

A survey of container drift damage in Mikawa Port caused by the storm surge of Typhoon No. 18

KUMAGAI Kentaro, Senior Researcher, Coastal Disaster Prevention Division, Coastal and Marine Department
(Keywords) Typhoon No. 18, storm surge, container, drift, damage survey

1. Overview of the damage survey

On October 8, 2009, Typhoon No. 18 came ashore near the Chita Peninsula. The surge associated with the typhoon caused flooding and scattered a large number of containers on the wharves of Mikawa Port (Photo 1).

In cooperation with the Chubu Regional Bureau's Port and Airport Department and the Port and Airport Research Institute, the author surveyed damage to the Jinno-Nishi Wharf in Mikawa Port and its vicinity on October 9, the day following the typhoon's landfall. The main components of the survey were 1) a survey of the conditions of flooding caused by the storm surge, 2) interviews on the actual circumstances of container drift, and 3) a survey of damage to the port facilities.



Photo 1: Scattered containers (provided by Japan Coast Guard)

2. Survey results

(1) Damage caused by the storm surge: Tide observation records of the Chubu Regional Bureau showed a highest tide level of D.L.+4.40 meters at 6:20. It should be noted that the tide observation station is located approximately one kilometer from the pier. The ground height of the wharf's No. 8 pier is D.L.+4.11 to 4.16 meters, and there is a gentle upward slope inland from there that reaches D.L.+4.34 meters at its highest point. Behind this is a gentle downward slope to around D.L.+4 meters and then a relatively flat area. Accordingly, it is thought that the flood depth of the wharf, minus the effects of the waves and wind, was between 0.1 and 0.4 meters. In some locations, this is equivalent to a flood depth at which even double-stacked containers would float (see reference*). Grass that had drifted due to the influence of the waves and wind was entangled in the fence surrounding the wharf (ground height of D.L.+4 meters) to a height of 0.7 to 0.9 meters.

(2) Actual conditions of container drift: According to the Aichi Prefecture's Mikawa Port Office, which has jurisdiction over the port, 136 containers out of 887 stored on the wharf moved significantly. The maximum straight-line distance of movement was approximately 250 meters. Most of the containers were stopped by a steel fence or nets that surround the wharf. The results of an interview with a witness are shown in Table 1.

Marks indicating places where containers had been

dragged were found in several areas on the pavement near the highest point in the No. 8 pier yard (Photo 2). Thus, it was found that some of the containers did not completely float but were rather dragged.

Table 1: Interview results

Time	Witnessed conditions
5:45	Seawater was confirmed overflowing from the No. 8 pier.
6:20	Container drift was confirmed. Containers did not start moving all at once, but little-by-little. They bobbed like boats made of bamboo leaves as they floated. Some containers were carried away while still stacked.
7:00	The containers stopped moving.
7:30	The water was withdrawn completely from the top of the wharf at this time.

(3) Damage to wharf facilities: The posts of the steel fence surrounding the wharf were deformed due to the impacts of the containers. In one example, a post measuring 6 cm in diameter was deformed in two locations at heights of 0.5 and 0.9 meters above the ground (Photo 3). There were no instances where the entire fence was knocked down.

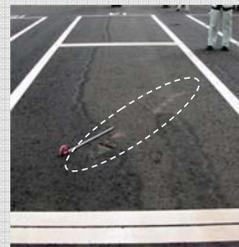


Photo 2: Drag marks



Photo 3: Fence post

3. Conclusion

While referring to the results of the survey, the author intends to conduct a numerical analysis of cargo that drifted from the wharf and study appropriate cargo management measures needed for countermeasures against drift damage. The author wishes to express his gratitude to Mr. Yoji Hirai, head of the Chubu Regional Bureau's Mikawa Port Office, and others for their cooperation in this survey.

*Generally, there is a raised height of approximately 0.15 meters that serves as a tunnel recess (depression for trailer loading), etc. Considering this, it is thought that empty 40-foot containers would float in floodwater having a depth of 0.28 meters when single stacked and 0.39 meters when double stacked.