

A Study on the Improvement of Marine Traffic System in the Ulsan Approaching Waters

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ABSTRACT : *Marine traffics near Ulsan approaching waters are crossing and converged at the diverging point of No. 1 route-No.2 route and No. 1 route -No. 3 route and are also concentrated at near No1. route approaching area and the headland of cape Gawnjeol. Because the number of berth will increase to 78 from 49 until 2011 due to additional developments, minor modification is expected for the water utilities. This study examined environmental conditions, marine accidental data, marine traffic capacity, traffic flow survey and fisheries zone status near Ulsan approaching water area. Finally, a questionnaire survey was carried out for experts and users to propose new plan.*

KEY WORDS : Marine Traffic System, Marine Traffic Survey, Marine Traffic Flow Simulation, Ship-Handling Simulation, Safety Assessment

1. Intruduction

Ulsan harbor is an important economical harbor in our country. It is responsible for carrying out 37% of the national cargo every year with 81% of that accounting for hazardous goods. Because large, middle or small size oil tankers come and leave the harbor frequently, Ulsan port is a place where there is a high risk of crude oil pollution.

Marine traffics near Ulsan approaching waters are crossing and converging at the diversion points of No.1 fairway - No.2 fairway, No.1 fairway-No.3 fairway as well as the area approaching No.1 fairway abeam the headland of cape Gawnjeol. By the year 2011, minor modifications are expected for the water utilities due to additional developments, the number of berths will increase from 49 to 78

This study examined environmental conditions, marine accident data, marine traffic capacity, traffic flow survey and fisheries zone status near Ulsan approaching water area. Finally a questionnaire survey was carried out for experts and users to propose a new plan.

2. The assessment of marine traffic environment

2.1 The assessment of marine traffic environment

Around the Ulsan port area where the tide phenomenon is extremely weak, the highest tidal range is 48.2 centimeters, average tidal range is 32.6 centimeters, the lowest tidal range is 17.0 centimeters, and therefore this is not a big factor when it comes to navigating and approaching it's shores.

The strongest rising tide current occurs in the south west direction. It takes 2.5-3.0 hours to reach the highest tidal range, with speed of about 0.5~1.8 knots. The strongest ebb current occurs in the northeast. It takes 1.0-3.0 hours to reach the lowest tidal range, with speed of about 1.1~2.0 knots. Nearby the Mipo harbor, from north-northeast direction, ocean current speed is about 0.5 knots. There is a warm current from the north around the bay, so the speed of concurrent flow is about 0.3 knots. In front of the newly developing harbor, the speed of the strongest rising tide current is 2.1 knots, the lowest is 1.2 knots.

The natural environment characteristic is that Kurusio current is flowing along Korea by the east coast, therefore when Kurusio current superposes the rising tide, the ocean current increases the speed to 4 knots. When ships navigate either inside or outside of the line connecting Ulgi lighthouse and Gwanjeol cape area, their speed will have a very big difference due to meteorological factors. Moreover eastern and southern parts are open towards the

ocean, therefore the wind speed and ocean waves from this direction will influence ships navigation, but influences with regards to fog occurrence, tide level difference and tidal current in the breakwater; are not significantly big.

2.2 Marine casualties investigation

This research analysis was within the last 5 years. This was based according to the result of the query of Korea maritime tribunal concerning the area along Ulsan approach on positions ((Lat. 35 20' ~ Lat. 35 40', Long. 129 20' ~ Long. 129 35') (2000 year ~ 2004 year).

Collisions occur in crossing situations on the No.1 fairway and the anchorage(M1-M7), which is used by small ships, as well as around dolphin wharf and the diversion point towards No. 2 fairway where the traffic flow inbound and outbound.

The area of the East anchorage is where the traffic flow usually overlap. The ships whose routes overlap in this area are the ships navigating from Pohang port to Ulsan and Onsan ports via East anchorage, tug boats carrying shipbuilding materials from Woobong,Ijin and Cheoyong towards Hyundai Mipo Shipyard and Hyundai Heavy Industry as well as ships navigating from Pohang to Busan Ports that use the area as a shortcut. This Overlapping of routes is mainly caused by the East anchorage protruding outside the outer sea area.

Another area where the danger of collision is high is the sea area east of the cape of Gwanjeol where Large ships as well as small tugs change their normal route to opt for a short route towards the left side of the No. 1 fairway Passing the SPM area or pass around the right side of the No.1 Fairway. Other ships heading from Pohang to Busan and vice-versa tend to pass this area also, taking their route dangerously close to the entrance of the fairway before passing the east anchorage. This change from their expected route causes unexpected alterations whereby increasing the danger of collision.

Stranding accidents occur in the entrance of defense port, in the M anchorage zone and nearby the entrance of the Onsan port.

Altogether 6 oil tanker accidents happened therefore there is more than 1 accident in an average year.



Fig. 1. Locations where Accidents occurred.

2.3 Marine traffic survey

Ulsan port marine volume of traffic(year 2000-2004) within the past 5 years taken from Ulsan Regional Maritime Affairs & Fisheries Office Port-MIS raw data of their computer center. The data from the VTS center used for the analysis was based on the highest traffic volume recorded within 3 days(72 hours)(Ulsan Regional Maritime Affairs & Fisheries Office, 2005) Below are the results of their analysis:

The M 1 to 7 anchoring zone is used by ship's of 1,000 GRT and it is being used at an average of 5,500 times yearly, which averages about 15 times a day, and that is twice higher than normal use. The maximum use is about 20 to 30 times, therefore it now in a saturated condition. The M9 to 10 anchoring zones used by ship's of 6000-7000 GRT and it is being used at an average of 1,530 times yearly, which averages about 4.19 times a day. M11 to 12 is used by ship's of 800-1200 GRT and it is being used at an average of 315 times yearly, which averages about 8.6 times a day. But now M 11 to 12 anchorages were removed due to port development which caused a shortage of anchorage area. E1 anchorage is being used by ship's of 3,200 GRT and it is being used at an average of 5,720 times yearly, which averages about 15.7 times a day. E2 anchorage is being used by ship's of 1,400 GRT and it is being used at an average of 1940 times yearly, which averages about 5.31 times a day. E3 anchorage is being used by ship's of 17,000 GRT and above, and it is being used at an average of 975 times yearly, which averages about 2.7 times a day. Compared to

E2 and E3 anchorages, E1 anchorage is more protected against severe weather conditions due to location, therefore it is usually used by small ships congesting the area creating a dangerous area for ship's navigating from Pohang to Ulsan. Fig. 2 shows the dangerous characteristics of the tracks followed by ship's leaving and entrance Ulsan port.

The first dangerous characteristic is that near cape Gwangeol. We can observe that the tracks are widely scattered which makes crossing and overtaking the only dangerous concerns. But this tracks are the same pattern used by ships leaving Ulsan port which makes the area very dangerous area for navigation. Moreover the traffic congestion makes it hard for the VTS operator to monitor safe navigation.

Next is the characteristics of tracks along the area from the entrance of No. 1 fairway up to the area above M1 anchorage considering the situation of the first characteristic where the same pattern is used by ships coming in and out, this is aggravated by the narrowing fairway of the area covered by the tracks and the absence of buoys to guide ships passing the area. Ships tend to pass inside or outside the fairway at will making navigation for ships unpredictable.

Thirdly, there are also some ships enter or leave port through the sea area nearby the Hwaamchu/east seawall. Fourthly, because the ships enter Onsan port from M anchorage it increased the volume of traffic. Because ships navigate in the M1-7 anchorage, in the dolphin wharf and on narrow and small water, it increased the risk of collision.

2.4 Fishery existing circumstances

The security of ships navigating, the navigation law and the route hypothesis ~ adjustment around the Ulsan, the investigation related to fishery distribution situation near the sea area, the result is that there is no fishery.

2.5 The survey for experts and users

Near the Ulsan port sea area, we take the user and the pilot association, the marine association as the object, collect the information about Onsan port route and the aids to navigation, and the opinion about the anchorage.

In the Onsan port the problems of ships entering or leaving port to be as follows

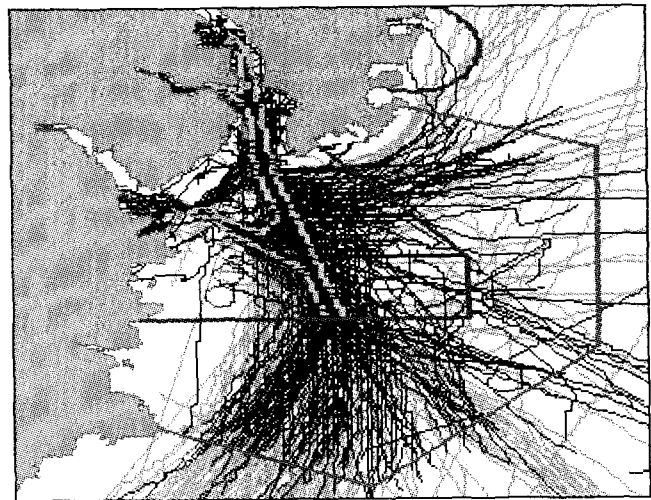


Fig. 2 Ship's track.

Firstly, nearby the first route, the sea area route is narrow and small, the routes which entering or leaving port ships are crossed and concentrated, the routes of ships which entering or leaving port, the ships and the harbor crossed and concentrated. The routes of ships entering or leaving port through 1 route west sea area crossed, route the side, therefore it violates 11th of law of the opening of a port.

Secondly, already surpassed the M anchoring zone use limit, because ships entering Ulsan port increased, the amount of anchorage use also increases, in route crossing and the volume of moving traffic flow increase to cause the certain danger.

Thirdly, breakwater nearby sea area navigational water is narrow and small, ships enter or leaves port - to enter the anchorage route ships entering port from Pohang port cross and centralize nearby the narrow sea area of breakwater, because of mobile not good tug boat, route encroachment and nearby break water entrance, ships has great angle change direction, these contains the risk

Fourthly, about the aids to navigation, as a result of the first fairway entrance goal absence, leaves the ships which ships enter port not to observe the standard but freely navigate happen frequently, therefore it needs to establish LANBY to distinguish the Ulsan port route. Seacoast lighthouses hold the post of the related Seuldo island lighthouse of defense port, as the leading light of Ulsan port east of the end of west of water break, it plays the extremely vital role, because of lighthouse altitude, light intensity and behind light, north Onsan port water break lighthouse recognition difficulty. In order to improve this situation, therefore the lamp is high/lighthouse diameter,

racon. The illumination lamp and so on the establishment is extremely essential. Moreover regarding Onsan port buoy, because behind light disturbance, on fairway buoy recognition also very difficult, therefore the LED establishment extremely is also similarly essential

3. The proposal of marine traffic system

Nearby the Ulsan port sea area, communication system likes Fig. 3 The Main item is as follows

3.1 From No. 1 fairway entering or leaving port and approaching waters

The 1st fairway turnover port and nearby waters scope is 580 meters, ships does not always navigate along the fairway, not only nearby waters enter port the ships and leave port the ships traffic flow overlapping, repetition, moreover enters or leaves port the ships and the port, the ships also alternately concentrates. Moreover the side waters occurs west the first route enters port the ships and leaves port ships overlapping and redundant, violates is open the order method instance and the sea accident also repeatedly is occurring.

In order to solve the above problem, reorganizes nearby waters the sea communication current capacity, does not let into leave port the ships traffic flow overlapping repetition, will leave the scope which will enter port from 150 meters to expand to 600 meters, will enter port front 1.8 nautical miles place establishments LANBY in the turnover, in addition also has established traffic separation zone which will connect enters port.

Table 1. The position of fairway

Fairway	No.	Lat.	Long.
limited line of port side	1	35-24-11.0 N	129-24-28.8 E
	2	35-22-22.2 N	129-24-43.2 E
limited line of starboard side	1	35-24-11.0 N	129-25-27.0 E
	2	35-22-22.2 N	129-26-10.8 E
Traffic separation zone	1	35-24-11.0 N	129-24-58.8 E
	2	35-22-22.0 N	129-25-23.4 E
	3	35-22-22.0 N	129-25-30.6 E
	4	35-24-11.0 N	129-25-01.2 E

3.2 Newly established anchorage

M 1 ~ 7 anchoring zones amount of use overruns. Because the Ulsan port enters port the ship anchoring zone use, increased 1 route marine volume of traffic, the route has traversed and in the port moves the volume of traffic. At the same time also increased the risk. Moreover as a result of the Ulsan port project, the M 11-12 anchoring zone is blocked, in order to solve the anchoring zone to be insufficient, in Woobong neighbor has supposed 8 anchoring zones newly.

Table 3. The position of anchorage

Position	
Lat.	Long.
35-23-09.0 N	129-22-46.2 E
35-23-19.8 N	129-22-18.0 E
35-23-36.0 N	129-23-00.0 E
35-23-42.0 N	129-22-31.2 E
35-23-39.0 N	129-22-00.0 E
35-24-00.0 N	129-23-03.0 E
35-24-04.8 N	129-22-18.6 E
35-24-04.2 N	129-22-12.0 E

3.3 East breakwater-Whaamchu Waters

In order to solve nearby the breakwater navigation waters to be narrow and small, enters or leaves port the ships, nearby the anchoring zone route and the ships which enters port from Pohang the direction turnover nearby the water break the volume of traffic centralism overlapping, because the mobility not good tug boat transports the navigation but to cause 잠식 and east the water break the entrance nearby as a result of the danger which the great angle change direction but causes, eliminates Geunchiam, Hwaamchu n the small ships and tug boat, 유도 east the breakwater distance.

3.4 Aids to navigation

Ulsan port 1st route difference navigation recognition difficulty, in order to extend the shore long distance lamp stand and extends the shore lamp stand the function, for eliminate but creates because of the recognition difficult question which the behind light, proposed resets up and the change likes the Table 1 aids to navigation.

4. The assessment using marine traffic

simulation

Nearby Ulsan port waters ESA value distribution like Fig.4 and Fig.5. Fig.4 is the marine traffic flow simulation test result which in the marine traffic system.

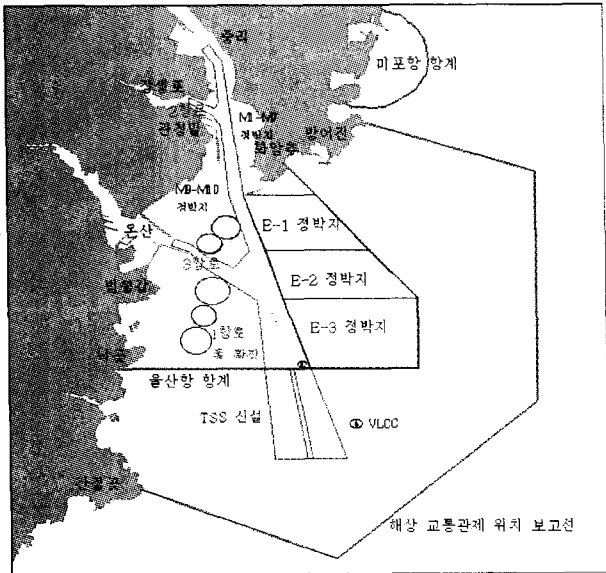


Fig. 3. The improvement of Marine Traffic System.

Fig.3 is in this research the proposal marine traffic system. May see the separation to be open to navigation proposal and so on region and LANBY establishment has the remarkable good effect compared to ESA value. This is because the traffic separation scheme hypothesis has the effect regarding marine traffic flow which the rectification ships decreases progressively alternately.

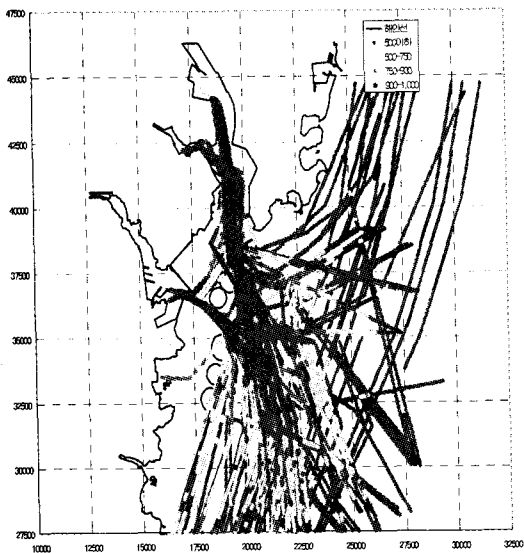


Fig.4. The result of ESA on the present route.

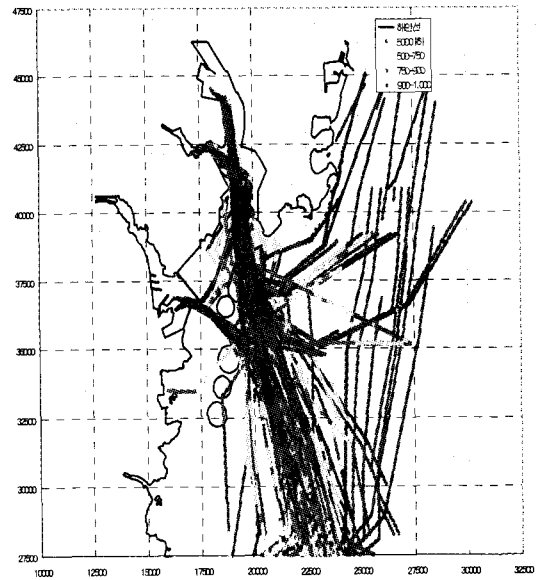


Fig.5. The result of ESA on the proposed route.

5. Conclusion

In neighbor this research through enters the waters natural environment, the sea accident, the marine volume of traffic to the Ulsan port, and the sea communication tense, the fishery present situation, carries on the diagnosis, proposed the navigation dangerous essential factor. And implements to the expert machine and user's questionnaire survey, the collection dangerous essential factor as well as the improvement plan. Use traffic characteristics which obtains in the sea communication tense investigation, implementation sea communication simulation test, appraises the Ulsan port the environment stress value. Through the analysis related specific sea area many kinds of projects sea communication appraisal result as well as expert opinion's and so on, proposes the navigation route. Has implemented the sea communication simulation test to this research proposal navigation route. The result obtained the proposal navigation route Has this better effect the conclusion.

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