



**Australian Government**

# **MARM5001A Calculate, assess and report on vessel trim and stability**

**Release 1**

# **MARM5001A Calculate, assess and report on vessel trim and stability**

## **Modification History**

Release 1

This is the first release of this unit.

## **Unit Descriptor**

This unit involves the skills and knowledge required to assess and report on vessel trim and intact stability as part of the survey function. It is limited to undertaking practical stability tests, simplified stability calculations, reporting inclining experiments and consideration of damage stability implications.

## **Application of the Unit**

This unit applies to people working in the maritime industry as a domestic commercial vessel marine surveyor and may form part of accreditation requirements for surveyors under Australian legislation.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |  |  |
|--|--|
| <b>1 Plan and prepare stability testing</b>                          | <p>1.1 <i>Applicable stability criteria</i> for class of vessel and its operations are identified and confirmed against <i>regulatory requirements</i></p> <p>1.2 Differences between Uniform Shipping Laws (USL) and National Standard for Commercial Vessels (NSCV) standards for assessing stability are identified and applied to survey plan as required</p> <p>1.3 <i>Information and data</i> is used to establish and verify stability characteristics required for safe operation</p> <p>1.4 Types of stability related hazards that may occur during all types of operations are identified</p> <p>1.5 Range of intended and/or likely vessel loading conditions are accurately identified and their impact on stability is assessed</p> |
| <b>2 Calculate vessel trim and stability</b>                         | <p>2.1 Simplified stability calculations are performed to assess compliance with applicable stability criteria</p> <p>2.2 Stability assessment methods for equivalent solutions are applied as necessary according to regulatory requirements</p> <p>2.3 Trim, draughts and freeboard are measured accurately to safely and efficiently allow assessment of compliance with criteria</p> <p>2.4 Effects of weight distribution that may compromise vessel safety are included in stability assessment</p> <p>2.5 Computer-based stability programs are used as appropriate to assist with assessing compliance</p> <p>2.6 Results are verified to confirm compliance</p> <p>2.7 Vessel is not put at risk during assessment</p>                    |
| <b>3 Apply tests, assessments and theories to confirm compliance</b> | <p>3.1 <i>Tests and assessments</i> that could assist to confirm stability compliance are verified and carried out according to safety instructions</p> <p>3.2 Small angle stability theories are used to establish metacentric height (GM) through transverse movement of weights across vessel deck</p> <p>3.3 Causes of inaccuracies and limitations of assumptions in tests, assessments and theories are interpreted accurately and considered in stability assessment report</p>   |

- 4 Identify other impacts on stability calculations**
- 4.1 *Types and effects of damage* on vessel stability are identified and considered according to regulatory requirements
  - 4.2 Damage *stability considerations* are accurately identified and effect of damage is correctly quantified
  - 4.3 *Operational impact* on stability is identified and considered in compliance assessment
  - 4.4 Vessel safety management plan is reviewed to ensure known or likely impacts on stability are included
- 5 Document and report findings**
- 5.1 Records are maintained and reports are prepared according to regulatory and organisational guidelines
  - 5.2 Survey report is completed according to regulatory requirements

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required Skills:

- Access and interpret a variety of information
- Analyse information and data
- Anticipate and solve problems that may occur in calculations
- Ballast management
- Calculate trim and stability using statutory formula and criteria
- Carry out a range of different stability tests and assessments
- Collate and prepare required documentation
- Collect and accurately interpret valid and reliable data and/or regulations
- Identify and correct causes of erratic or excessive deviation in mass movements during an inclining experiment
- Identify gaps in data and source additional information
- Identify hazards, assess risks, and develop and implement risk treatment options
- Liaise with relevant people to obtain information
- Read and accurately interpret vessel specifications and design drawings
- Relate effectively to people from a range of social, cultural and ethnic backgrounds
- Resolve conflict and negotiate effectively
- Select and use appropriate equipment
- Undertake research
- Use calculation and stability software
- Work independently and unsupervised

### Required Knowledge:

- Application of vessel construction principles and stability assessments applicable to a wide range of operational contexts
- Theories relating to damage stability and precautions to be taken to ensure down-flooding or progressive flooding does not occur
- Calculations and formulas related to determining vessel trim and stability
- Cargo loading and impact on stability
- Configuration and subdivision requirements of a typical vessel including:
  - collision bulkhead
  - down flooding
  - deck edge immersion
  - freeboard and bulkhead deck

- watertight compartments
- weather tight compartments
- vessel bulkhead
- Correct identification and use of equipment and data required for stability tests and calculations
- Damage control measures designed to maintain, stabilise or restore hull watertight integrity
- Definition of intact stability
- Distribution of load on a vessel
- Implications and management of free surface effect
- - Information and data requirements, and statutory documents such as stability book, safety management plans, certificate of operation, vessel history
  - Naval architectural theory to the level necessary to carry out stability assessments for a range of domestic commercial vessels surveyor is intending to survey
  - Procedures for:
    - carrying out an inclining experiment
    - determining weights to be added or subtracted from calculated displacement to determine lightship displacement
    - maintaining vessel security and stability
    - measuring draughts and or freeboard to determine displacement of a vessel i.e. carrying out a lightship measurement
  - Recordkeeping requirements
  - Regulatory requirements for:
    - calculating vessel stability
    - surveying vessels
    - vessel compliance to trim and stability
  - Requirements for conducting a load line survey
  - Risk management
  - Safety management procedures and precautions when determining vessel trim and stability
  - Simplified stability criteria as outlined in NSCV Part C6A and C6C
  - Survey report requirements
  - Typical problems and solutions related to vessel trim and stability
  - Types of simplified stability tests
  - Work health and safety (WHS)/occupational health and safety (OHS) requirements and safe work practices

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, the required skills and knowledge, the range statement and the Assessment Guidelines for the Training Package.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

The evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the Elements, Performance Criteria, Required Skills, Required Knowledge and include:

- analysing, planning and assessing trim and stability for at least five different vessels varying size and operational limits
- carrying out and reporting on at least three inclining experiments and three lightship measurements
- developing effective planning documents
- providing high quality reports
- performing accurate and reliable calculations
- ensuring behaviour reflects relevant current legislative and regulatory requirements.

### **Context of and specific resources for assessment**

Performance is demonstrated consistently over time and in a suitable range of contexts.

Resources for assessment include access to:

- industry-approved marine operations site where calculating, assessing and reporting on vessel trim and stability can be conducted
- tools, equipment and personal protective equipment currently used in industry
- relevant regulatory and equipment documentation that impacts on work activities
- range of relevant exercises, case studies and/or other simulated practical and knowledge assessments
- appropriate range of relevant operational situations in the workplace.

In both real and simulated environments, access is required to:

- relevant and appropriate materials and equipment
- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals.

### **Method of assessment**

Practical assessment must occur in an:

- appropriately simulated workplace environment and/or
- appropriate range of situations in the workplace.

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are

appropriate to this unit:

- direct observation of the candidate calculating, assessing and reporting on vessel trim and stability
- direct observation of the candidate applying relevant WHS/OHS requirements and work practices.

### **Guidance information for assessment**

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

In all cases where practical assessment is used it should be combined with targeted questioning to assess Required Knowledge.

Assessment processes and techniques must be appropriate to the language and literacy requirements of the work being performed and the capacity of the candidate.



## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.

- |  |   |
|--|---|
| Applicable stability criteria may include: | <ul style="list-style-type: none"> <li>• NSCV guidelines</li> <li>• USL Code</li> </ul>   |
| Regulatory requirements may include:       | <ul style="list-style-type: none"> <li>• Marine Safety (Domestic Commercial Vessel) National Law</li> <li>• NSCV</li> </ul>   |
| Information and data may include:          | <ul style="list-style-type: none"> <li>• Cargo information</li> <li>• Load lines</li> <li>• Means to:               <ul style="list-style-type: none"> <li>• sound tanks</li> <li>• read draught marks</li> </ul> </li> <li>• Stability book</li> </ul>   |
| Tests and assessments may include:         | <ul style="list-style-type: none"> <li>• Buoyancy and stability after flooding</li> <li>• Freeboard</li> <li>• Lightship measurement</li> <li>• Practical inclining</li> <li>• Roll period test</li> <li>• Simplified stability tests</li> <li>• Stability proof test</li> </ul>  |
| Types and effects of damage may include:   | <ul style="list-style-type: none"> <li>• Added mass</li> <li>• Flooding</li> <li>• Large amounts of water on deck</li> <li>• Lost buoyancy</li> </ul>   |
| Stability considerations may include:      | <ul style="list-style-type: none"> <li>• Ballast management</li> <li>• Closing openings</li> <li>• Damage control measures to maintain, stabilise or restore watertight integrity of hull</li> <li>• Distribution of load on a vessel</li> <li>• Positioning of stowage and lashing of cargo, stores and equipment</li> <li>• Taking action to avoid or minimise cargo shift</li> <li>• Taking precautions when using lifting equipment and other associated equipment</li> </ul> |
| Operational impact may include:            | <ul style="list-style-type: none"> <li>• Ballast</li> <li>• Cargo</li> <li>• Crew movement</li> <li>• Cross connections</li> </ul>  |

- Lifting gear (including cranes on deck)
- Passengers and passenger movements
- Towing
- Vessel mooring arrangements
- Wind /ice and other weather constraints

## **Unit Sector(s)**

Not applicable.

## **Competency Field**

Marine Surveying