

工學碩士 學位論文

**A Study on the Enhancement of the Quality of Pusan Port
Traffic Management Service**

指導教授 李殷邦

2001年 2月

韓國海洋大學校 大學院

海洋警察學科

尹 正 洙

工學碩士 學位論文

**A Study on the Enhancement of the Quality of Pusan Port
Traffic Management Service**

指導教授 李殷邦

2001年 2月

韓國海洋大學校 大學院

海洋警察學科

尹 正 洙

本 論 文 尹 正 洙 工 學 碩 士 學 位 論 文 認 准 .

主 審 鄭 泰 權 印

副 審 薛 東 一 印

副 審 李 殷 邦 印

2000年 12月 日

韓 國 海 洋 大 學 校 大 學 院

海 洋 警 察 學 科 尹 正 洙

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

1	.....	1
1.1	.....	1
1.2	.....	3
1.3	.....	3
1.4	.....	5
2	PTMS	6
2.1	PTMS	6
2.1.1	.....	6
2.1.2	.....	6
2.1.3	.....	8
2.1.4	.....	9
2.2	PTMS	11
2.2.1	.....	11
2.2.2	.....	12

2.2.3	.....	14
2.3	PTMS	16
2.4	PTMS	18
2.4	PTMS	21
3	PTMS	24
3.1	PTMS 가	24
3.2	.....	24
3.3	PTMS 가	29
3.4	가	35
4	.....	38
4.1	.....	38
4.2	.....	40
4.3	.....	41
4.4	.....	42
4.5	.....	43
4.6	.....	44
5	.....	45

5.1	.....	45
5.1.1	.....	45
5.1.2	.....	47
5.1.3	.....	49
5.2	.....	53
5.2.1	.....	53
5.2.2	.....	54
5.2.3	.....	55
5.3	.....	56
5.4	.....	59
5.4.1	PTMS	59
5.4.2	PTMS	60
5.4.3	(Contingency Plan)	61
6	.....	63
6.1	.....	63
6.2	.....	64
	.....	65

LIST OF FIGURES

<Fig. 1> The configuration of the thesis.....	5
<Fig. 2> Pusan PTMS Structure Tree.....	9
<Fig. 3> Arrangement of 5 Radar Sites.....	12
<Fig. 4> PTMS Mechanism in Pusan Port.....	19
<Fig. 5> Display of Ships' Approaching.....	19
<Fig. 6> Display of Ship's Target and Identification.....	20
<Fig. 7> Results of PTMS Work Related Port Operation in '99.....	22
<Fig. 8> Results of PTMS Work Related Traffic Safety in '99.....	23
<Fig. 9> Total Change Rate of Casualties Occured.....	27
<Fig. 10> Change of VTS Addressable Casualties.....	27
<Fig. 11> Total Volume of Vessel Traffic Casualties.....	28
<Fig. 12> Change Rate of Vessel Traffic Casualty Type.....	28
<Fig. 13> Display of Fishing Boats' Movement.....	39
<Fig. 14> Display of Vessel Traffic Congestion.....	41

<Fig. 15> The Research Position of Vessel Movement.....	45
<Fig. 16> The Research of Vessel Movement Direction.....	45
<Fig. 17> The Direction of Vessel Traffic Movement.....	48
<Fig. 18> Proposed Sailing Route and Integrated Traffic Area in Pusan Port.....	52

LIST OF TABLES

<Table 1> Related Parts for PTMS.....	8
<Table 2> Three Basic Services supplied by PTMS.....	10
<Table 3> Composition of PTMS System.....	11
<Table 4> Main Function of VTS 5060.....	13
<Table 5> Efficiency of VTS 5060.....	14
<Table 6> Main Character of Pusan PTMS System.....	15
<Table 7> Limit of PTMS Applicable Vessel.....	16
<Table 8> Limit of PTMS Applicable Sea Area.....	16
<Table 9> PTMS Reporting Lines.....	17
<Table 10> PTMS Reporting Procedure.....	17
<Table 11> Results of PTMS Work Related Port Operation in '99.....	22
<Table 12> Results of PTMS Work Related Vessel Traffic in '99.....	23
<Table 13> Statistic of Maritime Casulties "With and Without" PTMS.....	25
<Table 14> Total Change Rate of PTMS Addressable Casulties.....	26
<Table 15> Statistic of Maritime Casulties in Various Ports.....	30

<Table 16 > Operation Result Related to Pilotage of Pusan PTMS.....	33
<Table 17> Operation Result under Reduced Visibility	34
<Table 18> Distribution of Questionnaire Participant	36
<Table 19> Results of Questionnaire in Traffic Safety's Enhancement....	36
<Table 20> Results of Questionnaire in Port Operation Enhancement.....	37
<Table 21> Traffic Volume in Research Time and Position.....	47
<Table 22> Traffic Volume in Ship's Course.....	48

**A Study on the Enhancement of the Quality of Pusan Port
Traffic Management Service**

Jeong - su Yoon

*Department of Maritime Police,
Graduate School of Korea Maritime University*

Abstract

From a historical perspective, the 21st century will usher in a fourth wave of the ocean age, or ocean century. World trade has been increasing continuously in total volume , on the other hand, environmental protection on sea and conservation of fishery resources has been rising up the major issue. All of the world are pushing their efforts two major purposes to the full, one is taking competitive place in marine transportation throughout the world and another is environment protection.

Based on geographical advantages, locating in the center of the world's trunk routes, Korea has driven 'modernization and expansion of port facilities' to become a marine superpower in the New Ocean Age. At the same time, in order to actively correspond to the changes in the world marine environment, PTMS (Port Traffic Management System) has been

implemented in 1993 and established in 14 ports of Korea by 1998.

PTMS is integrated marine traffic control system and has been evaluated revolutionary effective in reducing marine casualties from other countries such as U.K since 1972 and Japan after 1977. Since 1998 in Korea ports, it's apparent that the result of 2 years' operation has played major role in improving safety and protecting coastal environment so far in Korea.

Also, Pusan Port as world leading port put its all effort in bring more ocean going vessels and securing their traffic route by providing them more information related to marine traffics through PTMS in port. During two years of operation, statistics of marine traffic accidents showed that many dynamic casualties such as collisions, groundings, and rammings has been decreased. However, due to increasing cargo volume, limited water area and unpredictable weather condition, potential risks still exist high.

In this paper, in order to maximize efficiency of PTMS and reduce various risks finally in the future, we examine PTMS addressable, non-addressable factors and the operational results in detail, and design suitable operational methods in Pusan Port.

가 VTS 1948

1960

1980 VTS

1993 / , / , / , / ,

, , , , , 11 가

. 1999

VTS PTMS(Port Traffic Management Service Center, : PTMS)

가

, ,

가 75 1996 2

1998. 12 PTMS가

90,000

,

,

VTS

[1][2]

가

VTS 7 가

1.2

PTMS가 2
가 , ,
가 가 .

PTMS .

PTMS
가 PTMS 가 ,
 , , , ,
 , , .

1.3

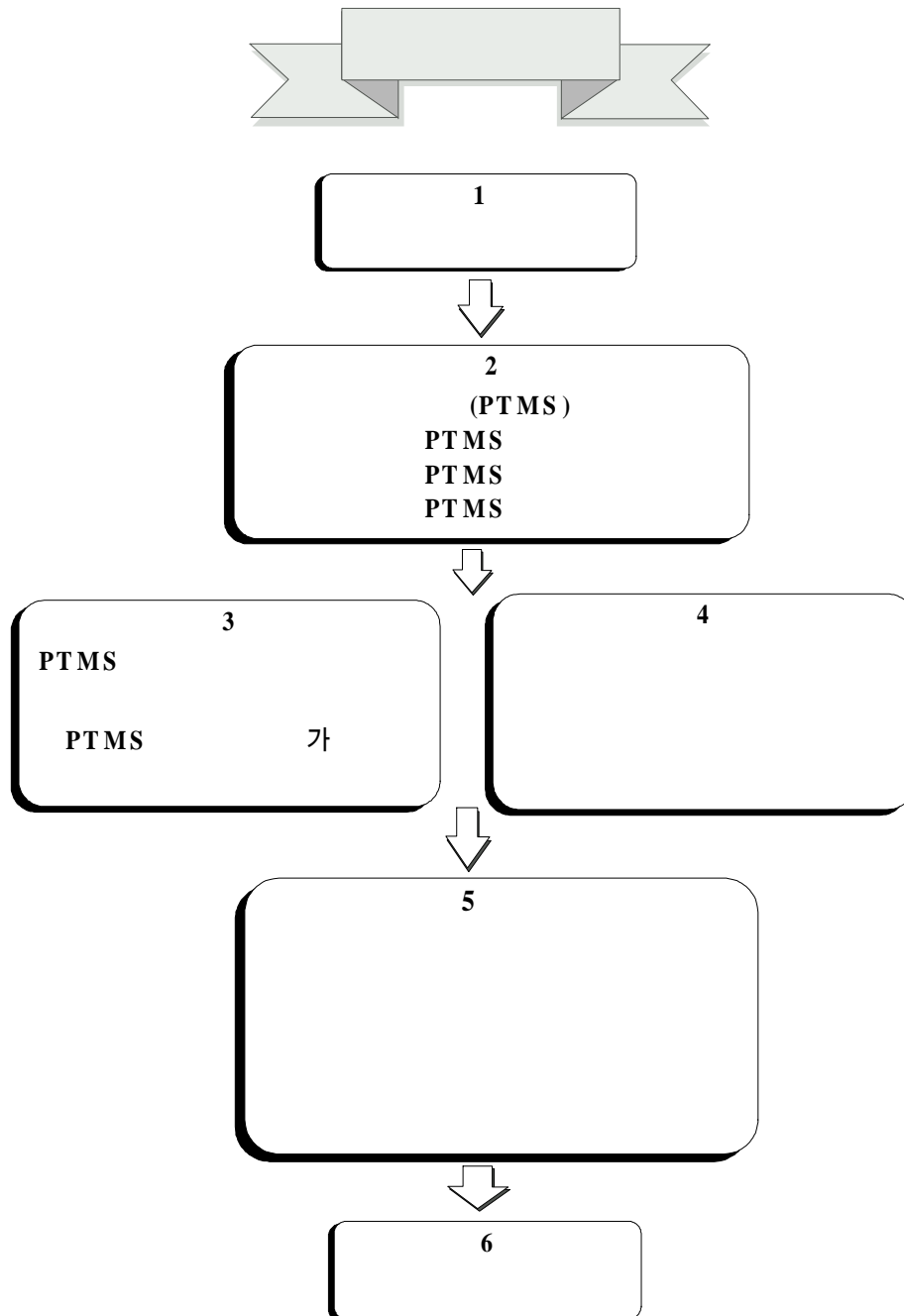
PTMS 2 PTMS
가 가 PTMS

PTMS 1
1 PTMS 가

1.4

6

<Fig. 1>



<Fig. 1> The configuration of the thesis

2

2.1

2.1.1

(IMO) VTS(Vessel Traffic Service) ‘ ,
(Competent Authority)

VTS

, VTS

[3]

, PTMS

(適時)

(豫測成)

2.1.2

1962

SSB,

8

. 1978 .

(HARBOUR MASTER)

BCTOC

1

가

6

VHF

1981

(PORT CONTROL)

가

1986

1996

1998

2

가

1998 12 . .

(CONTROL)

1999 PTMS

19

“ ”

2.1.3

PTMS

<Table 1>

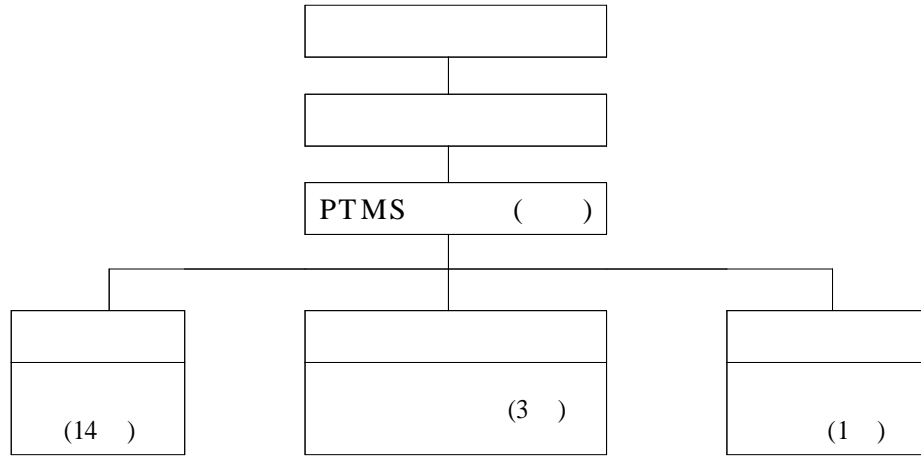
<Fig. 2>

PTMS

PTMS
1, 3, 1 5, 3 3

<Table 1> Related Parts for PTMS

	PTMS	· , , 가 · ·
	PTMS	
	· · ·	· , , · ·



<Fig. 2> Pusan PTMS Structure Tree

2.1.4

PTMS (Geographical Area), (Traffic Density and Pattern) (Information Service), (Navigational Assistance Service), (Traffic Organisation Service) . <Table 2>

[4].

<Table 2> Three Basic Services supplied by PTMS

<p>(Information Service)</p>		<ul style="list-style-type: none"> · , · · PTMS · (meteorological and hydrological conditions) · , ·
<p>(Navigational Assistance Service)</p>	<p>(monitor)</p>	<ul style="list-style-type: none"> · , · , · · (navigational advice) ·
<p>(Traffic Organisation Service)</p>	<p>PTMS</p> <ul style="list-style-type: none"> · · · 	<ul style="list-style-type: none"> · · · · (system of traffic clearance) · PTMS (sailing plans)

2.2 PTMS

2.2.1

PTMS

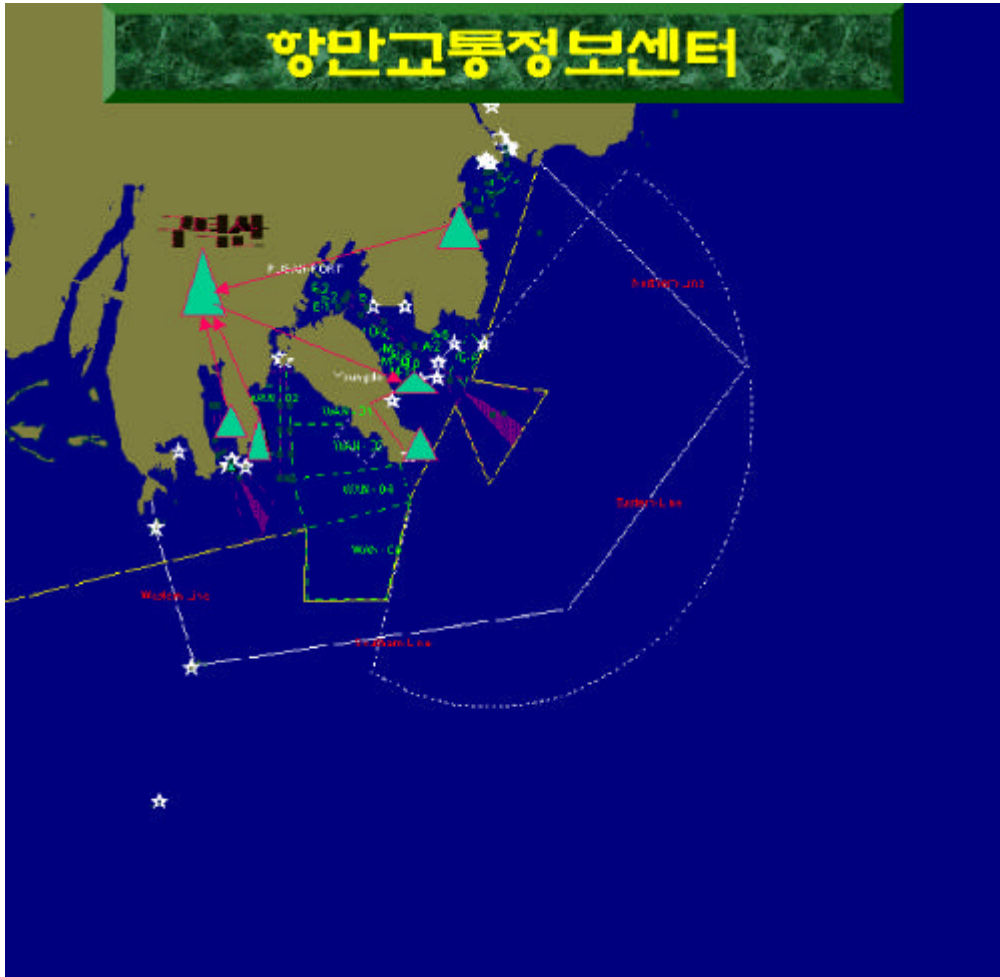
<Table 3>

<Table 3> Composition of PTMS System

CCTV	
VHF	
M/W	

<Fig. 3>

5 M/W 가
 . PTMS
 M/W PTMS SITE 65K
 BITE PTMS
 KONSBERG NORCONTROL SYSTEM A.S VTS
 5060 [5].



<Fig. 3> Arrangement of 5 Radar Sites

2.2.2

PTMS	KONSBURG NORCONTROL SYSTEM A.S
VTS 5060	<Table 4>
<Table 5>	[6][7].

<Table 4> Main Function of VTS 5060

VOC 5060- WORKSTATION/	<ul style="list-style-type: none"> · 29 · 가 · , · .
(R.D.P:RADAR DATA PROCESSOR)	<ul style="list-style-type: none"> · () · , , , ·
VET 5062- Video extractor and tracker	<ul style="list-style-type: none"> · · LAN 가 · 가
WIS 5060- Warning and integration server	<ul style="list-style-type: none"> · · multi-sensor fusion · integrated target table(ITT) Integrated object table(IOT) ITT : Table IOT : Table
VDB 6060-VTS Data Base	
VSS 5060-VTS Sensor Server	<ul style="list-style-type: none"> · External sensor · , · PTMS · GPS , VHF-DF, · , , CCTV system
VLR 5060- VTS Logging and replay	

<Table 5> Efficiency of VTS 5060

	<ul style="list-style-type: none"> · 12 가 가 · : 20 , 3
	<ul style="list-style-type: none"> · 6 , 30 2 , 20 · 6 가 ±30 가
	<ul style="list-style-type: none"> · 2 20 6 75 · 6 가 ±60 가
CCTV	<ul style="list-style-type: none"> · X,Y 가
	<ul style="list-style-type: none"> · 가 - 가 · 가 가 · 가
VHF DF	<ul style="list-style-type: none"> · VHF DF · Traffic Display
	<ul style="list-style-type: none"> · 가
	<ul style="list-style-type: none"> · 가가 가 가 · 가 가 · GMDSS, DGPS 가 · 1000 가

2.2.3

PTMS KONSBERG NORCONTROL SYSTEM A.S
 VTS 5060 <Table 6 > [8].

<Table 6> Main Character of Pusan PTMS System

	<ul style="list-style-type: none"> · · PTMS · 가 · () · 가 · AIS 가 가
	<ul style="list-style-type: none"> · 가 · · 가가 가 · 가 · 가
	<ul style="list-style-type: none"> · Work Station · 가 Self · Test ·

2.3 PTMS

PTMS

(ID)

. PTMS

VHF CH 12

PTMS VHF CH 12

, PTMS (

) .

.

<Table 7> , <Table 8> PTMS , <Table 9 > <Table 10 > [9].

<Table 7> Limit of PTMS Applicable Vessel

	. . . - 300 (,) - 2 - 가 200

<Table 8> Limit of PTMS Applicable Sea Area

	N-5 35 04 01 129 06 59 , 35 02 42 129 07 45 , 35 04 14 129 09 11 35 04 31 129 07 18

<Table 9> PTMS Reporting Lines

	35 00 , 129 10
15	35 00 , 129 10 35 05 , 129
	35 05 , 129 15

<Table 10> PTMS Reporting Procedure

		(ETA)
	PTMS 2	,
) (
	PTMS	,
		,

2.3 PTMS

PTMS
가 . 가
가 가

<Fig. 4> M/V. GIANT 가 A
2 ETA .

PTMS

VHF
가
가
PTMS 가
PTMS LINE



<Fig.4> PTMS Mechanism in Pusan Port

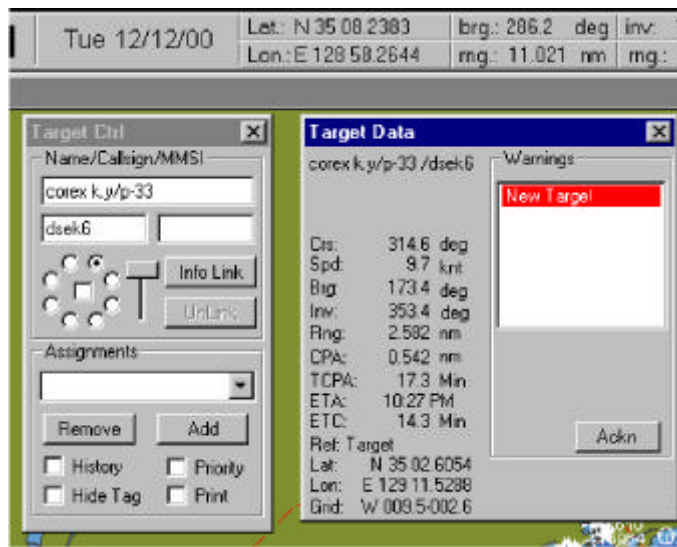


<Fig. 5> Display of Ships' Approaching

<Fig. 5>

M/V.

Corex Kwangyang M/V. Seju



<Fig. 6> Display of Ship's Target and Identification

<Fig. 6>

<Fig. 5>

가 2.58

CPA가 0.54

TCPA 17.3

2.5 PTMS

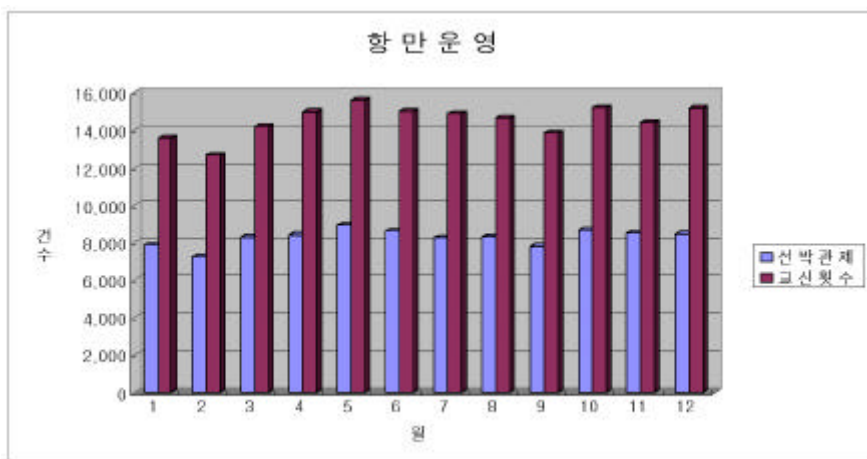
PTMS
 , ,
 , ,
 , ,
 , '99
 10 9,000 70%
 가 . PTMS가 2 가
 가 PTMS
 가 가
 . PTMS
 가 PTMS
 가 가 PTMS
 .
 PORT - MIS ,
 PORT - MIS
 , '99
 99,369 8,000 .
 가
 30% 가
 가

가 가 .
 가 가 .
 , ,
 가 .
 가 가 .
 가 .
 가 .
 가 .

<Table 11>, <Fig. 7> 1999

<Table 11> Results of PTMS Work Related Port Operation in '99

	1	2	3	4	5	6	7	8	9	10	11	12	
/	7,877	7,273	8,283	8,410	8,943	8,603	8,270	8,290	7,785	8,668	8,498	8,469	99,369
	13,602	12,674	14,190	15,006	15,618	15,043	14,883	14,670	13,859	15,222	14,389	15,182	174,338
	21,479	19,947	22,473	23,416	24,561	23,646	23,153	22,960	21,644	23,890	22,887	23,651	273,707



<Fig. 7> Results of PTMS Work Related Port Operation in '99

<Table 12>, <Fig. 8> 1999

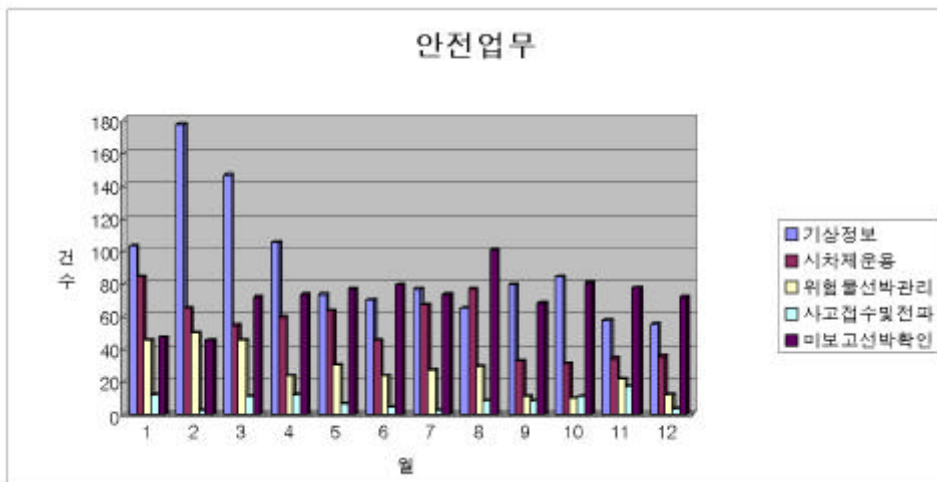
1 4

(冬節期)

40 80

<Table 12> Results of PTMS Work Related Vessel Traffic in '99

/	1	2	3	4	5	6	7	8	9	10	11	12	
	103	177	146	105	73	70	76	65	79	84	57	55	1,090
	84	65	54	59	63	45	67	76	33	31	34	35	646
	45	50	45	23	30	23	27	29	11	10	21	12	326
	12	2	11	12	6	4	2	8	8	11	17	3	96
	47	45	71	73	76	79	73	100	68	80	77	71	860
	291	339	327	272	248	221	245	278	199	216	206	176	3,018
	7,877	7,273	8,283	8,410	8,943	8,603	8,270	8,290	7,785	8,668	8,498	8,469	99,369
	8,168	7,612	8,610	8,682	9,191	8,824	8,515	8,568	7,984	8,884	8,704	8,645	102,387



<Fig. 8> Results of PTMS Work Related Traffic Safety in '99

3 PTMS

3.1 PTMS 가

PTMS가

10 PTMS

PTMS 가 [10].

가 VTS IMO VTS

1 가 가

가

가

가

가

가

가

가

PTMS 가

.

3.2

PTMS 1995 , 1996 ,

. 1998 6

가 . 4

<Table 13> <Table 14> <Fig. 9> <Fig. 10> <Fig. 11> <Fig. 12>

<Table 13> '95, '96, '97, '99 <Table 14>

<Fig. 9> <Fig. 10>

<Fig. 11> <Fig. 12>

PTMS

PTMS

[11].

<Table 13> Statistic of Maritime Casualties "With and Without" PTMS

		1995	1996	1997	1999
PTMS		3	5	3	1
		4	3	7	0
		13	11	12	13
PTMS		7	5	6	0
		2	1	1	2
		12	14	11	4
		2	1	0	1
		5	4	3	3
		3	4	4	2
		8	10	10	5
		2	1	0	8
	61	59	57	39	

[: PTMS]

<Table 14> Total Change Rate of PTMS Addressable Casulties

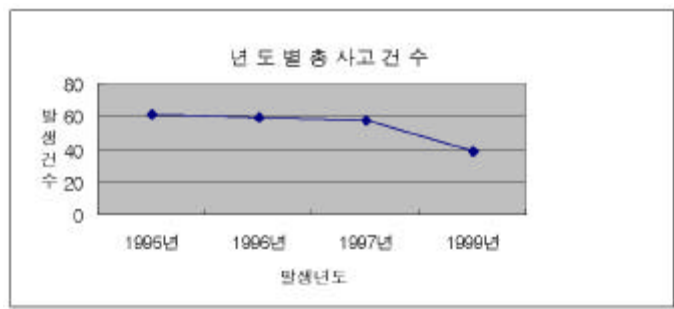
	'95	'96	'97	'99
	61	59	57	39
	-	-3	-3	-31
	20	19	22	14
	-	-5	+16	-36

[: PTMS]

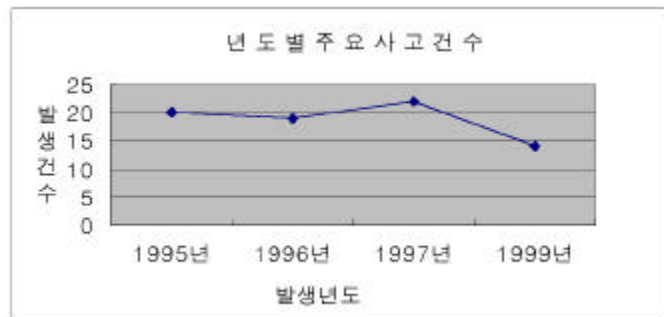
<Table 13> <Table 14> '95 61 ,
 '96 59 , '97 57 PTMS가
 '99 39 가 31%
 PTMS
 , , 가 20 , 19 , 22 , 14
 '95 , '96 , '97 , '99 33%, 32%, 39%, 36%
 . PTMS가 '97 '99
 36%가 ,
 '99
 가 .
 가

<Fig. 9> <Fig. 10>

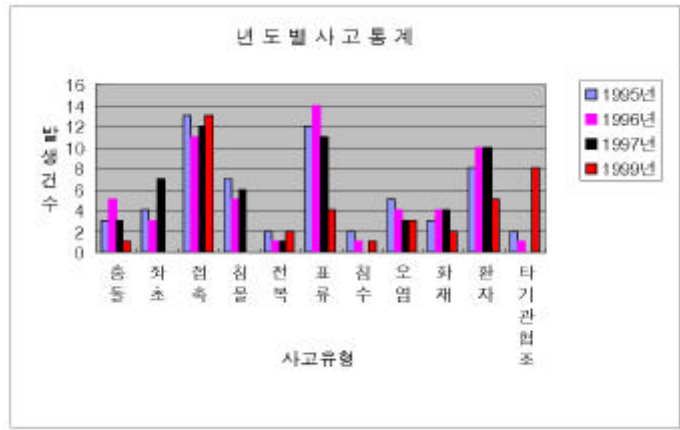
PTMS '96 , '97
PTMS '99 가



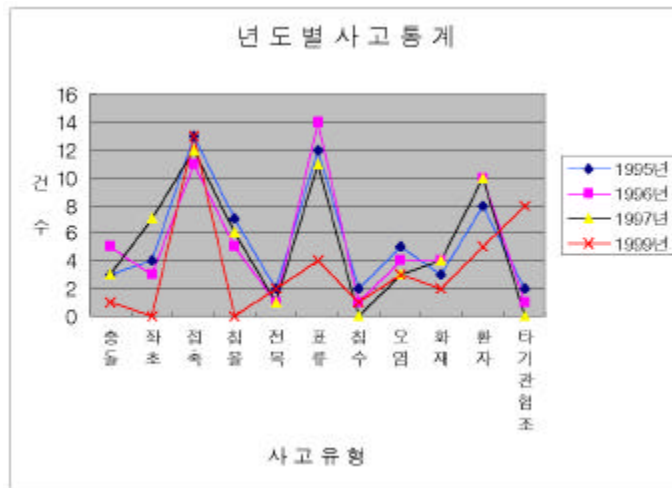
<Fig. 9 > Total Change Rate of Casulties Occured



<Fig. 10 > Change of VTS Addressable Casulties



< Fig. 11 > Total Volume of Vessel Traffic Casualties



< Fig. 12 > Change Rate of Vessel Traffic Casualty Type

<Fig. 11> <Fig. 12>

<Fig. 12>

PTMS '96 , '97
PTMS '99

가

PTMS

가

가

가

가

OPEN SEA

가

가

3.3

PTMS

가

PTMS

PTMS

PTMS

가

PTMS

가

가

가

<Table 15>

1991

1996

5

20

[12]

가

3

가

/ /

<Table 15> Statistic of Maritime Casulties in Various Ports

/				(%, /)
	113	93	206	55
/	13	60	73	18
/	8	179	187	4
	17	75	92	18
/	21	100	121	17
/	2	70	72	3
/ /	49	73	122	40
	20	36	56	36
	6	39	45	13
/	6	60	66	10
	255	785	1040	25
	1040			

[* : 20 * : 20
 : VTS 2 , '98. 10.]

<Table 15>

가

PTMS

PTMS가 '95 , '96 , '97

'99 가 1

36%가 가 . 31%,

PTMS . 1998 PTMS가

PTMS

PTMS

가 . <Table 15>

가 PTMS

가

PTMS

가 가 가

PTMS

2 ()

PTMS PTMS

가

PTMS

TEU 4 1999 6,440,000 .

가

가 .

<Table 16> PTMS가 '96 , '97 '99

PTMS

가

6 10

'99

294

가 .

PTMS가

가

PTMS

가

<Table 16> Operation Result Related to Pilotage of Pusan PTMS

			()
		(%)	
1996 ()	1850	.	.
1997	2300	12	.
1999	5450	294	85

[: PTMS]

PTMS가

<Table 17>

가 4 8
'96 , '97 , '99 230 ,
240 , 185 .
PTMS '96 ,
'97 7% , 8% PTMS '99 65%
가 . <Table 17> '96 , '97 . 15 ,
18 가 .

<Table 17>

PTMS

VHF

가

PTMS

PTMS

가

<Table 17> Operation Result under Reduced Visibility

		(A)	(B)	(%, B/A)
1996	15	230	15	7
1997	17	240	18	8
1999	13	185	120	65

[: PTMS]

가 PTMS

가

PTMS가 1

가

가

가

PTMS

가

가 가

가 가

가 가

가 PTMS

가

3.4 가

PTMS

<Table 18>

90

PTMS

[13]

<Table 19> <Table 20>

<Table 18> Distribution of Questionnaire Participant

	/				
	26	11	12	.	49
	8	10	1	.	19
	.	.	.	22	22
	34	21	13	22	90

[: VTS ,]

/ , ,

<Table 19>

99%가

72%가

<Table 19> Results of Questionnaire in Traffic Safety's Enhancement

	41	8	.	49
	11	9	1	21
	12	7	.	19
	64(72%)	24(27%)	1(1%)	89

[: VTS ,]

PTMS

PTMS

'96 , '97

58

PTMS

‘99 19 32% , ,
 가 36%가

. <Table 15>

55% 가

<Table 20>

92%가 55%가

PTMS

<Table 16>

294% 가

65% 가 .
 가

<Table 20> Results of Questionnaire in Port Operation Enhancement

	30	16	3	49
	10	9	2	21
	9	9	1	19
	49(55%)	34(37%)	6(8%)	89

[: VTS ,]

4

4.1

<Fig. 13>

A

. <Fig. 14>

가 .

가

가 가 .

)가

20

)

17 (

(.

가

가 .

2-3

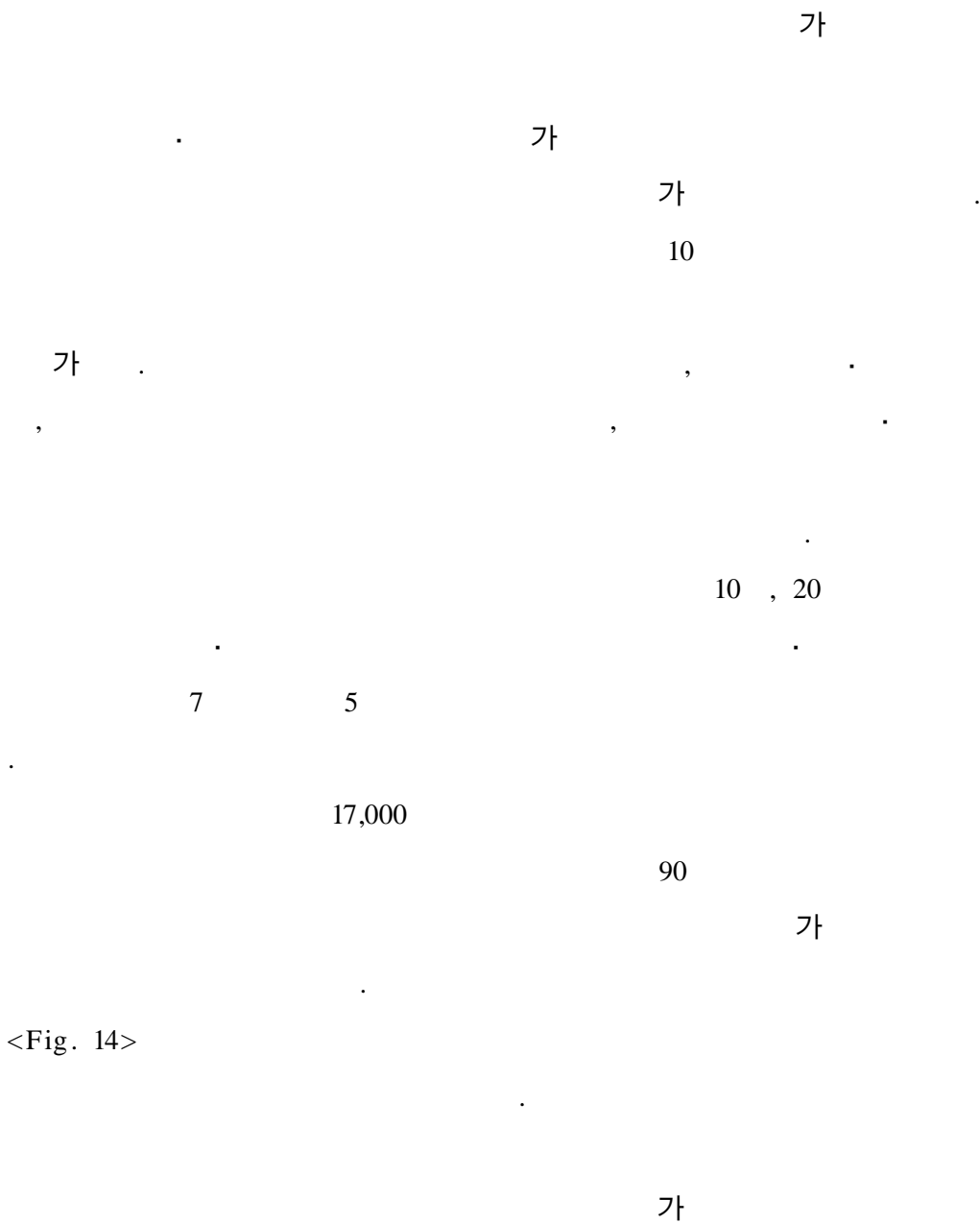
28 ()
 VHF 가 가 .
 PTMS
 VHF 가
 PTMS
 가
 가 가

[14]가 .



< Fig. 13 > Display of Fishing Boats' Movement

4.2





< Fig. 14 > Display of Vessel Traffic Congestion

4.3

가

가

가
LANBY(Large Automatic Navigational Buoy)
가

4.4

가
70 100
가
()
가
가
PORT GUIDE ENTRY “
” “ ”
PTMS
가

4.5

1 가 3
가 .
가
가
.
.
가 . 가
PTMS
PTMS 가
가 .
가 .
가 .
가 .
가 .
가 .
가 .
[15]

4.6

10

가

16

20

.

7

.

.

가

.

가

.

.

가

가

.

.

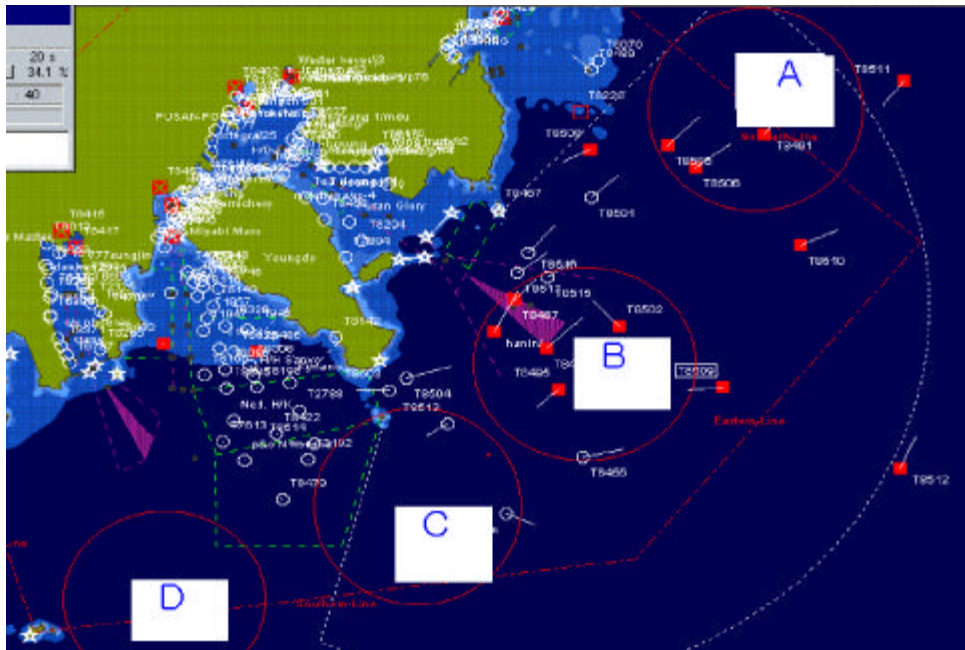
5

5.1

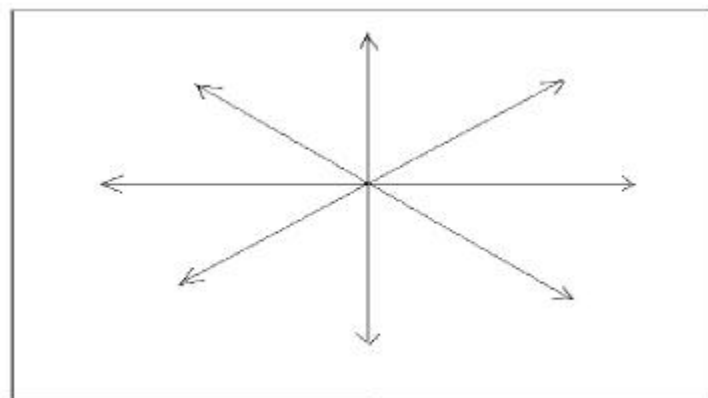
5.1.1

가 ,
가 . ,
가 . ,
가 ,
가 가
, <Table 15>
55% 가 가 .
가 ,
가 <Fig.
15> A, C, C, D 4 , 2
12 5 , 6 , 7 3 72
24 6 <Fig. 16>

5060-VTS Logging and Replay ()



<Fig. 15 > The Research Position of Vessel Movement



< Fig. 16 > The Research of Vessel Movement Direction

5.1.2

<Table

21> 04:00 08:00, 16:00 20:00 가
 45%
 08:00 12:00, 12:00 16:00 20:00 24:00
 00:00 04:00 가

<Table 21> B 47% 가
 C, D, A B 47%

<Table 21> Traffic Volume in Research Time and Position

						(%)
	A	B	C	D		
00:00 04:00	16	40	24	18	98	7
04:00 08:00	40	106	24	45	247	19
08:00 12:00	30	115	56	39	216	16
12:00 16:00	25	109	32	29	212	16
16:00 20:00	30	157	49	38	342	26
20:00 24:00	25	95	117	28	198	15
	166	622	328	197	1313	100
(%)	13	47	25	15	100	

[:]

<Table 22> Traffic Volume in Ship's Course

	A		B		C		D			(%)
0° , 180°	31	19	50	8	57	17	46	23	184	14
45° , 225°	115	69	329	53	173	53	128	65	745	57
90° , 270°	10	6	97	16	93	28	15	8	215	16
135° , 315°	10	6	146	23	5	2	8	4	169	13
	166	100	622	100	328	100	197	100	1313	100

[:]

<Table 22>

45° 225° 57% 가 0°
 180° , 90° 270° , 135° 315° 13 16% .
 45° 225° A, B, C, D 53 69%
 A 69% .
 가 .
 B 47%
 가 가 . 45° 225° 가
 가 .
 45° 225° A D .

<Fig. 17>



< Fig. 17 > The Direction of Vessel Traffic Movement

5.1.3

7 , 17.000 .

가 가 .

4000 TEU

가

.
.

PTMS가

()

.

(11 ,

) 가

(5)

043

198

35 03 48 ,

129 08 00

6.0

,

.

가 . , , , ,

.

가

.

,

, 5000 TEU

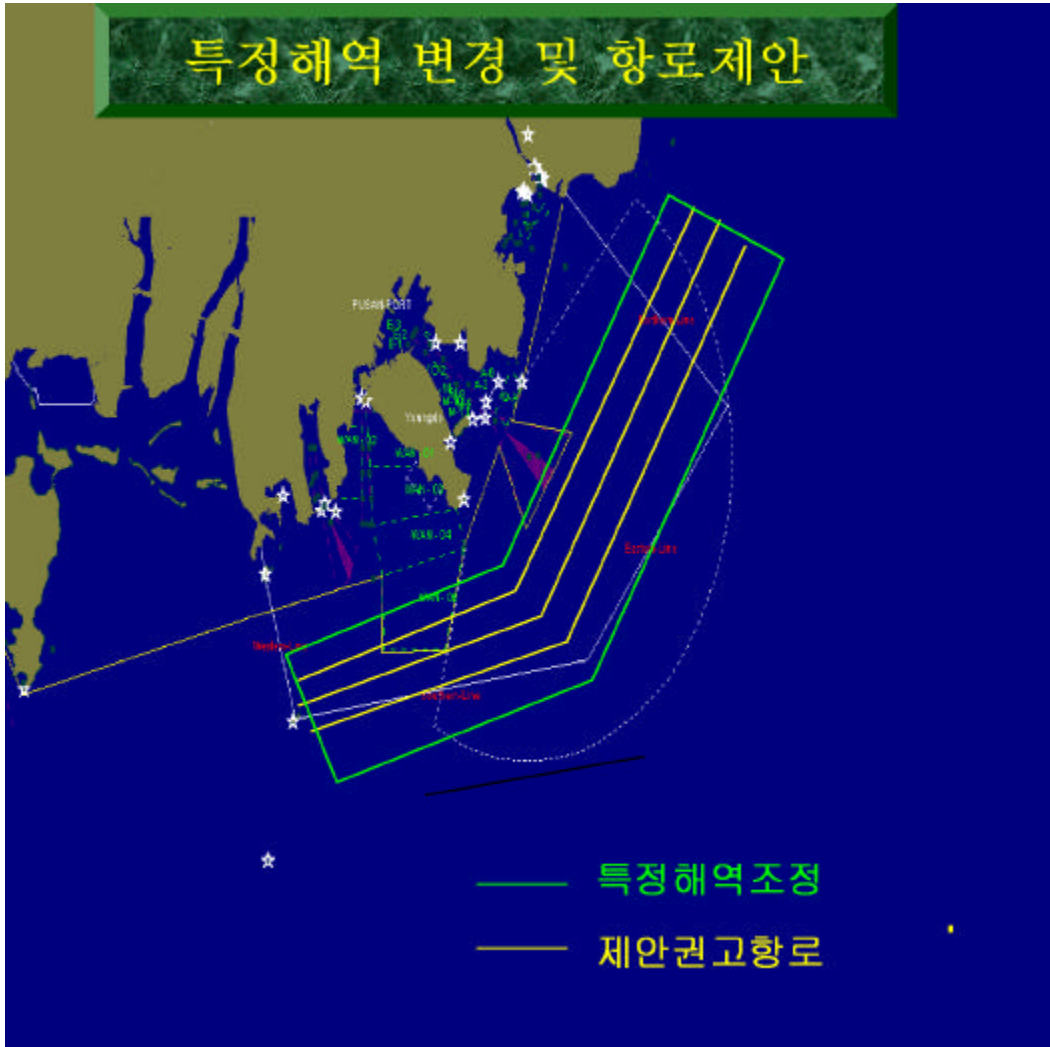
가

()

가
가
가 가

<Fig. 18>

1 2 2 5 2 2



< Fig. 18 > Proposed Sailing Route and Integrated Traffic Area
in Pusan Port

5.2

5.2.1

PTMS

가 PORT - MIS

,

.

. 9 , 8

PORT - MIS

가

.

.

PORT - MIS

가

PORT - MIS

가

PTMS

,

가 .

가

. PTMS

.

5.2.2

1978 STCW 1995 「 10 (Conference Resolution 10) 」 VTS STCW IALA VTS 가 1 4 가가 [16] 12 43 가 PTMS , , VTS PTMS VTS 가 가 PTMS 가 가

VTS-AIS

가 . 가

PTMS

AIS

PTMS

500

PTMS

PTMS

PTMS 가

5.2.3

PTMS

가

가

가

,
 . PTMS가 2
 ,
 PTMS 가 가 가 ,
 ,
 ,
 Good Seamanship .
 , (,)
 VHF 가 . , 가
 가 VHF
 가 .
 가 가
 가 .
 가 PTMS
 ,
 PTMS 가
 가
 PTMS
 .

5.3

PTMS 가 가 가

가 . PTMS

가 가 . 가

PTMS 가 가

가 가 . 가 PTMS

가 가 . , TRS,

VHF, IMT - 2000

가 .

SHIP-TO-SHIP, SHIP-TO-SHORE, SHORE-TO-SHIP

PTMS

SHORE - T O - SHIP

AIS(Automatic Identification

System)

PTMS

가

가

. PTMS

가

가

가

PTMS

PTMS

AIS

PTMS

PTMS

PTMS

PTMS

AIS가

[17]

90,000

가

(AIS)

가

5.4

5.4.1 PTMS

PTMS 가 ,
PTMS 28 (), 45 ()

45 PTMS

가 PTMS

PTMS 5 [18] .
10 가 가
가 .

가

가 .

. PTMS

PTMS

5.4.2 PTMS

가
가 10
VHF 가
28 ()
VHF
가 PTMS VHF
가

가

AIS

5.4.3 (Contingency Plan)

가 OPEN SEA

5

가

가

가

가

8

가

가

가

가

, . , 가

(Contingency Plan)

PTMS . , , 가 가
가
가 가
PTMS .
PTMS
가 가
가

가
PTMS (Contingency Plan)
, , ,
가
가
가

6

6.1

가 PTMS 2

PTMS

가 1

PTMS

64%, 100%, 100%

가 가

PTMS

90,000

AIS PTMS 가

PTMS-AIS

PTMS

6.2

PTMS

2

가

가

PTMS

가

가

가

PTMS

가

- [1] , “ VTS ”, 1999
- [2] , “VTS . ”,
 , 1 , 1999, pp.109 123.
- [3] IMO Resolution A.578(14), "Guidelines for Vessel Traffic Services", 1985.
- [4] IALA, "IALA Vessel Traffic Service Manual", May 1998,
IALA Recommendation V- 103, pp.25 26.
- [5] Kongsberg, Norcontrol. "Vessel Traffic Management System for Pusan MOMAF", Technical Quotation, Vol,1,4, 1996.
- [6] , “VTS Operator Training Manual”, Part 2,
1999.
- [7] , " 가 " , 1995, pp.124 140.
- [8] Kongsberg, Norcontrol. "Vessel Traffic Management System for Pusan MOMAF", Technical Quotation, Vol, 1,4, 1996, p.2.
- [9] , “ ”,
1999-43 .1999.
- [10] , “Quantification of The Effectiveness of Vessel Training Services”, , 1 , 1 , 1994, p.84.
- [11] , “ ”, 1998, pp.181 186.

- [12] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, p.234.
- [13] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, pp.239-241.
- [14] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, pp.239-241.
- [15] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, pp.175-188.
- [16] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, p.260.
- [17] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, p.105.
- [18] 김민준, “VTS 도입에 따른 항만 운영 효율성 향상 방안”, 2000, p.110.