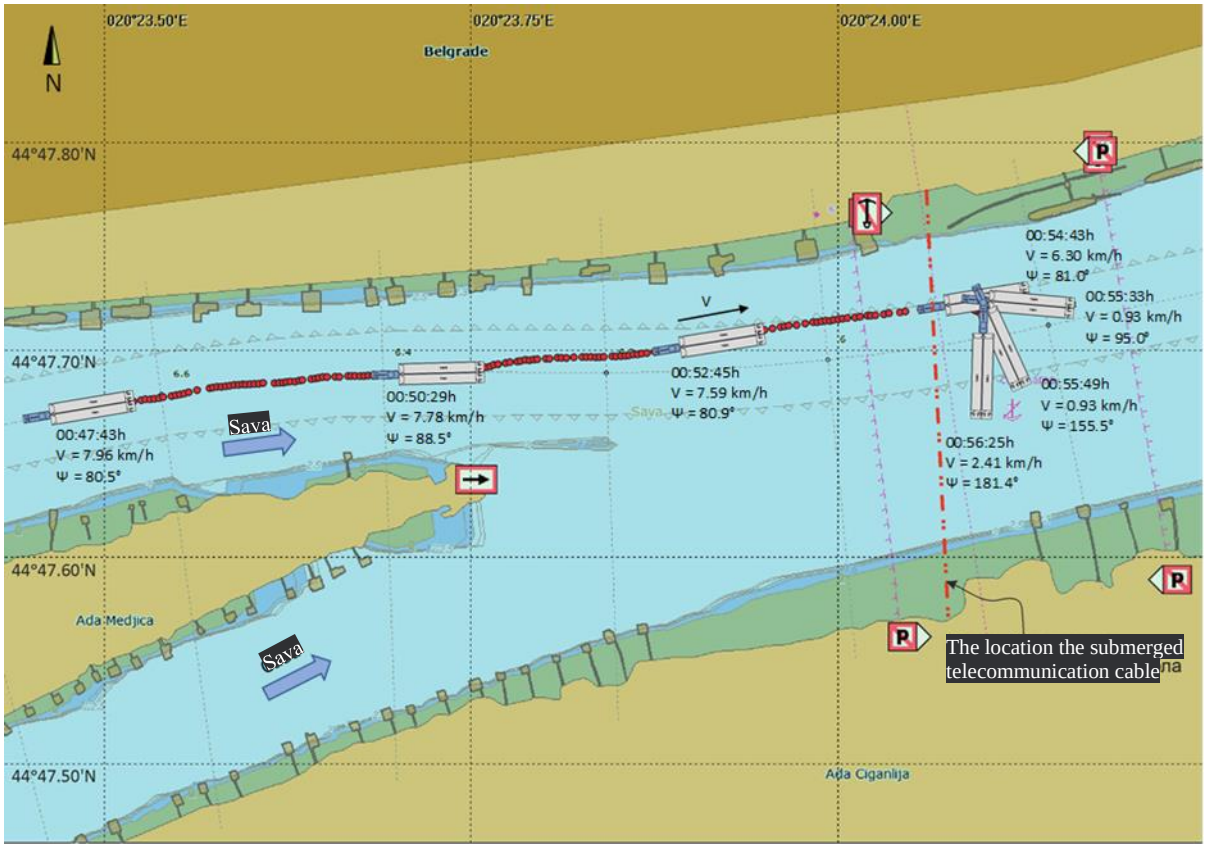


Figure 4.1.1.8. Trajectory of the pushed composition in the zone where the submerged telecommunication cable is found

This kind of movement, the navigation of the pushed composition clearly indicates the forced impossibility of downstream navigation. With the subsequent check, during the investigative procedure and the report of the crew members, it was established that the anchor on the barge "71610" had become detached during the navigation and that the anchor chain, 100 m long, had completely dropped - outside the sprocket.

If the length of the barge, the length of the pusher, the length of the dropped anchor chain, as well as the position of the submerged telecommunication cable are taken into account, the conclusion is clearly imposed that the anchor, which became detached and was dragged along the bottom (anchor plowing) during the navigation of the pushed composition "GAJO II", caught on the submerged cable, which led to the impossibility of further downstream navigation of the pushed composition and the described changes in speed and course. On that occasion, the submerged telecommunication cable was damaged.

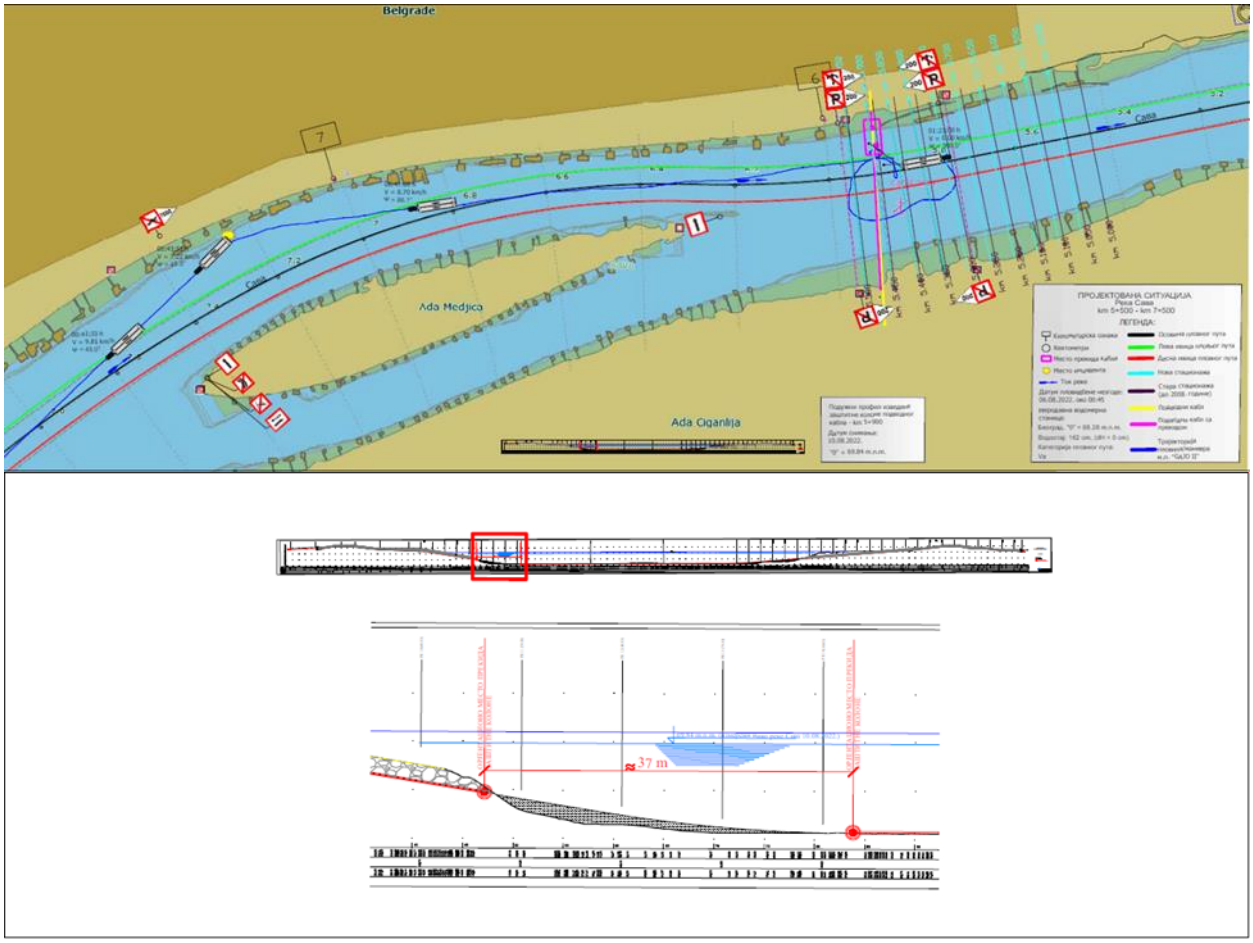


Figure 4.1.1.9. Damage to the submerged telecommunication cable

It should be emphasized that the anchor, after raising it before setting sail, was not secured with a stopper, which was the obligation of the crew member, crewman - the sailor, in accordance with Article 135 of the Law on Navigation and Ports on Inland Waters. The role of the stopper, which is located between the anchor windlass and the anchor throat chain pipes, is to take the force from the weight of the anchor and thereby relieve the windlass mechanism, and at the same time additionally secure the anchor and prevent unwanted release, knocking down of the anchor. In the case of the anchor device of the cargo barge "71610", the force, which is a consequence of the weight of the anchor (1.000 kg) was carried only by the peripheral brake, on the tension drum of the anchor windlass.

Bearing in mind the rules on safe navigation in inland waters, the following can be concluded:

- After the manipulative operational action of lifting the anchor from the barge "71611" was completed, by checking the security of the raised anchors on the barges "71610" and "71611", according to the statement, crewman sailor noticed that the stopper, for securing the anchor chain on the barges "71610" was not placed on the same, between the anchor windlass and the throat (chain pipes) of the anchor chain. The stopper prevents the anchor from falling into the water in the event that the peripheral brake on the tension drum of the anchor windlass fails. By the mentioned manipulation and handling of the deck equipment, i.e. by not placing the stopper in the prescribed place, the steward acted contrary to the rules of securing the anchor device against the possible fall of the anchor into the water during navigation. The crew member must carry out work on the vessel in accordance with the rules of navigation and the capacity in which he is boarded, in a manner that ensures safety of navigation that does not damage the vessel or its cargo, according to the Article 135 of the Law on Navigation and Ports on Inland Waters ("Official Gazzette RS' No.) 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41/18, 95/18, 37/19, 9/20 and 52/21).
- The shipmaster had the obligation to establish contact with the steward on deck after the technical operation of raising the anchor was completed and check whether the anchors were properly secured via the ship's internal radio link. In accordance with the general duty of due care, the shipmaster is obliged to take all precautionary measures required by the general duty of due care and navigational practice, in particular to avoid: endangering human life, damage to vessels, coasts, buildings, installations or other objects on the waterway, Article 48, paragraph 2, the Law on Navigation and Ports on Inland Waters ("Official Gazzette of the RS", No.) 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41/18, 95/18, 37/19, 9/20 and 52/21).

Taking into account the analysis of the downstream navigation of the pushed composition of the vessel "GAJO II", and that the inland navigation incident occurred around 00:43:51, it can be stated that the said composition was in operation, that is, it navigated in model (B).

By inspecting the vessel's Logbook in column 12, the navigation model data (A2) was entered, which means that the vessel "GAJO II", according to the Rulebook on the minimum number of crew members for safe navigation that ships and other vessels of the merchant navy must have ("Official Gazette of the RS", No. 28/15, 99/15, 3/17 and 8/19), hereinafter: Rulebook, did not have a crew on board that, in terms of number, composition and titles, enables safe navigation in the model (B), according to Article 15 of the Rulebook.

It can be noted from the vessel's Logbook that the vessel was in operation outside the navigation model (A2), which indicates that the crew performed work tasks during the time provided for crew rest, which is contrary to the Rulebook on the minimum number of crew members for safe navigation. Taking into account the analysis of navigation and the trajectory of movement in the impact zone of the downstream pushed composition, and the time of the extraordinary event, then the work activity of the shipmaster and crew members in the previous time period, indicates the workload in the given work mode. All the mentioned facts affected and resulted in the psycho-physical condition, i.e. the rest of the shipmaster, which is contrary to Article 140, paragraph 1 of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", No. 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41 /18, 95/18, 37/19, 9/20 and 52/21).

After the contact-impact with the floating object and despite the knowledge of the shipmaster that during the impact with the floating object, the anchor fell into the water from the barge "71610", the pushed composition of the vessel "GAJO II" continued its downstream navigation.

Arriving at the position of 5 km + 950 m, the anchor that came loose and was dragging on the bottom (plowing the anchor) during the navigation of the pushed composition "GAJO II" it caught the underwater cable and on that occasion the underwater telecommunication cable was damaged, which led to the impossibility of further downstream navigation of the pushed composition and the described changes in speed and course. On that occasion, the submerged telecommunication cable was damaged and torn. After stopping the pushed composition at the mentioned position, it turned upstream and anchored around 01:00 a.m. at 5 km + 750 m in the zone of the axis of the waterway. With the aforementioned actions, the shipmaster acted contrary to Article 172, paragraph 1, point 1) and 2) of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", No. 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41 /18, 95/18, 37/19, 9/20 and 52/21). namely:

• In the event of a inland navigation incident resulting in death or serious bodily injury, loss or extensive damage to property, the shipmaster is obliged to:

1) Keep the vessel at the site of the inland navigation incident until the investigation is completed, if the vessel's position does not endanger its own safety or the safety of other vessels.
2) Remove the vessel to the nearest place, if that vessel endangers its safety or the safety of other vessels and to try not to change the situation at the place of the inland navigation incident in order to determine the causes of the inland navigation incident.

Pursuant to Article 11.06, Chapter 11, additional local rules, sector "UŠĆE SAVE - SAVA MOUTH", Article 11.06 - berthing and anchoring, point 2. NAVIGATION RULES IN THE SAVA RIVER BASIN, berthing and anchoring of the vessels and compositions which do not show the marks from the Article 3.14 of these Rules (Additional marking of vessels that transport dangerous substances during navigation), except for boats, is allowed excluded from 9 km to 10 km + 300 m outside the waterway along the left bank (recommended place for berthing).

The shipmaster of the "GAJO II", after the inland navigation incident of the impact into a floating object in accordance with the aforementioned navigation rules, had the option to safely anchor the composition next to Ada Međica in the cross-sectional area of 7 km + 250 m, taking into account the ratio of the dimensions of the pushed composition of two units and the width of the watercourse at that position is 224 m, and the width of the designed waterway is 75 m. Another option for safe anchoring of the composition, allowed and recommended, from 9 km to 10 km + 300 m outside the waterway along the left bank.

On the basis of all written evidence collected during the safety investigation, the conclusion is reached that the shipmaster acted contrary to the rules of navigation, good navigation practice and legal provisions. After hanging the anchor for the telecommunications cable and breaking it, the crew anchored at the position of the waterway where the coastal signaling of the prohibition of anchoring and docking (prohibition signs A.6 and A.5) was placed.

As a result of the contact - impact with the left bow part of the barge "71610" on the outer side of the floating object, material damage was done and the following was determined by visual inspection:

• The first initial lateral contact in the zone of the edge of the deck at a distance of 91 cm from the first vertical metal pillar, square cross-section (Figure 4.1.1.10.).

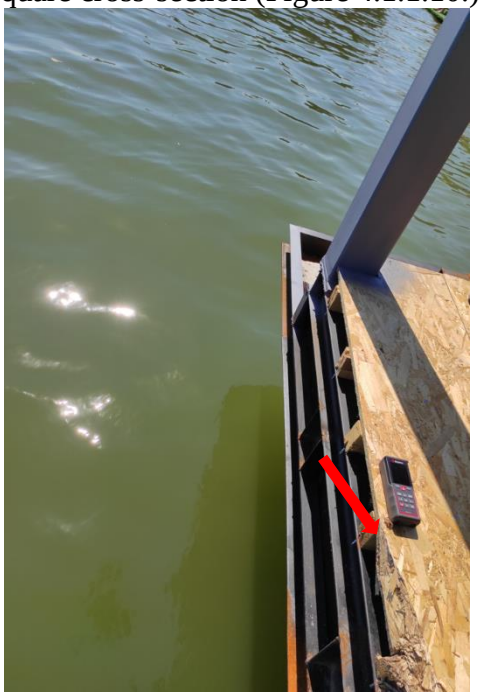


Figure 4.1.1.10.

- The contact of the barge continues continuously laterally downstream along the length of the outer-edge part of the deck of the floating object (Figure 4.1.1.11.).

Figure 4.1.1.11.

- At a distance of 2.47 m from the mentioned undamaged supporting vertical metal pillar, deformation of the outer-edge part of the lower base metal structure that connects the pontoons was observed (Figure 4.1.1.12.).
- Damage to the 4.91 m long side vertical metal grating (Figure 4.1.1.12.).

Figure 4.1.1.12.

- Damage to five transverse stiffeners (Figure 4.1.1.13.).

Figure 4.1.1.13.

- Five vertical metal supporting columns suffered tearing stress from the stiffening of the anchor point of the deck structure, they also suffered plastic deformation along their length, due to the action of the resulting axial force (Figure 4.1.1.11).
- The sixth and last downstream supporting vertical metal supporting pillar rolled out from the anchoring point of the deck metal structure, suffered plastic deformation along its entire length with partial fracture and separated from the final supporting horizontal metal beam of the roof structure (Figure 4.1.1.14.).

Figure 4.1.1.14.

- On the final part, the circumferential metal longitudinal grid of the roof structure suffered plastic deformation (Figure 4.1.1.14).
- Vertical transverse metal lattice supporters between the first and second rows of supporting pillars, suffered partial plastic deformation, namely: on the second external support towards the inner part of the deck, as well as on the third, fourth, fifth and sixth pillars (transverse lattice stiffeners between the supporting pillars), Figure 4.1.1.15.

Figure 4.1.1.15.

- The second supporting metal vertical pillar rolled out from the stiffening of the anchor point of the deck metal structure, and complete plastic deformation with torsion elements. The same separated from the stiffening in the resistance of the support on the roof structure and caused partial plastic damage to the transverse metal lattice structure of the roof (Figure 4.1.1.16.).

Figure 4.1.1.16.

- Damaged OSB boards of the deck along the entire length of the contact, as well as supporting wooden beams with insulation (Figure 4.1.1.17.).

Figure 4.1.1.17.

- On the access bridge, the deformation of the joint connecting the two segments of the deck walkway (Figure 4.1.1.18.).

Figure 4.1.1.18.

- Longitudinal deformation of the metal bow and stern bumper, due to the effect of stress force on pressure (Figure 4.1.1.19. and 4.1.1.20.).

Figure 4.1.1.19.

Figure 4.1.1.20.

- Deformation of the deck path (plastic convex deformation of the shape of a triangle). At the end of the access bridge in the connection zone with the deck of the floating object (Figure 4.1.1.21.).

Figure 4.1.1.21.

- Deformation of the horizontal metal holder of the downstream pile (Figure 4.1.1.22.).

Figure 4.1.1.22.

A visual inspection of the barge with the registration No. "71610" revealed the following:

• On the left side of the hull in the area of the bow on the bend that joins the side plating and the bow transom, plastic deformation of the plating and wale about 120 cm. At the end of the initial contact on the bow transom vertically about 70 cm, the plating is separated from the structure (Figure 4.1.1.23.).

Figure 4.1.1.23.

- A signal mast with a base spread out-torn off from the deck foundation, a rectangular foundation (Figure 4.1.1.24.).

Figure 4.1.1.24.

- Torn off deck support pillar with the cabinet of electrical installations and the command for manipulative operations with the ship's anchor. As part of the mentioned fixed deck equipment, deformed metal inlets for electrical cables (Figure 4.1.1.25.).

Figure 4.1.1.25.

- Metal protective box with a support partially separated from the anchor windlass reducer housing (Figure 4.1.1.26.).

Figure 4.1.1.26.

- The damaged anchor windlass is not functional for manipulative operations, capable of lifting the anchor once.
- A metal pillar support with a rectangular profile of 150 × 150 mm was observed on the bow deck, torn off from the floating object (Figure 4.1.1.27.).

Figure 4.1.1.27.

4.1.2. Issued safety recommendations

Shipowner/Owner
HIDRO-BAZA AGREGATI Ltd.

SR_01/22 The shipmaster had the obligation to establish contact with the crewman -sailor on the deck after the technical operation of lifting the anchor was completed and via the ship's internal radio link to check whether the anchors were properly secured. In accordance with the general duty of care, the ship master is obliged to take all precautionary measures required by the general duty of due care and navigational practice, in particular to avoid: endangering human life, damage to the vessels, coasts, buildings, installations or other objects on the waterway, Article 48, paragraph 2, Law on Navigation and Ports on Inland Waters.
It is recommended to the shipmaster of the vessel "GAJO II", that after the technical operation of the maneuver of lifting the anchor from the water, to place it in the intended berth, which is an integral part of the construction of the ship's hull according to the technical rules of construction. According to the instructions for handling the anchor windlass, the anchor should be provided with a fuse (stopper) on the anchor chain between the anchor windlass and the throat (chain pipes) of the anchor chain, in order to prevent the possibly uncontrolled loosening of the brake on the drive shaft of the anchor windlass and the anchor falling into the water. Based on Article 144, paragraphs 1 and 4 of the Law on Navigation and Ports on Inland Waters ("Official Gazette of the RS", No. 73/2010, 121/2012, 18/2015, 96/2015, 92/2016, 104/2016, 113/2017 and 41/2018), the shipmaster is obliged to check the ship's condition before departure and take care of the maintenance of the devices and equipment on the ship.

SR_02/22 Taking into account the analysis of the downstream navigation of the pushed composition of the vessel "GAJO II", and that the inland navigation incident occurred around 00:43:51, it can be stated that the aforementioned composition was in operation, that is, it sailed in model (B).
By inspecting the vessel's Logbook in column 12, the navigation model data (A2) was entered, which means that the vessel "GAJO II", according to the Rulebook on the minimum number of crew members for safe navigation that ships and other vessels of the merchant navy must have ("Official Gazette of the RS", No. 28/15, 99/15, 3/17 and 8/19), hereinafter: Rulebook, did not have a crew on board that, in terms of number, composition and titles, enables safe navigation in the model (B), according to Article 15 of the Rulebook.
From the vessel's Logbook, it can also be stated that the vessel was in operation outside the navigation model (A2), which indicates that the crew performed work tasks during the time provided for crew rest, which is contrary to the Rulebook on the minimum number of crew members for safe navigation. Taking into account the analysis of navigation and the trajectory of movement in the impact zone of the downstream pushed composition, and the time of the extraordinary event, then the work activity of the shipmaster and crew members in the previous time period, it is indicative that the workload is present in the given work mode. All the mentioned facts affected and resulted in the psycho-physical condition, i.e. the shipmaster, which is contrary to Article 140, paragraph 1 of the Law on Navigation and Ports on Inland Waters ("Official Gazette of the RS", no. 73/2010, 121/2012, 18/2015, 96/2015, 92/2016, 10 /2016, 113/2017 and 41/2018).
It is recommended to the shipmaster of the "GAJO II", taking into account that he sailed in model (B) and did not have a crew on board that, in terms of number, composition and titles, enables him to sail safely in model (B), in accordance with Article 15. of the Rulebook, to be obliged to comply

with the provisions of the Rulebook and the mode of operation of navigation according to the model for which he has a crew that, in terms of number, composition and titles, enables safe navigation, Article 3 of the Rulebook**.**

SR_03/22 The shipmaster of the "GAJO II", after the inland navigation incident of impact into a floating object in accordance with the previously mentioned navigation rules, had the option to safely anchor the composition next to the Ada Međica in the cross-sectional area of 7 km + 250 m, taking into account the ratio of the dimensions of the pushed composition of two units and the width of the watercourse at that position is 224 m, and the width of the designed waterway is 75 m. Another option for safe anchoring of the composition, allowed and recommended, from 9 km to 10 km + 300 m outside the waterway along the left bank.
On the basis of all written evidence collected during the safety investigation, the conclusion is reached that the shipmaster acted contrary to the rules of navigation, good navigation practice and legal provisions. After hanging the anchor for the telecommunications cable and breaking it, the crew anchored at the position of the waterway where the coastal signaling of the prohibition of anchoring and docking (prohibition signs A.6 and A.5) was placed.
It is recommended to the shipmaster of the "GAJO II", in accordance with the above, that in the event of an inland navigation incident in which there is fatal injury or serious bodily injury of a person, loss or damage of a large amount of property, the shipmaster is obliged to:

1) Detain the vessel at the site of inland navigation incident until the investigation is completed, if the vessel's position does not endanger its own safety or the safety of other vessels.
2) Remove the vessel to the nearest place, if that vessel endangers its own safety or the safety of other vessels and to try not to change the situation at the place of the inland navigation incident in order to determine the causes of the inland navigation incident.
3) To comply with the Navigation Rules on the Sava River Basin (International Commission for the Sava River Basin Zagreb, 2013), in accordance with Article 11.06, Chapter 11, supplementary local rules, sector "UŠĆE SAVE - SAVA MOUTH", Article 11.06 - berthing and anchoring, point 2. NAVIGATION RULES IN THE SAVA RIVER BASIN: berthing and anchoring of vessels and equipment, which do not display the markings from Article 3.14 of these rules (Additional marking of vessels transporting dangerous substances during navigation), except for boats, is allowed only from 9 km to 10 km + 300 m outside the waterway along the left bank (recommended place to berthing).

4.2. Inland navigation incident of the vessel “ROVINARI“

4.2.1. Short description

On October 1st 2022 around 4:00 p.m., the vessel "ROVINARI" in downstream navigation with two empty barges with registration marks "71609" and "71313" in one row, left the waterway, which resulted in impact into the boats and floating objects (pontoons). without visible registration plates. The mentioned vessels were anchored by the right bank of the Danube River, at a position of 1145 km + 400 m. As a result of the impact of the downstream pushed composition of the "ROVINARI", material damage was done to the floating objects and boats.

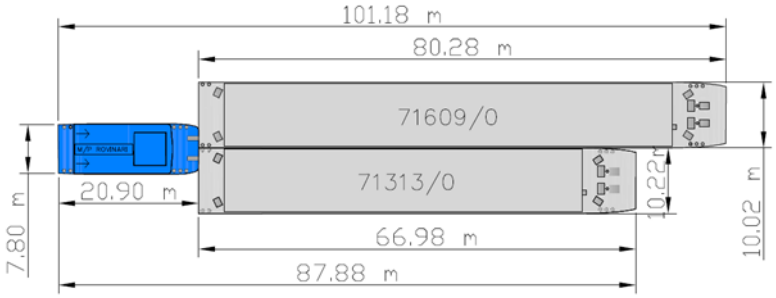


Figure 4.2.1.1. Model of the pushed composition the vessle “ROVINARI“

During the investigation, it was established that as a result of the inland navigation incident, there were no victims and no serious injuries, no damage was caused to the environment, nor was there any spillage of dangerous substances into the waterway, as well as other consequences that could affect the regular flow of the vessel traffic in the given sector.

Based on the request of the Center, the Directorate for Inland Waterways submitted for inspection historical data from the system for locating and tracking vessels, within the RIS system (River Information System Serbia), in the form of files with data from the AIS system for object MMSI[2] No. 279202417 , ENI No. 36000079, name "ROVINARI":

1. pdf, tabular overview of AIS messages from the given object for the period of time from 3:40 to 4:20 p.m., on October 1st 2022.

2. .kml, a format that allows the visualization of the vessel's trajectory with the help of the Google Earth application for a given period of time.

3. .mp4, video from AtoNs[3] application for locating and tracking vessels for a given period of time.

[2] MMSI No. (Maritime mobile Service Identity Number) is the international maritime radiocommunication identification number;
[3] AtoNs (Aids to Navigation)

According to these data, the following can be stated:

• According to the available data from the video recording on the ENC map in real time, the downstream navigation and positions on the navigation corridor (waterway) of the pushed composition of the vessel "ROVINARI" from 1148 km + 600 m to the position when the downstream composition at 1147 are shown km + 800 m over the right edge of the waterway leaving the same, on course Ψ=201.1°, at speed v=11.3 km/h at 15:48:07 (Figure 4.2.1.2.).

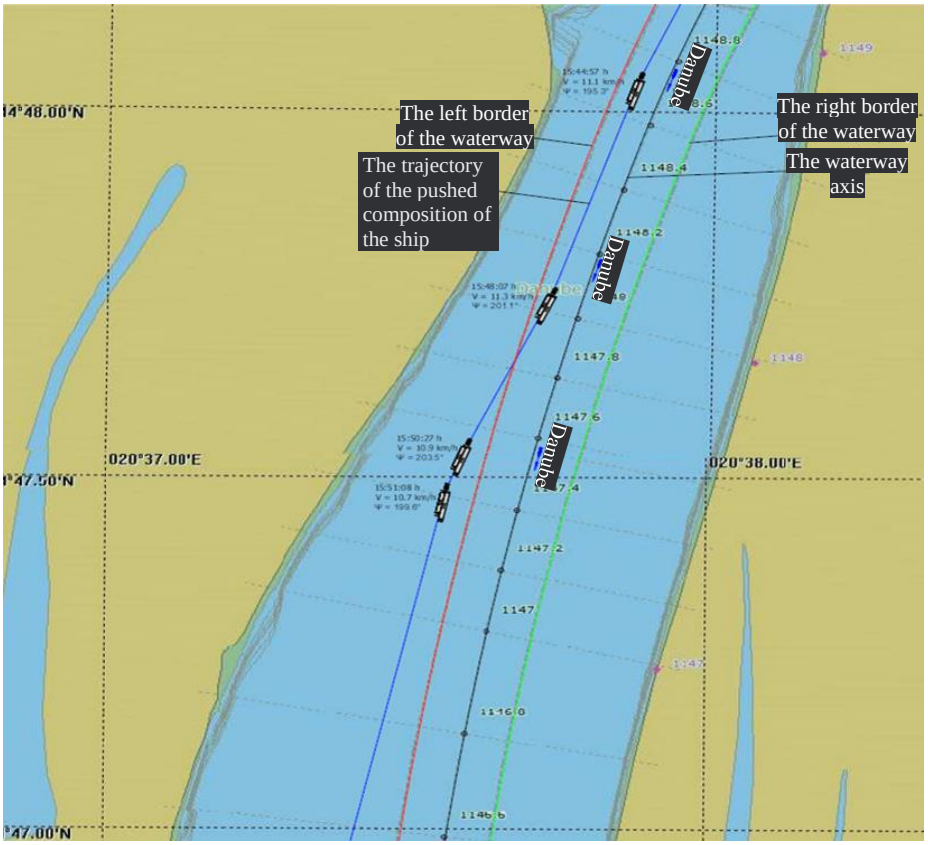


Figure 4.2.1.2.

- By looking at the trajectory of the downstream navigation of the vessel composition after leaving the navigation corridor, it can be stated that the position of the vessel composition is in the navigation corridor and follows the waterway at a relatively constant speed of about 10.7 km/h and with minimal changes in the bow course in relation to the true meridian (N), Ψ=193.6° - 191.4°, sails towards the right bank at a speed of about 10.7 km/h.
- The above navigation parameters are constant until the moment of the impact of the downstream vessel composition on the right bank at 04:04:46 p.m. at the position of 1145 km + 400 m, when the speed of the formation drops to 0.7 km/h, at the moment of the initial impact, change of speed and course in time are given on the diagram (Figure 4.2.1.3.). After hitting the shore, the vessel composition suddenly changes its cardinal course over the left side and amounts to Ψ=125.7° and continues sailing towards the right edge of the waterway, i.e. towards the left bank (Figure 4.2.1.4.), where it performed the maneuver of anchoring the composition closer to the shore, out of the waterway at 4:10 p.m. at 1145 km.

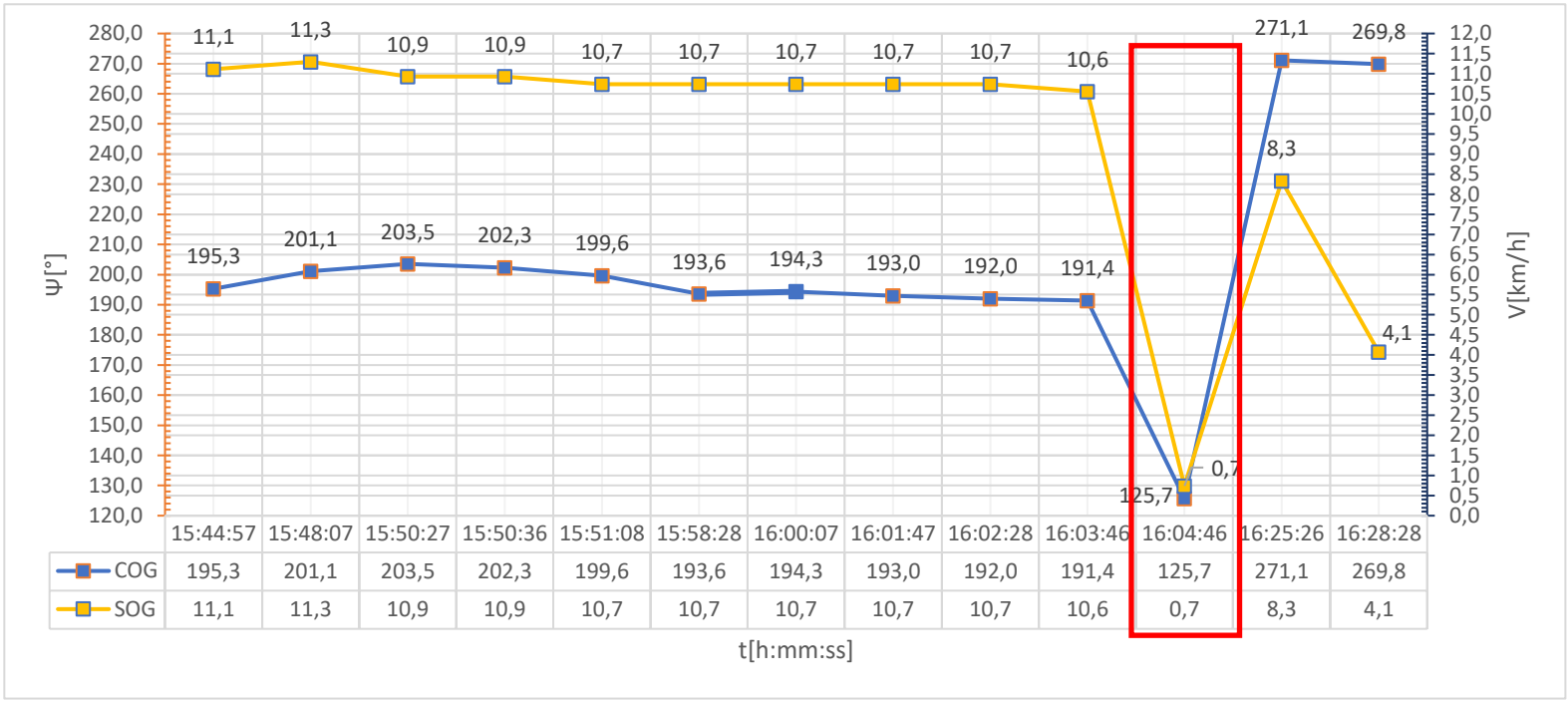


Figure 4.2.1.3.

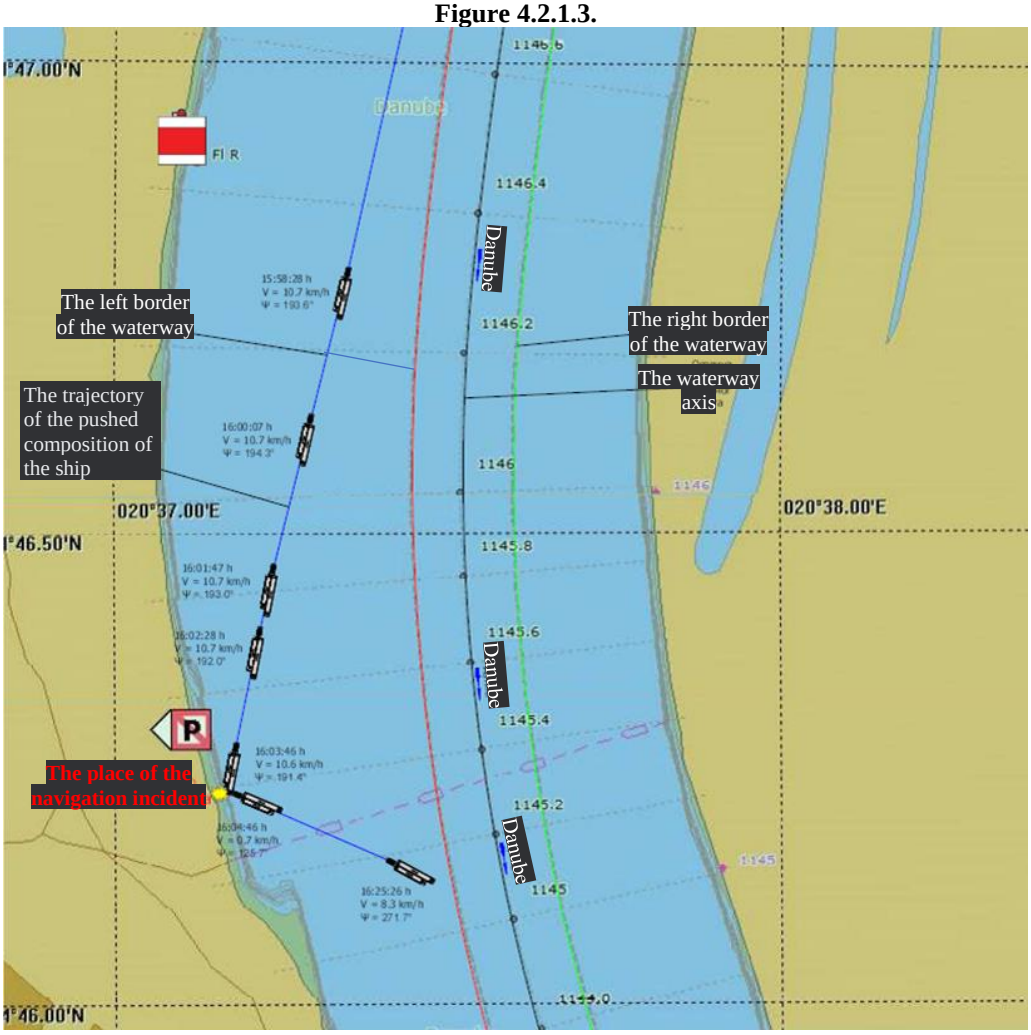


Figure 4.2.1.4.

Based on the statement of the navigation officer who managed the respective downstream composition, that is, the loss of steering control occurred at the moment when he fell asleep at the command desk, which in the subsequent period of time resulted in the impact of the vessels composition on the right bank.

After the inland navigation incident, a breathalyzer test was performed on the navigation officer on shift, who fell asleep on the command bridge. Based on the Official Note of the Ministry of Interior traffic police patrol at 6:50 p.m., the navigation officer was breathalyzed and the value of blood alcohol concentration was measured at 1.48 ‰.

Based on the analysis of the inland navigation incident of the downstream pushed composition of the vessel "ROVINARI" and the toxicological expert opinion of the Faculty of Pharmacy - Department of Toxicology of the University of Belgrade, the following can be stated:

• **Toxicological evaluation of the effects on the health and abilities of an intoxicated person who has committed an offense in waterborne traffic**

Based on the data of the case, the findings of the concentration of ethanol in the blood (Blood Alcohol Concentration, BAC), the following results were produced:

- Calculation of the BAC value at the time of the incident.
- Effects on health of the calculated BAC at the time of the accident.

Toxicological data analysis and evaluation:

Alcoholic beverage (four beers):

	option: a (min)	option: б (max)
Vol. (volume, mL)	285	375
Conc. (% ethanol/100 mL)	2.7	4.8
Number of drinks	4	4
The total amount of entered al. drinks(mL)	1140	1500
Total amount of ethanol ingested (g)	30.78	72

The amount of alcoholic drink and the concentration of ethanol in the drink vary depending on the form and type of beer consumed. According to the statement of the person who committed the offense, we did not find out what kind of beer was consumed, except that he drank "four beers" before work. According to the available data on the amounts and concentrations of ethanol in beers available on the market or in catering establishments, two final options were adopted when analyzing this case, from the minimum volume and at the same time the minimum concentration, to the maximum volume and strength of beer.

Intoxicated person:

Gender	male
Age (yrs.)	62
Body mass : 70 kg	70000
r (distribution volume for men):	0.55
Proportion of absorbed ethanol from GIT (bioavailability):	0.789

Events according to the timing (24-hour, hh:mm)

Time of consumption of alcoholic beverages (approximately "0" time is taken)[4]	2:00 p.m.
The time of the inland navigation incident	4:10 p.m.
Time of blood sampling	6:50 p.m.

The departure of the vessel (2:00 p.m.) corresponds to the beginning of the work shift and the "0" time of the drink intake. From then until the incident (4:10 p.m.), 2.16 hours passed, and until the blood sampling (6:10 p.m.), 4,833 hours. This information is important for the time reduction of BAC.

Table 4.2.1.1. Blood alcohol concentrations at the time of arrival at work ("0" time), incident and sampling, calculated according to Widmark (theoretical maximum values) and alcohol test findings (after sampling).

Blood ethanol concentration (BAC, ‰)	**Time of drinking, incident and sampling**			
	2:00 p.m. (WE)	**4:10 p.m.** (WE)	**6:50 pm.** (WE)	**6:50 p.m.** (ALCOTEST)
Option: a (min)	0.63	0.60	0.56	1.48
Option: b (max)	1.48	1.44	1.40	

The BAC values listed above correspond to the theoretical scenario, therefore the BAC level was calculated in the real scenario, which is why they are reduced by up to 20% (at the expense of drinking for a certain period longer than "a drink in a gulp" and due to the unknown whether the stomach is full or not, and thus in favor of " mitigating circumstances" for an intoxicated person.

At the time of the incident (4:10 p.m.) BAC was:

1. BAC According to WE: BAC 1.44 ‰ (max-theoretical scenario) or 1.15 ‰ (80% realistic scenario)
2. Recalculated value of BAC according to the analogy of calculated (WE) and measured values for the term 6:10 p.m., proportion: 1.53 ‰
3. The recalculated BAC value according to the alcohol test for 6:10 p.m. (1.48 ‰), by increasing the value obtained in the laboratory by the amount of ethanol eliminated in the meantime (0.04 g/100 mL/2.66 h, i.e. 0.04 ‰): 1.52 ‰

Given the discrepancy in BAC values for the term 6:10 p.m., a valid interpretation is that the proportion of these two values is used to calculate the BAC at the time of the incident or the calculated amounts of ethanol eliminated in the meantime are added to the measured BAC values. Therefore, approach 2 and 3 are considered only valid with the introduction of further conclusions.

[4] Widmark's equation does not recognize the way of drinking, but the cumulative amount of ethanol ingested. This approach is theoretical and implies the intake of alcoholic beverages "in a gulp" and on an "empty stomach". In a real scenario, these values can be and are generally lower by up to 20%. It is clear that generally a larger amount of alcoholic beverages is taken over a longer period of time. In addition, the fact whether it is drunk on a "full" or "empty" stomach has a significant impact on the bioavailability of the ingested alcohol, and thus on reaching a certain concentration in the blood.

Dose-effect on health:
A tabular representation of the dose-effect range on health and body functions is given. Bearing in mind that the recalculated BAC values in this particular case are at the very border of two ranges of BAC concentrations (0.08–0.15 ‰ and 1.5–3 ‰) and the effects described for them (and taking into account a number of other individual and objective factors that can affect BAC levels a tabulated list of symptoms for both BAC ranges is provided.

Table 4.2.1.2. Dose-effect of ethanol ratios for human

BAC	**Effects on health**
0.8–1.5 ‰	• Slurred speech • Impaired balance and coordination • Reflexes slowed down • Visual impairment • Unstable emotions • Nausea, vomiting
1.5–3 ‰	• He cannot walk without help • Apathetic, sleepy • Hard breathing • Unable to remember events • Loss of bladder control • Possible loss of consciousness

Health risk:
The amount of ingested ethanol (absolute) corresponding to a value of 54.4 g/day belongs to the category of heavy drinking, and the corresponding MOE (English Margin of Exposure, MOE) value is 0.485. Lower MOE values correspond to greater health risk.
Based on the obtained data on the intake of alcoholic beverages, in this particular case, the exposure to ethanol was about 72 g/day, i.e. The MOE is 0.36, which corresponds to the "heavy drinking" category.

Conclusion of the toxicological evaluation

1. The calculated BAC value at the time of the incident (4:10 p.m.) was: 1.52-1.53 ‰.
2. This amount of ethanol intake falls into the category of heavy drinking.
3. Health effects confirm that an intoxicated person in this state was not capable of responsibly operating a vessel.

Pursuant to the above, the deck officer on shift, who was in a state of intoxication while performing his duties and caused an inland navigation inccident, acted contrary to Article 140, paragraph 1, of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", No. 73 /10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41/18, 95/18, 37/19, 9/20 and 52/21).

Due to the initial impact of the bow part of the pushed composition of the vessel "ROVINARI" on boats and floating objects (pontoons), they were completely and partially pushed out of the water and stranded on the shore. A visual inspection revealed the following damages:

- Metal pontoon in the shape of a cube, connected in the form of an (L) construction, suffered longitudinal and transverse plastic deformations (Figure 4.2.1.5).

Figure 4.2.1.5.

- Catamaran-type torus pontoon, the same connected to each other by a metal lattice structure, suffered plastic deformation and stranded on the shore (Figure 4.2.1.6).

Figure 4.2.1.6.

- Pontoon on barrels, most of the surface stranded on the shore. Deck board covering damaged and separated from the lattice supporting structure (Figure 4.2.1.7.).

Figure 4.2.1.7.

- Five metal boats without registration plates pushed and stranded on the shore suffered plastic deformation of the hull, while another boat was submerged under the water mirror and pressed by the pontoon structure (Figure 4.2.1.8. and 4.2.1.9.).

Figure 4.2.1.8.

Figure 4.2.1.9.

4.2.2. Issued safety recommendations

Ship owner/Owner
HIDRO-BAZA AGREGATI Ltd.

SR_01/22 The navigation officer on shift of the vessel "ROVINARI", who was in a state of intoxication while performing his duties as a navigation officer on the command bridge and caused an inland navigation incident, **is recommended** for the sake of navigation safety, that while performing his duties as a crew member during the shift, he must not be in a state of intoxication, in accordance with Article 140, paragraph 1, of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", no. 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41/18, 95/18, 37/19, 9/20 and 52/21).

SR_02/22 Taking into account the analysis and the conclusion of the final investigation that the inland navigation incident occurred due to the steering of the downstream composition by the navigationofficer who was in a state of intoxication, for the purpose of prevention and safety of navigation.
It is recommended to the shipowner to, based on Article 14, paragraph 1 and Article 15, paragraph 1, point 10) of the Law on Health and Safety at Work ("Official Gazette of RS" No. 101/2005, 91/2015 and 113/2017), and based on the Article 140 of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", No. 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41 /18, 95/18, 37/19, 9/20 and 52/21), adopt the Rulebook for conducting a breathalyzer test of employed crew members.

To the Ministry of Construction, Transport and Infrastructure
Sector for Inspection supervision
Department for Navigation Safety Inspection Affairs

SR_03/22 Taking into account the analysis and conclusion of the final investigation, the inland navigation incident occurred due to the management of the downstream ship composition by the navigation officer who was in a state of intoxication.
It is recommended to the navigation safety inspector that, during inspection supervision, and possible control of alcohol testing of crew members, be equipped with a breathalyzer (breathalyzer), in order to determine the concentration of alcohol in the blood, i.e. making a decisive fact in the shortest period of time, in accordance with Article 140 of the Law on Navigation and Ports on Inland Waters ("Official Gazette of RS", No. 73/10, 121/12, 18/15, 96/15, 92/16, 104/16, 113/17, 41 /18, 95/18, 37/19, 9/20 and 52/21).