



## **Research on Ship Safety Navigation Countermeasures in Tidal Estuary**

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**Abstract:** Shipping has played an important role in transportation since ancient times. The ancient Beijing-Hangzhou Grand Canal has been built and is now vigorously developing the Yangtze River waters. Shipping is an indispensable part of transportation. Estuary waters can not be ignored. The tidal estuary area is a water area affected by tidal effects at the mouth of the sea. Estuary waters are the key exits of inland rivers to the ocean, and natural conditions are superior. However, due to the influence of river runoff, Tidal intrusion, waves, salt water intrusion, human production activities and other factors, the tidal estuary area has caused many changes in water flow patterns, diverse sediment composition, and complex river bed and substrate evolution. Such landforms as the estuary cause frequent maritime traffic accidents, bringing us a lot of loss of personal property. Therefore, this paper makes use of domestic and foreign literature and technology to study the safe navigation of tidal estuaries.

**Keywords:** Tidal; Esturay; Navigation safety; Solutions.

### **1. Introduction**

The estuary area is the gate for inland rivers to communicate with the ocean. According to the river runoff and the amount of sand carried, the estuary area is divided into two types by form-Delta and triangular port. The delta is an ocean that extends to the mainland and forms a funnel-shaped or trumpet-shaped estuary. It is generally formed in an estuary that carries more sediment and the flow rate of runoff is not very large; The triangular port is due to the protrusion of the mainland to the ocean. During the movement of the river carrying sediment, the sediment is deposited and formed. According to the tidal size of the estuary and the amount of sediment carried, it is divided into four categories. Strong tidal sea estuaries, such estuaries have strong tidal currents, carrying sediments mainly from the ocean outside the estuary; Weaktide road to the estuary, such estuary tide is weak, carrying a large amount of sediment,

sediment is easy to accumulate; In the estuary of the lake source, there are lakes in the upper reaches of such estuaries. After flowing through the lake, the tidal current weakens, and the sediment mainly originates from the coast; Land and sea bidirectional estuaries, such estuaries are characterized by the speed of runoff and tidal currents, and the amount of sediment in both the road and sea phases is relatively large. The above tidal classification is very clear. Due to the effect of different tides, the topography of the estuary area changes, and many ships are in danger here.

## **2. Study on Navigation Safety at Home and abroad**

### 2.1 Foreign studies on navigation safety

Foreign countries with advanced maritime traffic research-Japan, Japan's maritime traffic research expert Inoue Shinzo, proposed the use of quantitative models to assess the existence of narrow waterways in similar estuarine areas and the number of ships to and from the sea; E E Leftheria et al. avoid the recurrence of dangerous accidents through the assessment of the accident and the risk assessment of the ship's navigation; DQXiong et al. proposed the construction of a model to use a mathematical model to estimate the casualties and property losses of later generations of ship accidents; Mc Tso et al. designed equipment to help seafarers make mistakes in their navigation and improve the safety rate of navigation. On the basis of the final cause of the accident, Y Lu et al. proposed management and supervision recommendations to the maritime administration department to increase the safety rate of navigation from the root causes.

### 2.2 Domestic studies on safety of navigation

Chengzhiyou takes the contradiction existing in the waters of the estuary area as the research direction, studies the basic principle of the waters traffic contradiction in the estuary area with the method of induction and deduction, and actively explores the solution to the waters contradiction in the estuary area; Professor Ma Hui uses grey clustering and grey statistical evaluation methods to assess and quantitatively analyze the operating environment and existing risks of the narrow waterways in the port. Zhang Peng studied the possibility of accidents that occurred in ships during navigation, analyzed the main factors affecting navigation safety, and conducted a risk assessment of dangerous accidents that occurred on ships. Wuchunjie, Zhangzhiyuan and others conducted research on special waters respectively, which provided useful countermeasures for special waters management and safe navigation.

## **3. Analysis on the Navigation Status of Tidal Estuary**

### 3.1 Complex river estuary vessel traffic flow

The estuary is where the inland river meets the open sea. Therefore, if an inland ship

wants to enter the ocean, it must pass through the estuary channel. China's transport ships are constantly increasing, carrying a large number of ships every day. The estuary area is also the gateway to the sea where many tributaries finally meet, so it constitutes a complex traffic flow. Ships from inland waterways to the ocean and from inland waterways are easy to meet when the number of ships is large, and collisions with ships at sea are a huge loss to people and property.

### 3.2 High navigational density of ships

According to the current use of estuaries in China, the daily traffic volume of estuaries in many areas is more than 1,000 times, and the pressure of navigation safety increases dramatically. During the peak period of navigation, a large number of ships have been accumulated in and out of the port, causing congestion in the fairway, seriously affecting traffic, and causing great economic pressure on ships.

### 3.3 Complex and diverse types of ships in the voyage area

There are not only a large number of navigable ships in the estuary area, but also countless types of ships. Fishing boats as small as dozens of tons, as large as hundreds of thousands of tons of containers, chemical ships, as well as cruise ships, bulk cargo ships and other types of ships. Due to the economic development of our country, many foreign vessels have also entered our country's shipping area, and the number of sea vessels is increasing. The different types of ships in the area and the different regulatory standards have brought great difficulties to the maritime sector. The main reason for the high accident in the area is that the ship itself is too large and the wrong operation of the duty driver. For example, most of the fishing boats and crew members on small ships in the area are driving without a license, overloaded navigation, and lack of personnel. Wait.

### 3.4 Frequent accidents in the flight area

Due to the complex traffic flow, easy sediment deposition, and high navigation density in the estuary area, frequent traffic accidents occur in this section, especially the shipwrecks that occurred in the collision of the two ships.

## **4. Reasons for the current situation in the estuary area**

### 4.1 Infavourable supervision by the Maritime Regulatory Authority

At present, the daily supervision of ships by the maritime department has a VTS supervision system and daily inspections. Although VTS can observe large-scale waterways, it is still unable to conduct real-time monitoring of the canal segment. This is far from finding problems with ships. And the patrols on the shore can be very low,

there are certain defects; At the same time, there are also many ships passing through at night in the estuary area, but there are very few people on duty at night, and the spirit of the people at night is not very concentrated. It is easy to experience the phenomenon of lack of concentration and misjudgment of command and judgment, resulting in serious consequences.

#### 4.2 Reasons for the ship's own existence

Frequent accidents in the estuary area are closely related to the level of crew operation, ship status, and type of ship loading. The quality of the ship's own crew is the most important external factor for the safe navigation of the ship. The low quality of the crew members, the lack of on-time duty, the lack of qualified qualifications, and improper operation are the most common factors that make the two ships collide. The damage of ship control system, the damage of propulsion system, the ship's own width, captain, ship type, net load tons, etc., the distortion and damage of radar system are the problems of ship collision. Although the type of ship loading is not the cause of ship collision, the harm to people and the environment can not be ignored. For example, some flammable and explosive goods such as chemicals, oils, and natural gas, once leaked, will cause the ship's host to lose control, threaten the safety of the ship's personnel, and cause damage to the environment.

#### 4.3 Insufficient legal basis

Maritime law enforcement departments shall, in accordance with law, impose penalties on ships that commit illegal acts. However, the estuary belongs to the border area between the two inland rivers or the river and the sea, and there are very few laws that can be followed. Inland waters may be punished in accordance with the provisions of the Administrative Penalties on Inland Waterways of the People's Republic of China, the Regulations on the Administration of Inland River Traffic Safety, and the Provisions on the Environmental Management of Pollution of Inland Watercourses by Ships. However, the existing laws and regulations in China are only a large framework, and there are no specific requirements. Difficulties for law enforcement officers and opportunities for illegal ships. At the same time, the sea crew's awareness of the maritime traffic safety law is still very thin, and even some crew members do not seriously abide by the law and drill the gaps in the law.

### **5. Solutions**

#### 5.1 Strengthening the regulation of the VTS maritime sector

VTS is the core of the maritime Department's supervision of maritime traffic accidents. Therefore, if we want to strengthen the management of ships at sea, we need to

improve the network system of VTS departments so that ships in blind areas can be monitored in real time and improve the monitoring ability and navigation order of waters. After strengthening the supervision of the VTS department, other departments should also actively use VTS to monitor ships according to the law and according to the actual situation.

#### 5.2 Strengthen the supervision of the seaman's qualifying examination and improve the seaman's quality

The crew members must pass the qualifying examination and training on board and obtain a qualified certificate before they can formally enter the maritime navigation mission. Therefore, maritime supervisors should strictly supervise the crew so that they can truly grasp the relevant knowledge and fundamentally improve the quality of the crew. For crew members who have worked on board ships for many years, regular crew training should be carried out to strengthen the crew's safety awareness and legal awareness of compliance, and indeed improve the quality of all crew members.

#### 5.3 Conduct regular first aid exercises

First-aid drills are the survival skills that can save themselves when a ship collides. In fact, when a ship collides or is in danger, the vast majority of them have self-rescue time. They are familiar with the first-aid drill process and give themselves a new life. We should conduct emergency drills in different waters, in different states of suffering of ships and in different river sections of traffic flow, so as to improve the crew's ability to deal with different situations. In typhoon weather, clear measures to avoid Taiwan; After the ship breaks down, the emergency measures after the Anchorage are taken to ensure the safety of the ship and the personnel on board.

### **6. Conclusion**

In the most dangerous area of navigation in the tidal estuary area, due to the special geographical location of the estuary area, the unfavorable supervision of the maritime department, the reasons of the ships themselves, the influence of the tides, and the lack of legal basis threaten the safe navigation of the estuary area. It is hoped that the suggestions put forward in this paper can help the river estuary safe navigation, promote the ship safe navigation and ensure the safety of the ship personnel.

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