



C72-11.4.7  
(VTS49-11.1.1.3)

# IALA GUIDELINE

## G1150

### ESTABLISHING, PLANNING AND IMPLEMENTING VTS

## Edition 2.0

December 2020



# DOCUMENT HISTORY

---

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision
December 2019	1 <sup>st</sup> issue	New Guideline – Contains the content formerly in IALA Recommendation V-119 following splitting V-119 into a Recommendation (Recommendation 0119 - The implementation of Vessel Traffic) and an associated Guideline (G-1150) to align with the new IALA document structure.
December 2020	Entire Document	Major revision of new Guideline following splitting former Recommendation V-119 into a Recommendation and associated Guideline as above.

# CONTENTS

---

<b>1. DOCUMENT PURPOSE</b> .....	<b>4</b>
<b>2. INTRODUCTION</b> .....	<b>4</b>
<b>3. OVERVIEW</b> .....	<b>4</b>
<b>4. ESTABLISHING</b> .....	<b>5</b>
4.1. INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA (SOLAS) .....	5
4.2. IMO RESOLUTION A.857(20) GUIDELINES FOR VESSEL TRAFFIC SERVICES .....	6
4.3. IALA STANDARDS .....	6
4.3.1. RECOMMENDATIONS .....	7
4.3.2. GUIDELINES .....	7
4.3.3. MODEL COURSES .....	7
4.4. NATIONAL LAW .....	7
<b>5. PLANNING AND IMPLEMENTING</b> .....	<b>7</b>
5.1. PHASE 1: INITIATING .....	8
5.2. PHASE 2: PLANNING .....	10
5.3. PHASE 3: IMPLEMENTING .....	11
5.4. PHASE 4: CONTROLLING .....	11
5.5. PHASE 5: CLOSING .....	11
<b>ANNEX A CONSIDERATIONS WHEN INITIATING AND PLANNING A VTS</b> .....	<b>12</b>
<b>ANNEX B PASSIVE TRAFFIC MANAGEMENT MEASURES</b> .....	<b>16</b>

## List of Tables

<i>Table 1</i>	<i>Key practices associated with VTS</i> .....	<b>4</b>
----------------	--	----------

## List of Figures

<i>Figure 1</i>	<i>Graphical representation of legal, regulation and guidance hierarchy associated with establishing VTS</i> .....	<b>Erreur ! Signet non défini.</b>
-----------------	--	------------------------------------



## 1. DOCUMENT PURPOSE

The purpose of this Guideline is to provide a framework to assist authorities in implementing practices specified in IALA Recommendation R0119 on Establishment of VTS. This includes arranging for establishing, planning and implementing VTS.

IALA Guideline 1150 – Establishing, Planning and Implementing VTS is associated with Recommendation 0119 - Establishment of VTS, a **normative provision** of IALA Standard 1040 Vessel Traffic Services (VTS). To demonstrate compliance with the Recommendation the provisions of this Guideline need to be implemented.

## 2. INTRODUCTION

The IMO Convention for the Safety of Life at Sea (SOLAS) 1974 - Chapter V (Safety of Navigation), Regulation 12 provides for Vessel Traffic Services and states that:

*“Contracting Governments undertake to arrange for the establishment of Vessel Traffic Services where, in their opinion, the volume of traffic or the degree of risk justifies such services”*

Under the general provisions of treaty law and of IMO conventions, States are responsible for promulgating laws and regulations and for taking all other steps which may be necessary to give those instruments full and complete effect so as to ensure safety of life at sea and protection of the marine environment.

SOLAS also states that Contracting Governments planning and implementing VTS shall, wherever possible, follow the guidelines developed by the IMO.

IMO Resolution A.857(20) Guidelines for Vessel Traffic Services invites Contracting Governments to take account of the annexed Guidelines when developing, implementing, and operating vessel traffic services, specifically setting out the responsibilities of Contracting Governments for “*planning and implementing*” a vessel traffic service.

## 3. OVERVIEW

Key practices associated with establishing, planning, and implementing VTS include those shown in Table 1:

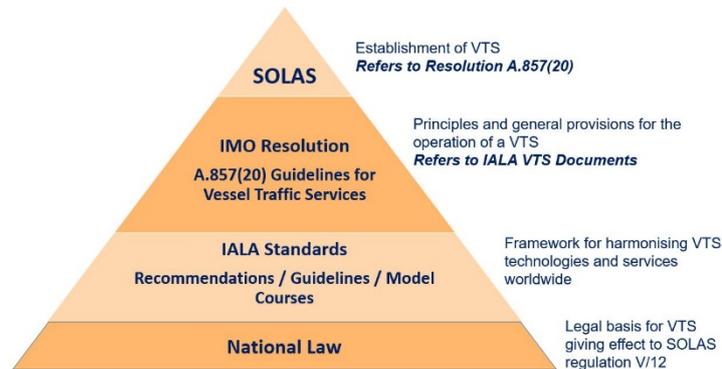
***Table 1 Key practices associated with VTS***

Activity	Applied via	Purpose
Establishing	Regulatory Framework	To establish a national legislative framework that gives effect to regulation V/12 of the Convention.
Planning	Needs Assessment	Comprehensive information gathering and analysis process to determine the need for VTS, the feasibility of operating VTS and the design necessary to achieve the needs identified
Implementing	Implementation Plan	Processes including: <ul style="list-style-type: none"> <li>• Project Management</li> <li>• Procurement</li> <li>• Conformance with IMO Resolution A.857(20) and IALA Standards</li> <li>• Authorisation</li> </ul>

## 4. ESTABLISHING

Governments undertake to arrange for the establishment of VTS by promulgating laws and regulations and for taking all other steps which may be necessary to give full and complete effect to the SOLAS regulation V/12 to ensure safety of life at sea and protection of the marine environment.

Where competent authorities have arranged for the establishment of VTS in national law as described below and are proceeding with the planning and implementation of VTS they should move to Section 5 (Planning and Implementing).



**Figure 1** *Graphical representation of legal, regulation and guidance hierarchy associated with establishing VTS*

The international framework for establishing a VTS includes:

1. International Convention for the Safety of Life at Sea (SOLAS) 1974;
2. IMO Resolution A.857(20) Guidelines for Vessel Traffic Services;
3. IALA Standards;
4. National law.

In addition to the VTS specific components listed above, the United Nations Convention on the Law of the Sea (UNCLOS) lays down a comprehensive regime of law and order in the world’s oceans and seas.

### 4.1. INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA (SOLAS)

SOLAS regulation V/12 recognizes VTS internationally as a navigational safety measure. In particular, it provides for VTS and states that:

*“Vessel Traffic Services (VTS) contribute to safety of life at sea, safety and efficiency of navigation and protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic.”*

SOLAS also states that:

*“Governments may establish VTS when, in their opinion, the volume of traffic or the degree of risk justifies such services.”*

and that:

*“Governments planning and implementing VTS shall, wherever possible, follow the guidelines developed by the IMO.”*



Under the general provisions of treaty law and of IMO conventions, States are responsible for promulgating laws and regulations and for taking all other steps which may be necessary to give those instruments full and complete effect so as to ensure safety of life at sea and protection of the marine environment.

#### 4.2. IMO RESOLUTION A.857(20) GUIDELINES FOR VESSEL TRAFFIC SERVICES

Resolutions are documents that IMO or its main bodies have accepted, and which IMO Member States are encouraged to accept and implement into their national legislation.

The IMO Assembly adopted Resolution A.857(20) Guidelines for Vessel Traffic Services in 1997 recognizing that:

- the safety and efficiency of maritime traffic and the protection of the marine environment would be improved if vessel traffic services were established and operated in accordance with internationally approved guidelines; and
- the use of differing vessel traffic service procedures may cause confusion to masters of vessels moving from one vessel traffic service area to another.

The Resolution describes:

- the principles and general operational provisions for the operation of a VTS and participating vessels; and
- the requirements for the VTS authority to be provided with sufficient staff, appropriately qualified, suitably trained and capable of performing the tasks required.

The Resolution also states that in establishing a VTS, the Contracting Government(s) or the competent authority should:

*“ensure that a legal basis for the operation of a VTS is provided for and that the VTS is operated in accordance with national and international law; and*

- *“ensure that a VTS authority is appointed and legally empowered;”*

#### 4.3. IALA STANDARDS

To achieve world-wide harmonization and improvement of VTS, IALA has developed a document structure to be used in order to develop and publish documents specifically related to the development, implementation, and operation of VTS. The principal components to the IALA document structure include:

- Standards
- Recommendations
- Guidelines
- Model courses

IALA standards are not mandatory; if an organization wishes to claim compliance with an IALA standard however, then it should implement the normative recommendations referenced in the Standard.

IALA standards relating to VTS include:

- 1040 - Vessel Traffic Services
- 1010 - AtoN Planning and Service Requirements
- 1050 - Training and Certification
- 1070 – Information Services



### 4.3.1. RECOMMENDATIONS

IALA Recommendations specify what practices shall be carried out in order to comply with a recommendation, and may be referenced, in full or in part, in an IALA standard.

Recommendations may be referenced as normative or informative, where:

- normative provisions are those with which it is necessary to conform to claim compliance to the Standard;
- informative provisions are those which specify additional desirable practices but with which it is not necessary to conform to claim compliance to the standard.

### 4.3.2. GUIDELINES

IALA guidelines describe how to implement practices normally specified in a recommendation. These documents provide detailed, in depth information on an aspect of a specific subject, indicating options, best practices and suggestions for implementation. IALA guidelines relate to planning, operating, and managing aids to navigation.

### 4.3.3. MODEL COURSES

IALA model courses are training documents which define the level of training and knowledge needed to reach levels of competence defined by IALA. Model courses for VTS include training programmes on the specific knowledge and skill requirements necessary for qualification as a VTS operator and other relevant VTS positions.

#### **IALA DOCUMENTATION RELATING TO VTS**

A reference list of the standards, recommendations, guidelines and model courses specifically related to the implementation and operation of VTS is available on the IALA website.

## 4.4. NATIONAL LAW

Key responsibilities of Contracting Governments and competent authorities in planning and establishing VTS described in IMO Resolution A.857(20) include:

- ensuring that a legal basis for the operation of a VTS is provided for and that the VTS is operated in accordance with national and international law;
- ensuring that a VTS authority is appointed and legally empowered;
- instructing the VTS authority to operate the VTS in accordance with relevant IMO resolutions;
- establishing a policy with respect to violations of VTS regulatory requirements and ensure that this policy is consistent with national law.

**Note: It is recognized that where a legal basis for VTS has not been established in national law it may take some time for this to be established.**

In such situations consideration could be given to proceeding with section 5 (Planning and Implementing) as described below to determine whether or not VTS is the appropriate mechanism to improve the safety and efficiency of navigation, safety of life at sea and the protection of the marine environment for a particular waterway.

## 5. PLANNING AND IMPLEMENTING

The implementation and operation of a VTS to improve the safety and efficiency of navigation, safety of life at sea and the protection of the marine environment is a significant investment. Careful planning should be undertaken to ensure a VTS is implemented effectively, achieves its objectives and is sufficiently resourced and funded on an ongoing basis.

When planning and implementing a VTS, a project management approach is recommended to ensure the major deliverables, assumptions and constraints are clearly documented. This will assist in defining the scope of the VTS, its goals and objectives that need to be met. Project management is considered as a discipline with the purpose to achieve specific goals and objectives by planning, organizing, motivating, and controlling resources.

Relevant international guidance prepared and published by appropriate international organizations regarding project management should be considered, or where there are national requirements for project management, these should be used.

**ISO 21500, Guidance on Project Management, is an international standard issued by the International Organization for Standardization (ISO).**

In summary, the standard:

- Provides high-level description of concepts and processes that are considered to form good practice in project management.
- Can be used by any type of organization, including public, private or community organizations, and for any type of project, irrespective of complexity, size, or duration.

Project management is undertaken in phases in order to improve control and quality. At the end of each phase, a review is typically conducted on the deliverables as well as on the performance of the project team. This helps the team ascertain whether the project proceeds to the next phase or undergoes revision.

This section provides an overview of the five project management phases and the key areas for consideration as they relate to VTS:

1. **Initiating** - This marks the beginning of the project. The goal of this phase is to define the project at a broad level and develop a business case.
2. **Planning** - During this phase, the scope and goals of the project are defined, and a project management plan is developed. It involves identifying the cost, quality, available resources, and a realistic timetable.
3. **Implementing** - This is the phase where deliverables are developed and completed.
4. **Controlling** – This phase is invariably carried out simultaneously with phase 3 (Implementing), thereby ensuring that project objectives and deliverables are met. This phase is about measuring project progression and performance and ensuring that everything happening aligns with the project management plan.
5. **Closing** - The closing processes are used to formally establish that the project phase or project is finished.

Where possible, VTS personnel should be engaged to ensure that their experience is taken into account and they have the opportunity to input into the process. This will also provide the VTS personnel with a sense of “ownership” of the project deliverables.

## 5.1. PHASE 1: INITIATING

The initiation phase is the beginning of the project. In this phase, the idea for the project is explored and elaborated. The goal of this phase is to define the proposed implementation of a VTS at a broad level and its feasibility to address the issues and problems associated with the volume of traffic and degree of risk in the waterway. This is usually undertaken using:

- **Business Case** - This document identifies the need for a VTS. In summary, it provides justification for implementing a VTS, including evaluation of the benefits, cost and risk of alternative options and provides a rationale for the preferred solution.
- **Feasibility study** – The purpose of a feasibility study is to establish whether a VTS is a viable solution to address the issue or problem. The following areas may be considered:

- **Risk** – Identifying and assessing the hazards associated with the volume of traffic and degree of risk in the waterway.
- **Operational feasibility** - Does implementing a VTS meet the authorities needs by solving problems and/or taking advantage of identified opportunities?
- **Legality** - What are the legal requirements to implement a VTS and can these requirements be met?
- **Technical capability** - Does the authority have the technical capabilities and resources to undertake implementing a VTS?
- **Budget** - Does the authority have the financial resources available, and is the cost/benefit analysis sufficient to justify implementing a VTS?
- **Time** - Can a VTS be implemented in a reasonable timeline?

To support this phase a process of comprehensive information gathering, and analysis is inevitably involved. This will enable relevant issues and problems in the maritime area to be identified, assessed, defined, and analyzed. Possible issues and problems relating to ship traffic include:

- interaction of maritime traffic;
- volume and composition of traffic;
- protection of the marine environment and the surrounding area;
- the local conditions such as geography, hydrological/meteorological, and tides.

Whilst there are many different risk management methodologies, IALA offers three risk management tools for assessing the risks in waterways when initiating and planning a VTS. Annex A contains a list of considerations (many of which are incorporated in the IALA risk management toolbox), to assist in:

- determining the need for a VTS;
- defining the functional requirements needed to achieve the desired level of safety and efficiency and protection of the environment; and
- determining the costs associated with implementing VTS and whether the expected reduction in risk would be justified in terms of the level of investment required;

Key components of the IALA risk management toolbox include:

- **PAWSA** – The Ports and Waterways Risk Assessment (PAWSA) tool provides a structured and systematic approach to:
  - identify major waterway safety hazards;
  - estimate risk levels, evaluate potential mitigation measures;
  - set the stage for implementation of selected measures to reduce risk.

As a qualitative tool, PAWSA is exploratory and the analysis seeks to get a deeper understanding of why a certain phenomenon occurs, its associated consequences and the potential effectiveness of additional mitigation measures.

A comprehensive explanation of PAWSA Mk II can be found in IALA Guideline 1124.

- **IWRAP** - The IALA Waterway Risk Assessment Program (IWRAP) risk assessment process provides a standardized, quantitative method to evaluate the probability of collisions and groundings in a given waterway. Using AIS data IWRAP is a Windows-based software program, allowing for different scenarios to be developed, so that changes such as those in traffic volume or composition, route geometry, aids to navigation or the introduction of other mitigating measures, can be modelled.

A comprehensive explanation of IWARP MKII can be found in IALA Guideline 1123:

- **SIRA** - The Simplified IALA Risk Assessment (SIRA) is a simplified qualitative method to assess the volume of traffic and degree of risk and identify potential risk mitigation options to reduce the risks to acceptable levels.

SIRA is particularly applicable where good quality AIS data, on which IWARP depends, is not available or where access to individuals with the necessary level of experience in the risk categories used by PAWSA is limited.

A comprehensive explanation of SIRA can be found in IALA Guideline 1138.

A key outcome of the project's initiation phase is the determination of the project's viability prior to committing the required staff, materials, and finances to the project. Completion of this phase will enable authorities to determine whether a VTS provides a viable solution to address the issues and problems identified and assessed as part of the feasibility study (and to proceed to Phase 2 (Planning) and Phase 3 (Implementing)) or if alternative passive traffic management measures may adequately address the issues and problems identified. Examples of possible passive traffic management measures are provided in Annex B.

Alternatively, it may be determined that a VTS should be implemented, possibly in conjunction with additional or enhanced passive traffic management measures.

## 5.2. PHASE 2: PLANNING

### In the planning phase, competent authorities should ensure:

- They are conversant with all IALA standards, recommendations, guidelines and model courses specifically related to the implementation and operation of VTS.
- They can demonstrate compliance with all the normative provisions of these standards (as explained in Section 4.3).

Once the project is approved to move forward based on the outcomes from Phase 1, the planning phase commences. This phase is key to successful delivery and focuses on developing a roadmap for everyone to follow.

Information collated in Phase 1 as part of preparing documents such as a business case and feasibility study will provide input to the planning phase. This includes the preparation of key documents associated with the planning phase such as:

- **Project plan** - Identifies the project timeline, including the phases of the project, the tasks to be performed, and possible constraints. Financial budgets should be estimated, resources and consideration given to quality deliverables.
- **Functional requirements** - The functional requirements address the issues and problems identified in phase 1.

Typically, functional requirements specify a behaviour or function the VTS is to accomplish. Examples of common functional requirements include:

*“The VTS shall have the capability to display a ‘real time’ common traffic image supporting multiple target feeds (including AIS, Radar, Satellite AIS and CCTV)”*

and

*“The VTS shall have the capability to interact with shipping via VHF voice communications throughout the VTS area”.*

The contents of Annexes A and B should be considered when defining functional requirements.

- **Risk plan** - identifies the anticipated risks and issues that may cause potential quality roadblocks to the project. This is important in the planning phase to mitigate those risks where possible in order to maintain the project's quality and schedule.

- **Communications plan** - Project stakeholders should be identified, and consideration given to establishing the appropriate level of communication with stakeholders relative to their influence and interest in the project. This assists with gathering critical input, planning activities, securing resources needed, building trust, and ultimately gaining the buy-in required.
- **Procurement plan** - Identifies the purchasing requirements to meet the needs of the project. The plan should include objectives and specific protocols for method of procurement to meet the needs of the proposed VTS.
- **Acceptance plan** – Identifies the tasks that need to be completed to implement a VTS and the criteria that must be met before the VTS is declared operational.

### 5.3. PHASE 3: IMPLEMENTING

---

This phase turns the project plan into action by implementing the requirements and tasks described in all of the plans. Particular attention and constant monitoring should be paid to quality of deliverables, risks and issues, schedule, costs, budget and overall project status.

Successful implementation of the project is greatly influenced by:

- the quality of the project documents prepared in Phase 2 (Planning);
- communication with team members, stakeholders, and upper management with regular updates at all levels.

### 5.4. PHASE 4: CONTROLLING

---

Project monitoring and controlling activities contribute to keeping the project on track by ensuring that the project remains within scope, on time and on budget so that the project proceeds with minimal risk. This process involves comparing actual performance with planned performance and taking corrective action to achieve the desired outcome where there are significant deviations.

Unlike the other phases, monitoring and controlling should be continuously performed throughout the life of the project.

### 5.5. PHASE 5: CLOSING

---

In the closing phase, the final deliverables of implementing the VTS have been met and the VTS should be declared operational. Project resources can be released, and the success of the project should be measured including evaluating what did and did not work well with the project.

## **ANNEX A    CONSIDERATIONS WHEN INITIATING AND PLANNING A VTS**

The IALA risk management toolbox provides a detailed methodology for identifying and assessing relevant issues and problems. Considerations when initiating and planning a VTS, and using the toolbox, may include:

### **A.1. TRAFFIC DATA**

Information should be obtained on:

- traffic safety records;
- the complexity of traffic patterns;
- ship traffic densities, including traffic trends;
- any interference by vessel traffic with other marine-based activities;
- information on recent traffic surveys and evaluation of these surveys.;
- breakdown of all vessel traffic in terms of type and size of ships, and categories of cargo carried, especially ships with hazardous and polluting cargos;
- efficiency of maritime traffic flow;
- delays, causes, and costs.
- congestion including location;
- stakeholder feedback.

### **A.2. THE GEOGRAPHY OF THE AREA**

The maritime area should be defined and described in terms of geography. The following areas should be considered:

- narrow and/or winding fairways;
- basins, piers and quays along the fairway;
- number, size, and location of anchorages;
- shallows, shifting shoals;
- navigation hazards such as wrecks, shallow water, or reefs;
- protection of infrastructure such as locks, bridges, or offshore renewable energy installations (OREI);
- established traffic routing measures such as traffic separation schemes (TSS), recommended routes and areas to be avoided);
- geology of the riverbed/seabed and shoreline;
- stability of the riverbed/seabed profile;
- routine dredging operations;
- meteorological conditions (prevailing winds, fog, ice conditions, etc);
- hydrological conditions;
- state of hydrographic surveys.

### **A.3. PROTECTION OF THE MARINE ENVIRONMENT**

Elements to consider include:

- whether the area concerned or part of it is a formally declared 'Particularly Sensitive Sea Area' based on IMO Res. A.720(17), as amended, or whether there are any sensitive areas in the proximity which may be affected by pollutants as a result of shipping accidents;
- whether any fishing grounds and/or fish farms are involved;
- other formal protection of the area based on either international, national or local rules and regulations e.g. whether the area is classified as a 'special area' under MARPOL Annex 1;
- records of marine pollution caused by shipping accidents, and the resulting damage to the economy and the environment in terms of clean-up costs, effects on wildlife, fish stocks and tourism;
- whether there is an established national policy on the protection of the marine environment and any criteria set regarding pollution;
- the views of the general public on the environmental issue and the marine environment in particular;
- the availability of an emergency response organization to respond to a marine incident.

### **A.4. ACCIDENT AND INCIDENT DATA**

Information should be obtained on:

- maritime accidents/incidents in the area, including information on the economic consequences;
- areas with a high frequency of accidents/incidents;
- results of accident/incident investigations;
  - the recorded root causes of the accidents/incidents;
  - any recommendations contained in reports on accidents/incidents, and implementation status of these recommendations;
  - the competency of the crew manning ships entering the area;
- the opinions of stakeholders regarding traffic safety in the area.

### **A.5. VTS AREA**

Elements to consider include:

- delineating the VTS area and, if appropriate, VTS sub-areas or sectors;
- rules for ship traffic such as one-way traffic zones and hazardous cargo;
- allocation of waterway space or management of infrastructure such as locks and bridges;
- types and sizes of ships required or expected to participate in the VTS;
- adjacent VTSs and/or ship reporting systems and co-ordination of operations/procedures.

### **A.6. VTS CENTRE OPERATIONS**

Elements to consider include:

- the operating hours of the VTS;
- tasks to be performed by VTS personnel;

- responsibilities of VTS personnel;
- health and safety considerations;
- structure of information flows;
- operational procedures;
- physical security of the VTS centre and remote sites.

## **A.7. DESIGN AND TECHNOLOGY**

Elements to consider include:

- system users and user requirements;
- general outline for a VTS database; and, if appropriate, a general outline for means to retain and retrieve the traffic image, radio and other communication methods and other relevant information;
- VTS equipment life cycle, warranty, and maintenance (including training for operational use and maintenance);
- basic functional design, including reliability and availability targets;
- back-up and redundancy arrangements for critical equipment such as surveillance and communications equipment to meet reliability and availability targets;
- man/machine interface and human factors.

## **A.8. ALLIED SERVICES**

Support from allied services should be assessed in terms of their contributions, limitations and potential effectiveness, which may include:

- pilotage, including pilot boarding arrangements;
- availability of tug assistance;
- co-operation between authorities, allied services, and the port community, including government agencies such as immigration, customs, coastguard etc.

## **A.9. LEGAL**

Elements to consider include:

- legal framework, consistent with national law;
- policy with respect to violations of VTS regulatory requirements;
- liability.

## **A.10. VTS PERSONNEL, RECRUITMENT AND TRAINING**

Elements to consider include:

- staffing level;
- recruitment;
- qualifications, training and certification;
- managerial requirements.



## **A.11. FUTURE REQUIREMENTS**

Elements to consider include:

- Trends in maritime traffic and future developments which could have an impact on:
  - the number of ships;
  - types and sizes of ships;
  - cargo carried.
- developments in VTS and navigation-related technology;
- implications of future SOLAS carriage requirements for navigational and/or communication equipment onboard and their applicability to ships expected in the VTS Area.

*Note: The SOLAS Convention is not applicable to small craft.*

## **A.12. FINANCIAL**

Elements to consider include:

- funding, including source(s);
- implementation and ongoing operating costs.



## **ANNEX B PASSIVE TRAFFIC MANAGEMENT MEASURES**

Examples of passive traffic management measures to consider as additional or alternative risk mitigation measures to VTS to address the issues and problems associated with the volume of traffic and degree of risk in the waterway include:

- enhancement of the existing legal and organizational framework, such as adjustments in local by-laws, rules and recommendations;
- space allocation policy;
- ships' routing (SOLAS V/10 and IMO resolution A.572(14));
- ship reporting systems (SOLAS V/11 and IMO MSC/Circ.1060);
- enhancements to visual and radio aids to navigation;
- enhanced pilotage requirements;
- dredging or full/partial clearance of navigational hazards to improve safety within navigational channels;
- implementation or enhancement of emergency response organization.