

Executive Summary: a study and survey establishing the master plan and operation plan of safe water transportation

1 Introduction

- 1.1 The Marine Department has the mission to administer, control, regulate, supervise, and conduct activities to promote and develop maritime transportation. After continuous attempts and tremendous resources, maritime transportation has obviously exhibited significant growth--providing benefit to society and the economy. However, with this growth have come casualties and accidents, and damage to property, life, and the environment. Thus, for sustainable development, all development measures shall be conducted simultaneously with safety measures in order to have accidents as low as practicable.
- 1.2 The aims of establishing safety master plan and an operation plan for water transportation are to provide recommendations for essential measures to promote safe water transportation in the Gulf of Thailand, the Andaman Sea, and the inland waterway during the next decade. These essential measures directly concern seafarers on board ships, ships and their equipment, and the contiguous environment. It is expected that all proposed measures (e.g. inspiring safe attitudes, accident prevention measures, searching and rescue measures) will be based on local constraints, efficient water transportation, and economics.

2 Problem Statement

- 2.1 Accident statistics during 1992-2005 presented an average of 30.7 accidents--41.5 vessels per annum. Among these, 18 were sunk, including 15.6 injuries and 35.9 deaths (including lost persons). The type of ship that most often encountered accidents was passenger ships (and related types, e.g. cargo-passenger), accounting for 30.3% of accidents, followed by ships carrying general cargo - container and barges, accounting for 22.7% and 14.1%, respectively.
- 2.2 The likeliest place for an accident was the Bangkok Metropolitan Area, which accounted for 70.3%, followed by the eastern region, the east coast of the southern region, and the west coast of the southern region at 10.0%, 8.8%, and 5.4%, respectively. These figures are in proportion with the traffic volume in those locations.
- 2.3 The causes of accidents were human error, ships and equipment, and the contiguous environment. Determined from gray theory and probabilistic theory, human error was the principle cause of accidents, accounting for 87.2%, followed by the contiguous environment and ships and its equipment at 6.8% and 5.6%, respectively. This means that the most effective solutions would relate to human error.

- 2.4 Without proper action, if future traffic growth and accident rates conform to the past traffic volume, it can be presumed that the number of accidents will reach 35, 55, and 79 in 2008, 2017, and 2016, respectively.

3 Risks and Ways to Reduce Accidents

- 3.1 Risk assessments were conducted in accordance with the Formal Safety Assessment (FSA), the International Maritime Organization (IMO)'s recommendation. Level of risk is determined from the multiple of occurrence probability and severity level. Occurrence probability is defined from rare to often, 1-7, from an accident occurring with 5000 vessels within a 20-year period (1×10^{-5}) to an accident on a vessel every month). Severity level is defined from a minor to a catastrophic accident, 1-4, with minor injury to more than 10 deaths or damage of the whole vessel.
- 3.2 Comparative study indicates that Surathani was the highest risk area, with an accident rate of 1×10^{-3} , followed by Sriracha-Laem Chabang and the middle Chao Praya River, although at a lower accident rate (1×10^{-5}) but at a severe level.
- 3.3 The first priority regarding ways to reduce risk is an engineering approach that will diminish danger, followed by a management approach or work procedures that include protection measures. Last are measures to reduce loss when the first two options do not work.

4 Accidents: Events and Protection

- 4.1 Every accident normally begins from a dangerous situation and then evolves to an accident. Finally, depending upon the level of severity, the accident may progress to the catastrophic level or be one that involves minor damage with little delay on a continuous journey.
- 4.2 The above phenomena mean that accident reduction has to start with the prevention of dangerous situations. However, if the prevention measures are not successful, there is a need for a monitoring system in order to determine the nature of the dangerous situation so that control measures can be implemented. If control measures are successful, the dangerous situation will evolve to a safe condition. However, if these measures fail the dangerous situation will become an accident. In this case the controlling measures have to have the capacity to determine the occurrence of accidents (or any other system of ascertaining facts) so that other measures take place to prevent sequential accidents and reduce losses.
- 4.3 Examples of preventing danger-situation measures are knowledge and safety attitudes in terms of not entering dangerous situations. Other necessary measures are the seaworthiness of vessels and proper surroundings, e.g. channels, lights, buoys to reduce danger from ships, equipment, and other physical dangers.
- 4.4 Examples of monitoring and controlling measures are Vessel Traffic Services (VTS) for determining the situation and for providing information or suggestions to master mariners for safely maneuvering. Other examples are patrol boats in risk areas and communication systems to Receive Danger Information from stakeholders (RDI).

- 4.5 Examples of monitoring and controlling traffic after accidents include broadcast of accident news, installing buoys at wrecks, and patrol boats when the situation demands.
- 4.6 Examples of search and rescue are establishing a coordination centre, an operation centre, and exercise at appropriate intervals.

5 Guidelines for Safe Administration

- 5.1 The means to achieve safety is by establishing a safety system comprised of a safety policy, a designated person(s), understanding problems, formulating a correction plan, commence and control, and evaluation for formulating a new plan to resolve all remaining and new problems.
- 5.2 Successful work is not an individual task but comes from the contribution of the whole organization. Existing mechanisms (organization structure of bureaus, divisions, and offices) should support this attempt via their own operation plans, which include requirements identified in the master and operation plan of safety water transportation. The work carried out in safe transportation performance should be taken as criteria for rewarding progress and assigning punishment.
- 5.3 Safe water transportation is not merely the task of the Marine Department but is the responsibility of the whole community. It is necessary for entrepreneurs to understand the long-term benefit of safe transportation. Seafarers as well should seek a safe work place for quality of life. Under this concept, safety attitude and social values are a major contribution.

6 Foreign case study

- 6.1 The story of a foreign case study covers attempts by the International Maritime Organization (IMO) and 3 developed countries, the United Kingdom (UK), the United States of America (USA), and Australia, which are leading countries of the 3 continents. The aim is to explore various measures and to adapt them, as applicable, to the Thai context.
- 6.2 Examples of these measures are (1) trustworthiness of STCW certificate holders, (2) long-range of ship identification for security and search and rescue operation, (3) port state control to diminish low-quality vessels, (4) review the effectiveness of the implementation of the IMO's convention and its volunteer programme, (5) marine incident and accident investigation, and (6) refugee bay for ships in distress.

7 Potentials and Constraints of the Marine Department

- 7.1 The aim of this section is to understand the potential and constraints of the Marine Department in order to make it ready to implement all safety measures. According to Ministry Rule: Administration Organization B.E. 2545, its obligations are to promote, support, and develop water transportation and connections to other transport modes, covering both passengers and cargoes. This duty includes the development of ports, dock yards, fleets, and related activities for comprehensive services, convenience, speed, efficiency, and safety. These all are to strengthen exporters.

- 7.2 The aforementioned duties are of a resource consuming nature. Its budget in the fiscal year 2006 is 3326.68 million Baht. The majority, 2826.30 million, was consumed in investment projects, followed by the salary and operating budget, 388.04 million and 104.69 million, respectively. These all were conducted by a staff of 2101.
- 7.3 Interviews and brainstorming with Marine Department officers have indicated various problems occurring within the organization. For example, these are insufficient knowledge of operating officers, insufficient training, inadequate budget, ratio of budget to task was not balanced among various offices, and improper equipment.
- 7.4 Insufficient resources lead to the risk of unsuccessful operation; however, the best achievements under these constraints are to carefully set priorities and proper management of manpower, money, and equipment.

8 Master Plans

- 8.1 The above comprehensive study depicted 5 master plans. These are (1) the plan to Develop Safety Management within the organization, (2) the plan to develop and improve Safety Standards, (3) the plan to develop and improve Safety Laws and Regulations, (4) the plan to Promote and Develop Safe Water Transportation, and (5) the plan to Develop Marine Incident and Accident Investigation.
- 8.2 The Safety Management Plan integrates various requirements occurring in other plans into one system. It requires 2 operation plans, i.e. the plan to Setup a Safety Database and the plan to develop a Safety Organization.
- 8.3 Developing and Improving Safety Standards is essential for the prevention of dangerous situations, which leads directly to numbers of accidents. It requires 3 operation plans, of which some are the same as the previous plan. These are (1) the plan to develop a Safety Organization, (2) the plan to develop and improve Safety Standards and (3) the plan to Disseminate Standards for public interest.
- 8.4 Developing and Improving Laws and Regulations are similar to the Standard Plan, except for the compulsory requirements. Therefore, an additional operation plan is the plan for Water Transportation Inspection for law enforcement. Another requirement is the dissemination of laws and regulations within the plan to disseminate standards.
- 8.5 Promoting and Developing Safety Water Transportation originated from the concept presented in topic 4, Accidents: Events and Protection. It requires 9 operation plans. These are (1) the plan to Build Safe Attitudes for all Stake Holders, (2) the plan for Ship Surveys, (3) the plan to Inspect and Improve Physical Conditions, (4) the plan for Water Transportation Inspection, (5) the plan to Establish Vessel Traffic Services, (6) the plan for an RDI and Controlling System, (7) the plan for Search and Rescue (8) the plan to Setup a Safety Database, and (9) the plan to Combat Pollution.
- 8.6 Marine Incident and Accident Investigation is a methodology that turns previous accidents into lessons. It is an important step toward preventing similar accidents so that they will not happen again in the future. It requires 3 operation plans. These are (1) the plan to develop a Safety Organization, (2)

the plan for Marine Incident and Accident Investigation, and (3) the Plan to Disseminate Investigation Reports.

9 Operation Plans

- 9.1 As presented in table I, the 5 master plans lead to 14 operation plans. These are (1) the plan to Setup a Safety Database, (2) the plan to Develop and Improve Safety Standards, (3) the plan to Develop and Improve Safety Laws, (4) the plan to Disseminate Safety Standards, Safety Laws, and Investigation Reports, (5) the plan to Inspect Water Transportation, (6) the plan to Build Safety Attitudes, (7) the plan to Survey Ships, (8) the plan to Inspect and Improve the Physical Environment, (9) the plan to Establish Vessel Traffic Services, (10) the plan to Receive Danger Information and Counterattack, (11) the plan for Search and Rescue, (12) the plan to Combat Pollution, (13) the plan to Investigate Marine Incident and Accident, and (14) the plan to Setup a Safety Organization. The Safety Organization Plan is the first requirement but has to be presented last in order to collect all the requirements of all plans.
- 9.2 The operation of operating plans requires the contribution of the whole organization. The analysis of each unit contribution (bureaus, divisions, and offices) and their relations are presented in table II.

Table I Master Plan and Supporting Operation Plan

Item	Operation Plans	Master Plans				
		Safety Management	Developing and Improving Safety Standards	Developing and Improving Laws and Regulations	Promoting Safety Water Transportation	Marine Incident and Accident Investigation
1	Safety Database	✓				
2	Developing and Improving Safety Standards		✓			
3	Developing and Improving Laws and Regulations			✓		
4	Disseminating Standards, Laws, and Investigation Reports		✓	✓		✓
5	Inspection of Water Transportation			✓	✓	
6	Building Safety Attitudes				✓	
7	Ship Surveys				✓	
8	Inspect and Improve Physical Environment				✓	
9	Establishing Vessel Traffic Services				✓	
10	Receipt of Danger Information and Counterattack				✓	
11	Search and Rescue				✓	
12	Pollution Combating				✓	
13	Marine Incident and Accident Investigation					✓
14	Safety Organization	✓	✓	✓	✓	✓

Source: Consultant's analysis

Table II Operation Plans and Responsible Units

Item	Operation Plans	Unit within Marine Department												
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	Safety Database	○	○	○	○	○	○	●	○	○	○	○	○	○
2	Developing and Improving Safety Standards			●		○			○	○	○			○
3	Developing and Improving Laws and Regulations			●		○			○	○	○			○
4	Disseminating Standards, Laws, and Investigation Reports	●		○		○			○	○				○
5	Inspection of Water Transportation		○			○				●				○
6	Building Safety Attitudes	○							●	○				○
7	Ship Surveys			●	○					○				○
8	Inspect and Improve Physical Environment				○		○	○		○	●		○	○
9	Establishing Vessel Traffic Services				○	○	○			●				○
10	Receipt of Danger Information and Counterattack				○	○	○			●				○
11	Search and Rescue					○	○			●				○
12	Pollution Combating					○				●				○
13	Marine Incident and Accident Investigation			○	○	○	○		○	●	○		○	○
14	Safety Organization	●	○	○	○	○	○	○	○	○	○	○	○	○

Remark: Unit code: (1) Office of the Secretary (2) Finance Division (3) Ship Survey Division (4) Ship Registration Division (5) Legal Division (6) Pilot Division (7) Technical and Planning Division (8) Merchant Marine Training Centre (MMTC) (9) Marine Safety and Environment Bureau (10) Channel Development and Maintenance Bureau (11) Maritime Promotion Bureau (12) Survey and Engineering Bureau (13) Marine Offices

Symbol code: ● main responsibility; ○ supporting responsibility

9.3 These operational plans require a budget during the period 2008-2017 up to 1667.63 million Baht. Its principles and reasons, performance indexes, necessary resources, and response persons are presented in table III.

Table III Operation Plans: Principle, Performance Indicator, Budget and Response Persons

Operation Plans		Budget (million Baht)	Response person(s)
1. Plan to Setup Safety Database Principle: Measure promoting efficient work. There are 4 kinds of database. These are (1) Safety navigation database, (2) Facilitating Work database, (3) Supporting safety database, and (4) Work progress database.		0.0 (include in already hired contract)	Director of Technical & Planning Division
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Database size • Number of accesses 	<ul style="list-style-type: none"> • User satisfaction 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
2. Plan to Develop and Improve Safety Standard Principle: Measures preventing dangerous situations by formulating best practice of water transportation community through setting up Safety Standard Committee and Safety Committee.		31.5	The designated Deputy Director General
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of complete standards • Number of meetings 	<ul style="list-style-type: none"> • Satisfaction of concerned persons 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
3. Plan to Develop and Improve Laws and Regulations Principle: Measures preventing dangerous situations, prepared by procedures conforming to Formal Safety Assessment Procedures (an IMO procedure used to establish laws and regulations). Considered and reviewed by Safety Standard Committee and Safety Committee.		14.9	The designated Deputy Director General
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of completed laws and regulations, • Number of meetings 	<ul style="list-style-type: none"> • Satisfaction of user, controller, and committee 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
4. Plan to Disseminate Standards, Laws, and Investigation Reports Principle: Measures preventing dangerous situations, successor of enacting safety standards, laws and regulations, and accident investigation.		58.2	Director of Office of Secretary supported by technical persons
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of disseminations, participating persons, person-day 	<ul style="list-style-type: none"> • Knowledge after training • Satisfaction 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		

Table III Operation Plans: Principle, Performance Indicators, Budget and Response Persons (continued)

Operation Plans		Budget (million Baht)	Response person(s)
5. Plan to Inspect of Water Transportation Principle: Measures making law enforcement. Organized by having special inspecting teams work in very strict manner for 2 weeks--then rotate to other locations.		240.6	Director of Marine Safety and Env. Bureau
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of operations • Number of infringements • Fines 	<ul style="list-style-type: none"> • Infringement per operation • Repeated infringement 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
6. Plan to Build Safety Attitude Principle: Measures preventing dangerous situations. A person who has a good attitude will not enter into a dangerous circumstance.		14.0	Director of MMTC
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of trainings (times, persons, person-day) 	<ul style="list-style-type: none"> • Attitude after training • Satisfaction 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
7. Plan to Survey Ship Principle: Measures preventing dangerous situations by eliminating danger from improper ships.		69.5	Director of Ship Survey Division
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of inspected ships • Inspection duration 	<ul style="list-style-type: none"> • Number of inspected ships per officer • User satisfaction 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
8. Plan to Inspect and Improve Physical Environment Principle: Measures preventing dangerous situation by eliminating danger from improper physical environment.		49.2	Director of Channel Dvp. and Maint. Bureau
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Dredging works • Navigation aids 	<ul style="list-style-type: none"> • User satisfaction 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
9. Plan to Establish Vessel Traffic Services Principle: Surveillance, Controlling, and Supporting Search and Rescue Measures implemented at appropriate locations i.e. Laem Chabang-Sichang, Chao Praya River, and Phuket.		827.4	Director of Marine Safety and Env. Bureau
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of vessels 	<ul style="list-style-type: none"> • Accidents in service area 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		

Table III Operation Plans: Principle, Performance Indicators, Budget and Response Persons (continue)

Operation Plans		Budget (million baht)	Response person(s)
10. Plan to Receive Danger-Information and counterattack Principle: Measures assisting master mariners in making the Marine Department aware of dangerous situations and in acting on this information.		269.4	Director of Marine Safety and Env. Bureau, Marine Offices
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Amount of information received • Number of operations 	<ul style="list-style-type: none"> • Ratio of operations to receive • Satisfaction of concerned persons 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
11. Plan to Establish Search and Rescue Coordination Centre Principle: Measure reducing loss from accidents when preventing and controlling measures did not succeed.		10.0 (only exercise operation expense are normal budget)	Director of Marine Safety and Env. Bureau,
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of exercises • Number of operations 	<ul style="list-style-type: none"> • Satisfaction of concerned persons 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
12. Plan to Combat Pollution Principle: Measure reducing loss from accidents when preventing and controlling measures do not succeed.		23.0 (only exercise and training, operation expenses are normal budget)	Director of Marine Safety and Env. Bureau,
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of exercises • Number of operations 	<ul style="list-style-type: none"> • Satisfaction of concerned persons 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
13. Plan to Investigate Marine Incidents and Accidents Principle: Measure turning accidents into lessons to avoid similar incidents in the future.		60.0	Director General
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of investigations 	<ul style="list-style-type: none"> • Number of recommendations • Satisfaction of concerned persons 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		
14. Plan to Setup a Safety Organization Principle: Measures identifying response person(s), resolving organization conflict and dealing with inadequate resources.		0.0 (include in normal budget)	Director General
Quantity indicators	Qualitative indicators		
<ul style="list-style-type: none"> • Number of accidents • Ratio of receive to acquire budget 	<ul style="list-style-type: none"> • Reduce accident loss • Ratio of budget and staffs allocated for safety 		
Time indicators	Cost indicators		
<ul style="list-style-type: none"> • Completed within planned schedule 	<ul style="list-style-type: none"> • Within budget limit 		

Source: Consultant's analysis

10 Economic Considerations

- 10.1 The economics study covers 6 subjects. These are (1) damages in case of no proper means to reduce them, (2) possible decrease, (3) the required budget, (4) economic return, (5) priority, and (6) performance indicators.
- 10.2 The damage study found that the major cost was loss of property, accounting for 438.94 million Baht a year. The majority came from cargo vessels, e.g. general cargo vessels, container vessels, barges, and tankers, followed by the cost of the environment, loss of life, and administration accounting for 219.7 million Baht, 156.16 million Baht, and 0.6 million Baht, respectively. Altogether it was 815.4 million Baht a year. Without proper means to resolve loss of accidents will reach 1300 million Baht in 2017.
- 10.3 The study of possible decreases came from the statistical comparison of casualties per registered ship in Thailand and the USA. The context of Thailand was 5.9 times over the USA context. Therefore, from comprehensive plans similar to other developed countries, the degree of 50% lower than the current situation was determined possible. Regarding the decreasing pattern, the USA context suggested a steady rate of 5% per annum. Additionally, in order to avoid fluctuation it is advised to use a 5-year moving average instead of year by year statistics.
- 10.4 There are 2 types of expenses: the expense of operational plans under this project, which amounted to 1667.63 million Baht during 2008-2017, and normal fiscal expenses, since the Marine Department has conducted several activities concerned with safety, such as training seafarers, inspecting water transportation, etc.
- 10.5 The allocation of fiscal expenses for safety expenses grasps the budget provided for strategy concerns with control and maintenance of water transportation for convenience, speed, efficiency, and safety amounting to 241 million Baht in the fiscal year 2005. Since the assumption of economics study is a constant 2005 price, so 241 million Baht were applied constant during the entire period.
- 10.6 The economic internal rate of return (EIRR) under the previous benefits and expenses assumption is 13.6% per annum, much higher than the interest in September 2006, which was 8.0% per annum. The net present value (NPV) at a 10% discount rate is 197.8 million Baht and the ratio of benefit to cost (B/C) is found at 1.07. Indeed without fiscal expenses, which can be presumed an already paid budget, the EIRR, NPV, and B/C will reach 57.4%, 1.678.7 million Baht, and 2.42, respectively.
- 10.7 Regarding sensitivity analysis, it was found that the project can absorb sensitivity around $\pm 5\%$ (table IV), so some risk in obtaining a return lower than the bank interest rate is foreseen. However, when considering possible loss of oil spill greater than 1000 tons, which would cost more than 1000 million Baht, a one-time accident during a 10-year period would cost more than half of the entire expenses. Consequently, as large a budget as possible for the safety project is suggested.

Table IV Sensitivity Analysis of EIRR

Sensitivity of Benefit	Sensitivity of expense		
	1.0	1.05	1.10
0.90	8.3%	5.9%	3.7%
0.95	11.0%	8.6%	6.3%
1.00	13.6%	11.1%	8.8%

Source: Consultant's analysis

- 10.8 In case of insufficient budget, the consultant proposes 4 dimensions to determine priority. These are (1) operating mechanism (interactive between plan and target), (2) concern for safety factors -- human, equipment, and surrounding, (3) capacity to reduce loss, and (4) coverage area.
- 10.9 The study gives priority to the dimension of operating mechanism in order to prevent dangerous situations, control dangerous situations, and reduce loss, respectively. The second dimension in order of priority concerns safety factors since they deal with preventing dangerous situations. This dimension gives high priority to plans dealing with human factors as the major cause of accidents, followed by surroundings and equipment. The third dimension concerns the capacity to reduce loss as this dimension yields a greater result compared to others. The last dimension concerns area coverage since covering a no-risk area yields little advantage.
- 10.10 The first 3 most effective plans (highest marks) under the aforementioned criteria are (1) developing and improving standards, (2) developing and improving laws and regulations, and (3) dissemination of standards, laws, and investigation reports. The other important plans at close rank are marine incident and accident investigation and building safety attitudes.
- 10.11 When considering resources consumed per mark (not including plans which do not require an additional budget, i.e. safety organizations and safety databases) the first 3 most resource-effective plans are (1) developing and improving standards, (2) building safety attitudes, and (3) search and rescue. The most consumed resource is vessel traffic services.
- 10.12 There are 2 types of Performance Indicators, (1) indicators measuring the Marine Department and (2) indicators measuring units within the Marine Department. The person who responds to the Marine Department's indicators is the Director General. These are indicators concerned with the number of accidents and the loss of accidents, which is expected to be 5% lower than the last 5-year average, and with the allocation of resources used for the safety project. The second type of indicators is the amount of works conducted, e.g. number of trainings, cubic metres of dredging, etc, and resources used per work.