



Combined Development of Epidemic Prevention and Control with Port Facility Security at Cargo Terminal

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Abstract. The cargo terminal opened to the international trade has the characteristics of direct contact with ships sailing on international routes, 24-h uninterrupted production, and high mobility of personnel, which has become an extremely important link in the prevention and control of the COVID-19 epidemic. In particular, there have been a number of confirmed cases of sailors in China. Therefore, the prevention of “imported cases” has become the top priority of epidemic prevention and control at China’s ports. The COVID-19 epidemic is a “public health incident”, and the port facility security incident is a “social security incident”. Two emergencies that seem to be of different categories have similarities in the focus of prevention and control and the specific implementation level. In accordance with the existing operation system and information-based supervisory measures, the open terminals that have accumulated 17 years of experience in port facility security performance work have adopted rapid, orderly, and effective prevention and control measures in response to the epidemic, which have played a positive role in curbing the spread of the epidemic in the port area. Combined with the experience of port facility security work during the past 17 years, the role of port facility security in epidemic prevention and control is analyzed, suggestions for port facility security work under the normalization of epidemic are put forward to ensure the public safety of port. At the same time, the experience and lessons learned from this response to the COVID-19 epidemic also provide a development direction for optimizing the security of port facilities.

Keywords: cargo terminal · epidemic prevention and control · port facility security

1 Introduction

As a large world trade country, shipping business undertakes more than 90% of import and export cargo transportation in China [1]. Therefore, doing a good job in the epidemic prevention and control of open terminals and ensuring their safe operation plays an important supporting role in ensuring the development of the national economy. The current domestic epidemic prevention and control situation continues to stabilize, but

the rapid spread of the COVID-19 epidemic abroad has brought new challenges to epidemic prevention and control in China. As a key node in the prevention and control of imported epidemic prevention and control at waterway ports, the cargo terminal focuses on preventing the occurrence of epidemic incidents caused by the normal ship-to-shore movement of ships on international routes and their crews. In this sense, the security work has improved the ports' management ability to deal with social security emergencies.

To ensure the normal production and operation of freight terminals, during the epidemic prevention and control period, how to ensure that port companies "carry out epidemic prevention and safety production simultaneously" has also become a huge challenge for port companies. Since 2004, China has embarked on the security work of port facilities for the international trade opening ports, especially the widespread application of information-based supervisory measures, which has played a positive role in the prevention and control of the COVID-19 epidemic.

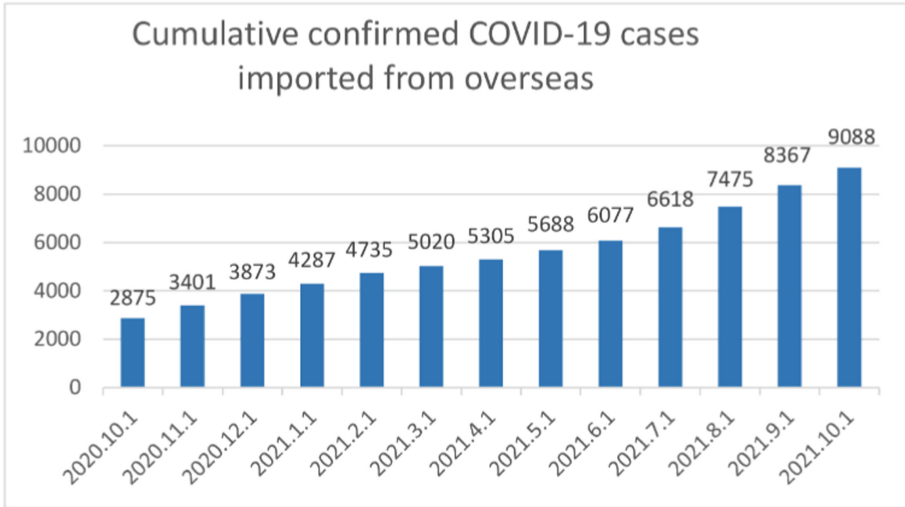
2 Current Situation of Port Facility Security Work Under the Covid-19 Epidemic

2.1 Situation of Imported Cases from Overseas in China

With the development of the overseas epidemic situation, there have been many cases of positive nucleic acid tests for crew members on international routes berthing at our ports, and the foreign import prevention work of water transport ports is facing severe risks. The Ministry of Transport attaches great importance to it and has successively issued the "Guidelines for the Prevention and Control of the COVID-19 Epidemic for Ship Crew" and the "Guidelines for the Prevention and Control of the COVID-19 Epidemic of Ports and Frontline Personnel", and timely revised and improved them according to the development of the epidemic to implement the main responsibility of the enterprise, and clarify the control measures for preventing the epidemic. At the same time, port enterprises are faced with great challenges in the situation that "epidemic prevention and safety production should be carried out simultaneously" (Fig. 1).

2.2 Port Facility Security Work Background

After the "9•11" terrorist attack in 2001, to effectively prevent global ports and ships from being threatened by terrorist activities, and to provide safety guarantees for the rapid development of the shipping industry and port industry, The 1974 International Convention for the Safety of Life at Sea (SOLAS Convention) Maritime Security Amendment and the International Ship and Port Facility Security Code (ISPS Code) were adopted by the International Maritime Organization (IMO) Diplomatic Conference in December 2002. Measures were taken to improve maritime anti-terrorism capabilities and strengthen the port state's supervision of ships arriving in ports, terrorist attacks on ports using ships were prevented. Since China implemented the SOLAS Convention on July 1, 2004, port administrative departments and port companies at all levels have worked together to build a complete port facility security management system for opening up terminals based on current risk analysis, formulate targeted management measures response



*Information resource: Official website of National Health Commission of the People’s Republic of China

Fig. 1. Situation of COVID-19 cases imported from overseas in China

to daily and emergency situations. The safe operation of open terminals was ensured through effective means such as normal training, funding guarantees, and system consolidation, which plays an important role in maintaining stability of major events such as the Beijing Olympics, the Shanghai World Expo, and the G20 Summit.

2.3 Combination of Port Facility Security with Epidemic Prevention and Control

Under the current situation of foreign defense imports, since the focus of prevention is on the normal ship-to-shore movement of ships on international routes and their crews, the opening of the cargo terminal to the international trade relies on existing security personnel, security equipment, security work processes, etc. For common operations such as port perimeter and channel control, cargo loading and unloading, and ship material delivery, a series of effective port facility security measures have been adopted. Meanwhile, effective application of information technology makes the normal production possible in the condition of “zero contact” of personnel, which effectively curbed the spread of overseas imports in the port.

3 The Role of Port Facility Security in Epidemic Prevention and Control

According to the “Emergency Response Law of the People’s Republic of China”, the COVID-19 epidemic is a “public health incident” and the port facility security incident is a “social security incident”. Although these two are classified in different ways, they also have certain commonalities. From the perspective of prevention and control, both of them are aimed to strengthen internal control and external input prevention and control. From

the specific implementation level, they are both on-site operators and security personnel. Therefore, the prevention and control of the COVID-19 epidemic is closely related to port security. The effective operation system and information-based supervisory measures of port facility security play a very important supporting role in the prevention and control of this epidemic.

3.1 Specialization of Personnel

Professional protective personnel play an important role in the operation system of port facility security work. Each open terminal has established a professional team by hiring external professional security companies or training internal full-time employees to be responsible for land entry and exit inspections, ship landings and landings, port border patrols, etc. They are also required to pass daily internal training and three-month security training, standardize working procedures, and be familiar with their job functions. During the prevention and control of the COVID-19 epidemic, the entry and exit of personnel, vehicles, and materials, as well as the prevention and control measures of the crew's entry and exit passages, are all included in the duties of security personnel. Compared with other industries, due to factors such as professional personnel and proficiency in operating procedures, most companies do not send additional personnel to prevent and control entrances and exits, which can save labor for companies.

3.2 Intelligent Equipment and Facilities

The Ministry of Transport has formulated the industry standard of "Port Facility Security Equipment and Facilities Configuration and Technical Requirements" (JT/T844-2012), which stipulates the basic requirements and related technical requirements for the configuration of security equipment and facilities in open terminals from the following aspects: perimeter security equipment and facilities, passage control equipment and facilities, security inspection equipment and facilities, security monitoring equipment and facilities, security communication equipment and facilities, etc. Port enterprises are equipped with intelligent security equipment and facilities according to standard requirements, such as personnel and vehicle gates, isolation piers, electronic access control systems, video surveillance systems, which played an active role in this epidemic prevention inspection, monitoring, and information communication.

The gate machine based on face recognition can be taken for an example, through identifying people's facial information and features, it adopts the technologies like Convolutional Neural Networks (CNN) under the frame of TensorFlow for recognition. In the process of face recognition, the recognition time is ≤ 0.2 s, the accuracy rate of face verification is $\geq 99\%$ [2]. This technology realized the precise management of personnel, reduced the probability of human contact, and ensured the production efficiency. The deployment [3] and in-depth application of the Beidou system has achieved centimeter-level accurate positioning of port personnel and vehicles (Fig. 2).

3.3 Smooth Information System

The port facility security work has a security communication and communication system, and has established an internal security contact address book and an external security

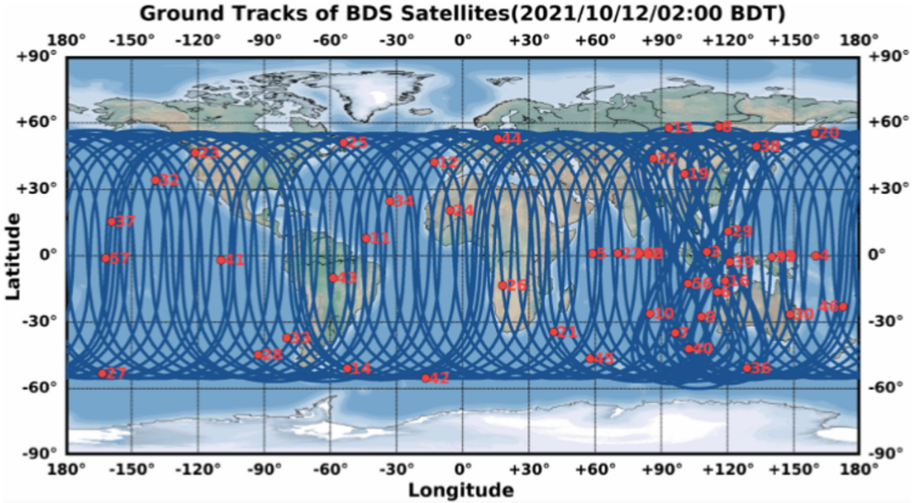


Fig. 2. Current Ground Tracks of BDS Satellites

contact address book. The internal security contact address book mainly includes the contact information of the security work leadership group and the company’s internal related departments, which are used for communication and collaboration within the company; the external security contact address book includes local public security, customs, border inspection, maritime affairs, fire protection, tugboats, pilot, hospital and other related departments, as well as municipal, provincial and national transportation authorities. With the help of port facility security work, the above-mentioned departments can be intertwined into a large communication network, and conduct information declaration through the mini program in WeChat or App, which can push forward the epidemic prevention and control requirements and safety knowledge in time, realizing the rapid transmission of information.

3.4 Hierarchical Response Measures

According to the “Security Regulations for Port Facilities of the People’s Republic of China”, the security level of port facilities is divided into three levels from low to high, and companies have formulated different security measures for each level to guide port companies in normal times (security Level 1), special periods (security Level 2 or 3) different operating mechanisms, and through the security training once every three months to operate and improve, so that when emergencies occur (such as the COVID-19 epidemic), the control of entrances and exits, ship ladders, and loading and unloading operations of port companies can be handled calmly.

4 Safeguard Measures for Port Facility Security in Epidemic Prevention and Control

4.1 Perimeter and Passage Security Measures

4.1.1 Security Measures for Land Entrances and Exits of Port Facilities

Land entrances and exits of port facilities, as the main passage for people, vehicles, and materials to enter and exit the freight terminal, are the first line of defense for port facilities to respond to the epidemic. Except for closed entrances and exits, security personnel are generally on duty at the main entrances and exits of the port area 24 h a day, and anti-epidemic inspection channels are set up to examine the “health code”, “tour code” of personnel or take registration by scanning the code, so as to realize the dynamic management and control on the basis of Big Data. While inspecting incoming and outgoing personnel, vehicles, and materials, security personnel also undertake tasks such as temperature measurement and vehicle disinfection. Persons with abnormal body temperature, “health code” and “tour code” are prohibited from entering the port to strengthen the prevention and control of foreign personnel.

4.1.2 Security Measures for Disembarking and Disembarking Passages

The opening of the cargo terminal to the international trade is assigned with a dedicated person on duty at the boarding gate of the ship to control the disembarkation and disembarkation channels. In non-essential circumstances, the crew will not disembark, and the port enterprise personnel will not be able to board the ship. For personnel who must board the ship for operations (such as container lashing operators), before boarding the ship, the landing staff shall check their boarding certificates, measure their body temperature, and check their protective equipment. They can only board the ship after they meet the requirements and strictly control them. In the activity area on the ship; the crew is generally prohibited from disembarking. If the crew needs to disembark under special circumstances, the landing card shall be checked by the staff on duty at the stairway, the body temperature shall be checked, the protective equipment shall be checked, and the scope of their ashore activities shall be controlled.

Tianjin Port (Group) Co., Ltd. implemented “one check, one measure, nine questions, two verifications and one record” (Table 1) for the landing of ships to avoid imported epidemics (Fig. 3).

4.2 Security Measures for Cargo Handling Operations

With the recovery of terminal production operations, the number of people, vehicles, and goods entering and leaving the port has increased, and the pressure on port facility security has increased. Before ships sailing on international routes berth, through the technical means, the online declaration mode for port customs clearance in special periods is opened, and the dynamic data of entry and exit is reported online, so as to realize the “online” monitoring and approval. The terminal and the shipowner shall negotiate on loading and unloading matters, and announce to them the current situation of the port epidemic and the relevant requirements of port facility security; during the cargo

Table 1. Tianjin Port (Group) Co., Ltd. Measures for ship landing management

Category	Measure
One check	Check if all people on ship wear a mask
One measure	Measure body temperature
Nine questions	Query the visiting unit, ask about the boarding and disembarkation matters, ask who is on the ship, where to disembark, ask if you have been to medium and high-risk areas recently, ask their name, ID number, contact phone number, and current residence
Two verifications	Check the ID card or work certificate, check whether there is a boarding certificate or a letter that it is necessary to disembark to handle related matters
One record	Do a good job in inquiring record account management



Fig. 3. Port facility security inspection for embarking and disembarking personnel and measures for epidemic prevention and control [4].

loading and unloading process. Operators communicate with each other through intercom, mobile phone, etc., and closely monitor the loading and unloading process through the video monitoring system, to prohibit irrelevant personnel from approaching the ship loading and unloading area, and interdict the risk of epidemic spreading brought by people-to-people contact.

4.3 Security Measures for Ship Store Delivery Activities

Ship materials mainly include food, daily necessities and other materials supplied by ships in the port, which are generally purchased by the ship owner (or entrusted by the ship agent), and the port enterprises conduct inspections of the ship material delivery activities in the port. During the epidemic prevention and control period, due to the difficulty of material procurement, and to strengthen the management of personnel,

vehicles and materials entering and leaving the port, some port companies assisted the ships in the procurement of materials. The procurement channel of living materials through “online + offline” is opened, so that crew can “place an order online and take delivery upon berthing”. Port enterprises are available to deliver the goods to the side of the ship or directly lift the goods to the ship by the port enterprise, and make contact, handover and payment through intercom, WeChat and other carriers. The crew cannot be allowed to go to the ground or have direct contact with the port personnel during the whole process to reduce the risk of imported epidemics.

5 Suggestions for Port Facility Security Work Under the Normalization of Epidemic

When a crisis comes, whether it is a public emergency or a social security incident, the prevention and control work should be a community with a shared future. Lessons learned from the epidemic prevention and control, and summing up existing experience can provide enlightenment for further improving the response capacity of port facility security work.

5.1 Optimizing the Organization

In response to this COVID-19 epidemic, led by the National Health Commission, 32 departments including the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the Ministry of Transport established a joint prevention and control work mechanism for the new coronavirus infection. Under the joint prevention and control mechanism, there are working groups on epidemic prevention and control, medical treatment, scientific research, publicity, foreign affairs, logistics support, and forward work, with responsible comrades from relevant ministries and commissions as the team leaders, clear responsibilities, division of labor and coordination, and form an effective joint force for epidemic prevention and control.

All open port companies have established a port facility security work leading group and a security emergency command group, with the main person in charge serving as the leader of the leading group, but the composition of the members varies from company to company. It is recommended to refer to the establishment of the epidemic prevention and control organization, and include the heads of the departments responsible for security, production operations, equipment and facilities management, business operations, and external liaison into the security organization to realize the full coverage of port facilities security work in all production processes.

5.2 Improving Emergency Response Capabilities

In the early stage of the COVID-19 epidemic, some companies had insufficient emergency drills and emergency preparedness for public health emergencies, which exposed problems such as insufficient anti-epidemic materials and insufficient safety protection for employees. To further enhance the emergency handling capabilities of freight terminals, it is recommended to strengthen extreme thinking and imaginary thinking, further



Fig. 4. Personnel positioning and tracking system

refine the emergency response procedures for port facility security, strictly implement the requirements of port facility security training at least once every three months, and strengthen actual combat drills.

In addition, it is necessary to strengthen emergency linkage with transportation management departments at all levels, as well as local public security, joint inspection units, medical treatment, fire protection and other institutions, enhance cross-regional and cross-departmental emergency cooperation, and realize the integration and sharing of port facility security resources.

Furthermore, it is needed to establish an electronic map of the port area and issue electronic tags with positioning functions (such as positioning badges, helmet positioning tags, personnel positioning bracelets) for people in the port, etc., combined with GIS, Beidou and other satellite positioning systems to realize intelligent tracking of the location, trajectory of personnel, and displacement, to achieve precise control of personnel in emergency situations (Fig. 4).

5.3 Increasing the Introduction of Advanced Technology

In terms of preventing the importation of epidemics, the country still mainly relies on traditional methods such as “Huge-crowd strategy” to check personnel and enter information, which consumes a lot of manpower and energy. Intelligent and digital identification methods need to be popularized and promoted. Port companies should closely track industry trends, implement personnel identification and positioning functions through the introduction of equipment or using small programs, big data and other technical defense measures, and open new security inspection modes such as personnel identification verification and personnel tracking.

During the epidemic prevention and control process, new technologies such as 5G, drones, and autonomous driving, as well as new models such as online office, web conferencing, and “Internet+” have been widely used [5]. Through building an information

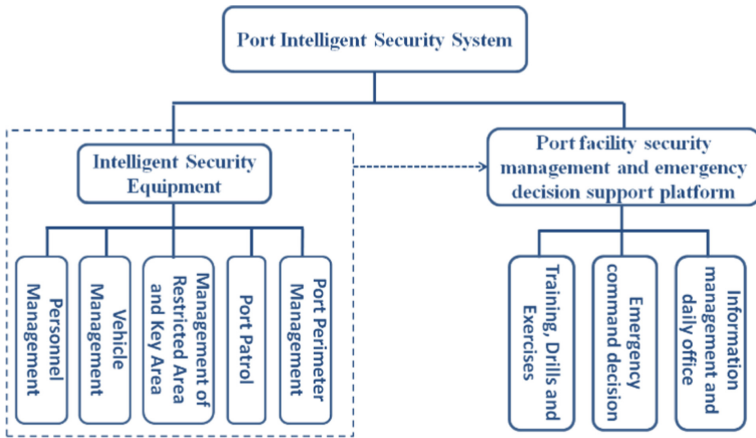


Fig. 5. Layout Architecture of Port Intelligent Security System

service platform of intelligent port, new technologies and information technology have been used to avoid the dense population and reduce the risk of infection. By this means, the intelligent management of people, vehicles, perimeters, restricted areas and key areas in the port is thus realized. See Fig. 5 for the layout architecture of port intelligent security system.

5.4 Strengthening Humanistic Care

In port companies’ response to the epidemic prevention and control work, security personnel have been fighting on the front line of epidemic prevention and inspection, and most of the epidemic prevention and control work is undertaken by door guards and security personnel. Door guards and security personnel as the forefront of epidemic prevention, have not only added additional tasks such as temperature measurement and other epidemic prevention tasks, but also increased their risk of epidemic infection, bringing double pressure on the security personnel’s body and mind.

Port companies should strengthen the care for front-line security personnel, equip them with high-tech equipment (such as infrared human body temperature rapid checker, self-service personnel identity anti-counterfeiting verification terminal, etc.), strengthen personnel safety protection, strengthen personnel substitution capabilities, and timely conduct personnel psychological counseling, etc. Also, they need to commend and reward security personnel who perform outstandingly at work, and always maintain the security team’s enthusiasm and ability to prevent and control the epidemic.

6 Conclusion

Ports are critical gateways to China’s foreign trade. Once attacked by terrorists, it will cause significant harm to the public security of the port area, the region, and even the national interest and people’s livelihood. The cargo terminal is an important gateway

for the country's foreign trade and the "lifeline" to guarantee the supply of materials. Especially the cargo terminal opened to the international trade, as the forefront of direct contact with ships sailing international routes, the prevention and control of the COVID-19 epidemic is particularly important. The experience accumulated during the 17 years of port facility security work has played a positive role in the prevention and control of the epidemic and effectively controlled the spread of the epidemic in port enterprises. At the same time, learning lessons from the epidemic to strengthen the intelligent and information-based construction of port, building an information service platform of intelligent port, summing up experience, improving the emergency response capabilities of port facility security, and enhancing the emergency support role of port facility security will always play a role in ensuring the long-term and orderly development of port facility security.

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