New PIANC Guidelines and Key Considerations for the Design of Dry Bulk Marine Terminals

Richard Morgan, Grace Go

PIANC Working Group 184 is preparing a report titled 'Design Principles for Dry Bulk Marine Terminals'. It is a new PIANC guideline that will be released in late 2018 to address key considerations for designing dry bulk marine terminals. This presentation will outline some background relevant to PIANC, the working group processes and what the WG184 report will contain.

What is PIANC? The letters stand for 'Permanent International Association of Navigation Congresses'.
It is a forum for collaboration amongst professionals from around the world who are involved with technical, economic and environmental issues for waterborne transport infrastructure.

PIANC BACKGROUND

PIANC was established in 1885 and is the longest-standing organisation in the ports and maritime field.
PIANC is non political and not for profit. So far, PIANC has produced 168 technical reports and 21 reports are currently being prepared for publication.

This work is done on a voluntary basis and PIANC genuinely tries to get broad participation from members around the world to produce state-of-the-art guidelines in subjects relevant to the port and maritime industries.

PIANC BACKGROUND

PIANC holds international congresses every 4 years hosted by member countries around the world. The last congress was in San Francisco in 2014 and the next congress is planned to be in Panama City in 2018. One of the highlights of this will be the recent widening of the canal to take larger ships.

Dates and Venues of Congresses since 1947

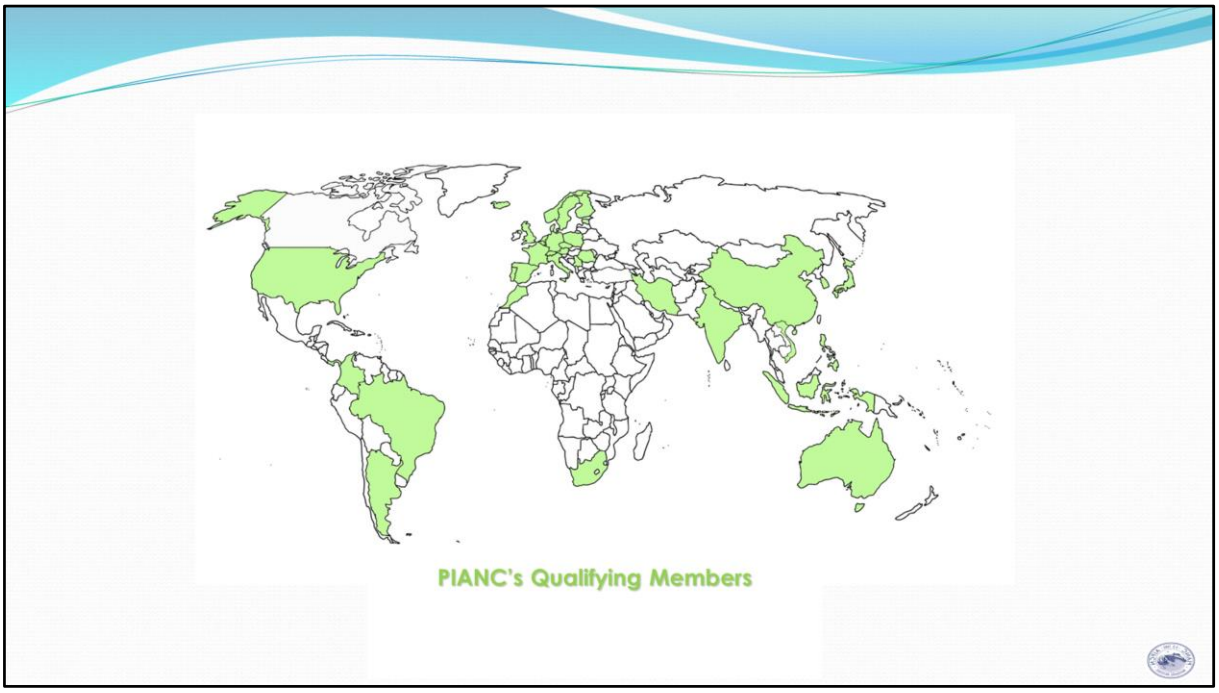
1949	Lisbon
1953	Rome
1957	London
1961	Baltimore
1965	Stockholm
1969	Paris
1973	Ottawa
1977	Leningrad
1981	Edinburgh
1985	Brussels
1990	Osaka
1994	Seville
1998	The Hague
2002	Sydney
2006	Estoril
2010	Liverpool
2014	San Francisco
2018	Panama

These are the congresses held since after World War II. I was fortunate enough to attend the Brussels 1985 Congress which was the century Congress for PIANC and a real milestone event for the organization. The Congress was opened by the King of Belgium so it was a very high profile event in the country which hosts the headquarters of PIANC.

The Australian national section of PIANC, called PIANC Australia, has become increasingly active over recent years. Highlights would be the 2002 PIANC Congress in Sydney and the Australian national group being recognised as the best national group and given a presentation at the 2014 San Francisco Congress.

PIANC MEMBERS

There are more than 2,000 individual PIANC members including students and there are more than 450 corporate PIANC members who are port authorities, chambers of commerce, universities and other public & private-sector organisations.



PIANC is represented in 65 countries and it has international commissions and working groups to reflect the diversity of topics and issues covered.

PIANC has various Commissions. Amongst 8 commissions, there are 4 commissions for technical and scientific activities, focusing on:

Inland navigation (InCom);

Maritime navigation (MarCom);

Recreational navigation (RecCom) and;

Environmental matters (EnviCom).

Working Group 184 sits under MarCom – Maritime Navigation Commission.

Our group was formed in early 2016 to address a key international concern that came to PIANC's attention – the lack of guidelines for planning and designing bulk cargo terminals.

PIANC has produced overall guidelines on Port Planning and a series of guidelines on specialist terminals including oil terminals and small and medium container terminals, and has others in production including RoRo Terminals and LNG terminals.

However, no current guidelines exist for the planning and design of specialist marine terminals for the import and export of bulk solids such as coal, iron ore, grain, aggregates etc. Existing guidelines are dated and technology, vessels and bulk handling equipment technology has progressed rapidly in recent years.

Bulk terminals handle some of the largest vessels in the world. With around 4.55 billion tonnes of bulk solid cargo being transported by sea, it was thought that universal guidelines for site selection, planning and design of terminals would be useful to promote effective, efficient and environmentally sustainable facilities.

Stephen Cork, who chaired WG 158, identified the need for design principles for bulk ports and was instrumental in developing the terms of reference for WG184.

Terms of Reference

1. **Definition of the problem**
   No current guidelines exist for the planning and design of specialist marine terminals for the import and export of bulk solids such as coal, iron ore, grain, aggregates etc.

2. **Objective of the working group**
   To address the site selection, planning and design of the specialist terminals required for the reception and delivery of these products.

   To also address floating trans-shipment operations, self-unloading vessels and transporting dry bulk materials in containers.

Here is an extract from the terms of reference for WG184.

The objective of the group is to address the important aspects considered for planning and designing bulk cargo terminals from selecting an appropriate site to means of transporting dry bulk materials.

Terms of Reference

3. Matters to be investigated

- Location
- Vessel Handling and Mooring
- Water depths
- Cargo Hazard Management
- Handling equipment
- Storage facilities
- Stockyard handling of ores
- Single user terminals
- Trans-shipment
- Environmental and social considerations
- Port Process and Processing

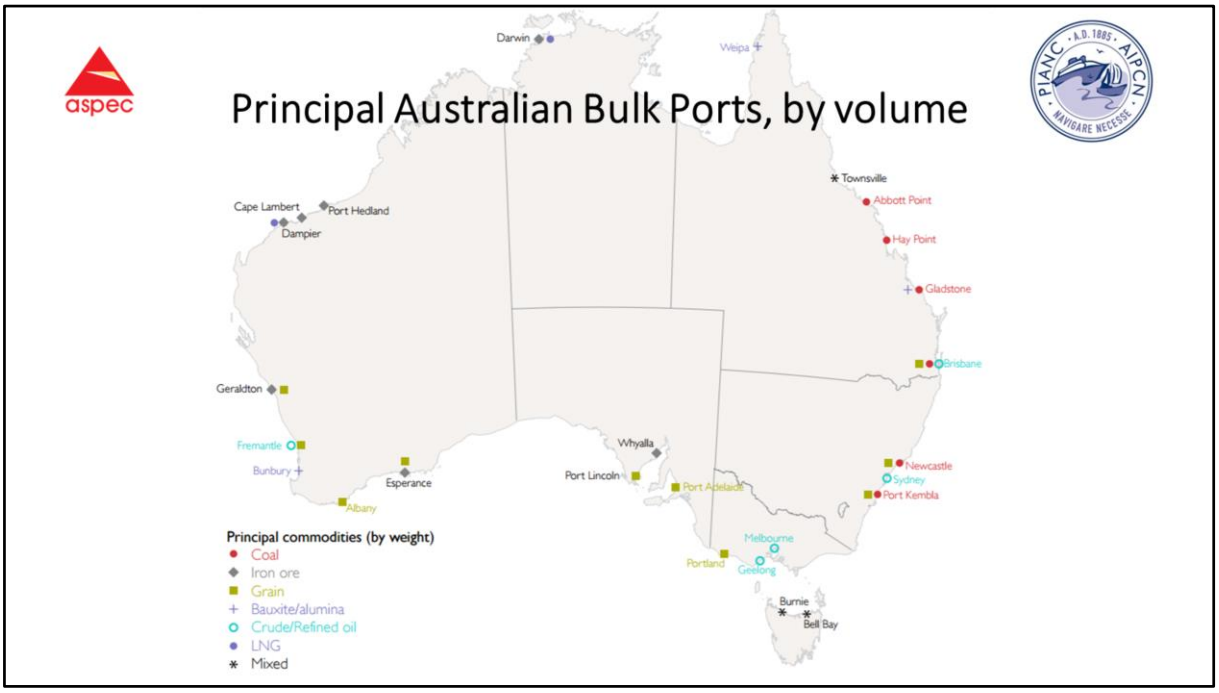
WG184 has created a draft table of contents based on the list of matters to be investigated, stated in the Terms of Reference.

PIANC Guidelines Principle

- Review other work and PIANC reports
- Refer to other guidelines / publications where relevant
- Avoid repetition

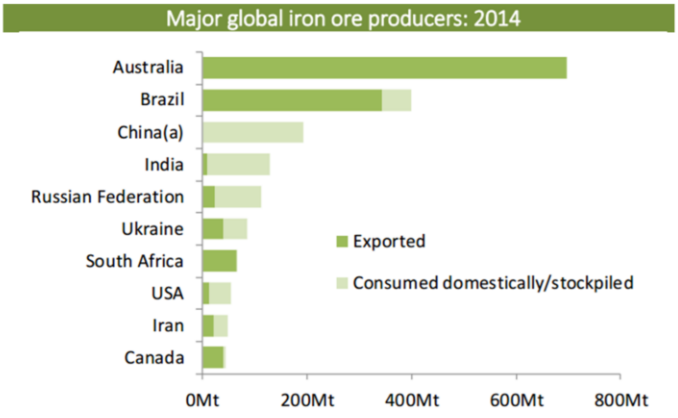
PIANC guideline principles are adopted in the process of writing the report. We review other work and published PIANC reports to understand what has been previously covered.

We then refer to other PIANC guidelines in our report where appropriate and try not to recreate what has already been covered – for example, design of fender systems, channels, breakwaters etc.



WG184 is unique in that it is the first PIANC group that has been chaired by Australia. It makes sense because Australia is significant in the bulk port space. Australia's principal bulk ports manage commodities such as coal, iron ore, grain and bauxite on a large scale.

Iron Ore



For example, 37% of global iron ore exports come from Australia.

Coal

Rank	Exporter	2015 Coal Exports	% World Total
1.	Australia	US$28.4 billion	36%
2.	Indonesia	$16.4 billion	20.8%
3.	Russia	$9.3 billion	11.7%
4.	United States	$5.7 billion	7.2%
5.	South Africa	$4.3 billion	5.4%
6.	Colombia	$4.3 billion	5.4%
7.	Netherlands	$3 billion	3.8%
8.	Canada	$2.7 billion	3.4%
9.	North Korea	$1.1 billion	1.4%
10.	Poland	$737.2 million	0.9%

And 36% of coal exports come from Australia.

PIANC WG184

In this photo (from left):

Marko Poot (The Netherlands)
Bob Lamont-Smith (Australia)
José Manuel García Muiña (Spain)
José Ángel de Martino Tenas (Spain)
Richard Morgan (Australia)
Geraldo S. Araujo (USA)
Chris Jones (UK)

Taken in Madrid,
September 2016

There are 11 members in WG184. This picture was taken in Madrid, September 2016 during the second international meeting.

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0.0 Preface	Jose Garcia - Spain
1.0 Overview of Dry Bulk Marine Terminals	Bob Lamont-Smith – Australia
2.0 Bulk Shipping	Bob Lamont-Smith – Australia
3.0 Terminal Planning Considerations and Design Variables	Geraldo Araujo - USA
4.0 Terminal Loading / Unloading Infrastructure	Chris Jones - UK
5.0 Materials Handling Systems and Equipment	Marko Poot – Netherlands
6.0 Project Implementation Process	Richard Morgan - Australia
7.0 Operations and Maintenance	Jose Angel – Spain
8.0 Dry Bulk Shipping Hazards	Bob Lamont-Smith – Australia
9.0 Environmental & social constraints	Jim Stoddart - Australia
10.0 Case Studies	Peter Kastrup - Australia

These are the chapters in the report. Principal authors have been allocated. In some cases, there is a secondary author. The whole group gets involved in review of the material with other experts called upon as required for specific areas.

Milestones

Date	Milestones
2/3/2016	Kick-off meeting in Belgium
18/5/2016	International Teleconference 1
13/7/2016	International Teleconference 2
5-7/9/2016	International Face-to-Face Meeting 1 in Madrid-Gijon
7/12/2016	International Teleconference 3
June 2017	Perth meeting
October 2017	Rotterdam meeting
March 2018	Draft Report Submission
May 2018	Presentation to MarCom
September 2018	Final Report

WG184 members have been working together through teleconferences and face to face meetings on a regular basis. The initial kickoff face-to-face meeting was held in Brussels in March 2016. The next face-to-face meeting was held in Spain in September 2016. Future face-to-face meetings will be held in Perth and Rotterdam. It is planned to have a draft report ready in the 1st quarter of 2018 and the final report in the 3rd quarter of 2018.

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- 0.4 Scope of the guideline
- 0.5 Working Group

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- 1.3 Shipping types
- 1.4 Bulk Terminal types
- 1.5 Key Elements of bulk terminals
- 1.6 Associated infrastructure
- 1.7 Land Requirements, Zoning & Approvals
- 1.8 Navigation Channels:

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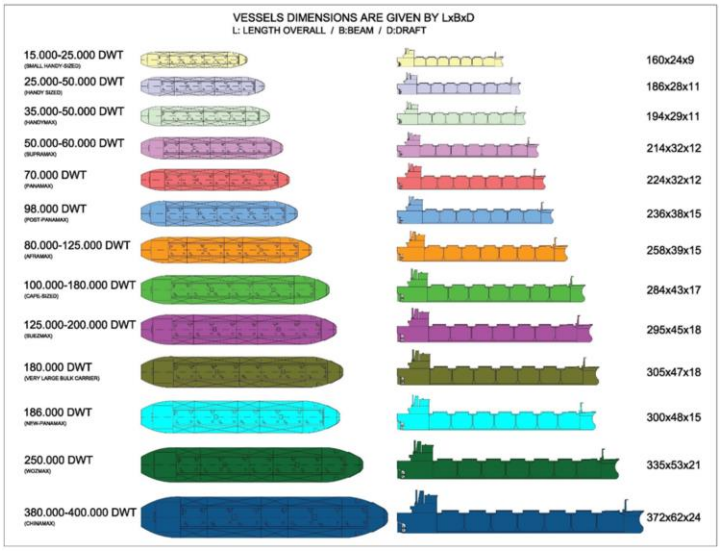
- 2.2 Bulk Shipping Fleet
- 2.3 Bulk Shipping Categories & Sizes
- 2.4 Shipping Dimensions
- 2.5 Important Bulk Shipping Issues
- 2.6 Vessel Handling
- 2.7 Mooring of Bulk vessels

3.0 Terminal Planning Considerations and Design Variables
- 3.1 Introduction
- 3.2 Terminal Planning Parameters
- 3.3 Terminal Location
- 3.4 Terminal Sizing
- 3.5 Economic Considerations

Here is a level-two table of contents for the WG184 report. The first two chapters – Chapters 0 and 1 – provide background information and an overview of dry bulk marine terminals.



Considered vessels in range of small, mid-sized, and conventional LNG vessels

For example, general information about shipping fleets is included in these chapters.

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Chapter 2 then goes into bulk shipping. Chapter 3 looks at terminal planning considerations and design variables. One of the key matters investigated by the group is site selection – this is discussed in Chapter 3.

From a planning standpoint, the selection of a terminal location will depend on key aspects related to the terminal business objectives, physical requirements and site conditions. How to select the most appropriate site for an export and import bulk terminal and its relevance to effective port processes and operations can be found in the report.

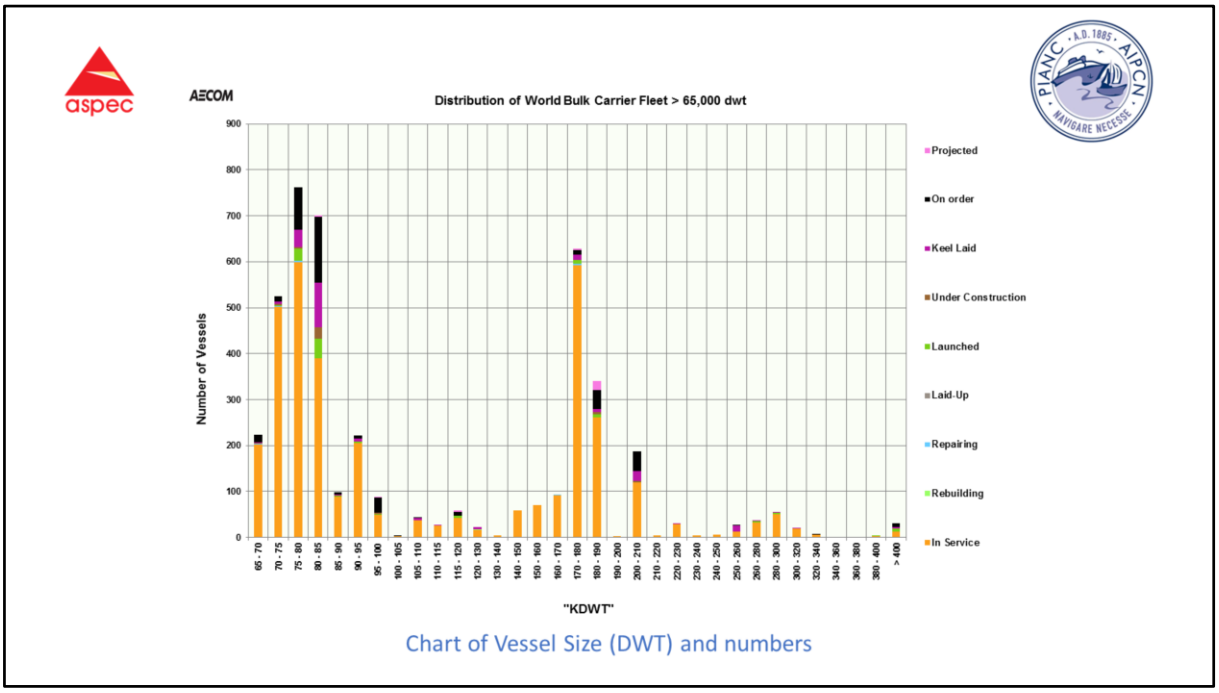
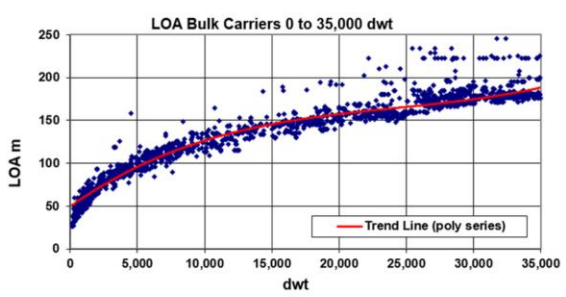
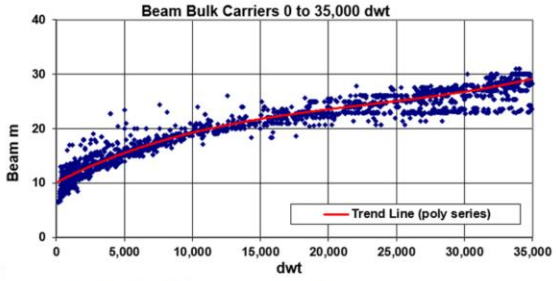


Chart of Vessel Size (DWT) and numbers

Chapter 2 covers bulk shipping including ship sizes. You can see here a graph of the distribution of ship sizes greater than 65,000 dwt (deadweight tonnes) from this chapter.





Length overall (LOA) and beam vs deadweight tonnage (dwt)

Here are also some graphs showing varying shipping dimensions in Chapter 2.
Length overall (LOA) and beam vs deadweight tonnage (dwt). Trend lines have been plotted to give some overall guidance of generic dimensions for ships.

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7.0 Operations and Maintenance
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8.0 Dry Bulk Shipping Hazards
- 8.1 Types of Hazard
- 8.2 Management & Mitigation of Hazards
- 8.3 Applicable Standards and Legislation
- 8.4 Responsibility

As we move onto Chapter 4, we look at terminal loading and unloading infrastructure at open sea terminals, protected harbor, nearshore transshipment terminals, etc. Chapter 5 explains materials handling systems and equipment.

Inshore Berth

Open sea terminal

Chapter 4 covers both protected harbours and open sea terminals. On the left, you can see an inshore berth in a protected harbour. On the right, an open sea terminal.

Mooring System

Chapter 4 also covers mooring systems.

Here you can see different types of unloading equipment from Chapter 5 including grabs and continuous unloaders. Bulk ports generally require high capacity loading and unloading equipment. However, there is a large variety of types of equipment available which will affect the configuration of the terminal. The commodity type also has a large influence on the equipment selection.

These are typical types of stacking machines from Chapter 5. Here, you can see a skyline conveyor, slewing-luffing stacker, wing stacker, fixed luffing stacker and stacker-reclaimer.

Trans-shipment solutions are being used more extensively these days and a large number of different systems are available, some of which are shown here. Key considerations for trans-shipment and equipment types are also discussed in Chapter 5.

The top left image shows a simple grab base system. The top and bottom right systems are a combination of grab unloading from the barge and conveyor loading of the ship. The bottom left system is fully enclosed with a bucketwheel reclaim system in the barge and a conveyor for loading the ship.

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Chapter 6 looks at project implementation process from study phase to commissioning. Chapter 7 then describes terminal operations and maintenance. Chapter 8 looks at hazards involved in bulk terminals and shipping.

Modular construction

One of the construction methods discussed in Chapter 6 is Modular Construction whereby large components are fabricated offsite and transported to site by heavy lift ship or barge.

Control Cabin

Chapter 7 – operations and maintenance – recognises the increasing trend for more automation for operations. For example, there is a trend to make much greater use of video cameras and sensors. The technology for remote operation of equipment is also advancing rapidly.

Loading sequence hazard

One of the dry bulk shipping hazards included in Chapter 8 is loading sequence hazard which resolve in severe economic loss if an event like this happens.

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9.1 Working with Nature (Refer to PIANC EnviCom documents)

9.2 Marine environment

9.3 Terrestrial environment

9.4 Social environment

9.5 Pollution

9.6 Climate Change

10.0 Case Studies

10.1 Herb Elliott Port, Port Hedland, Australia

10.2 EMO Terminal, Rotterdam, The Netherlands

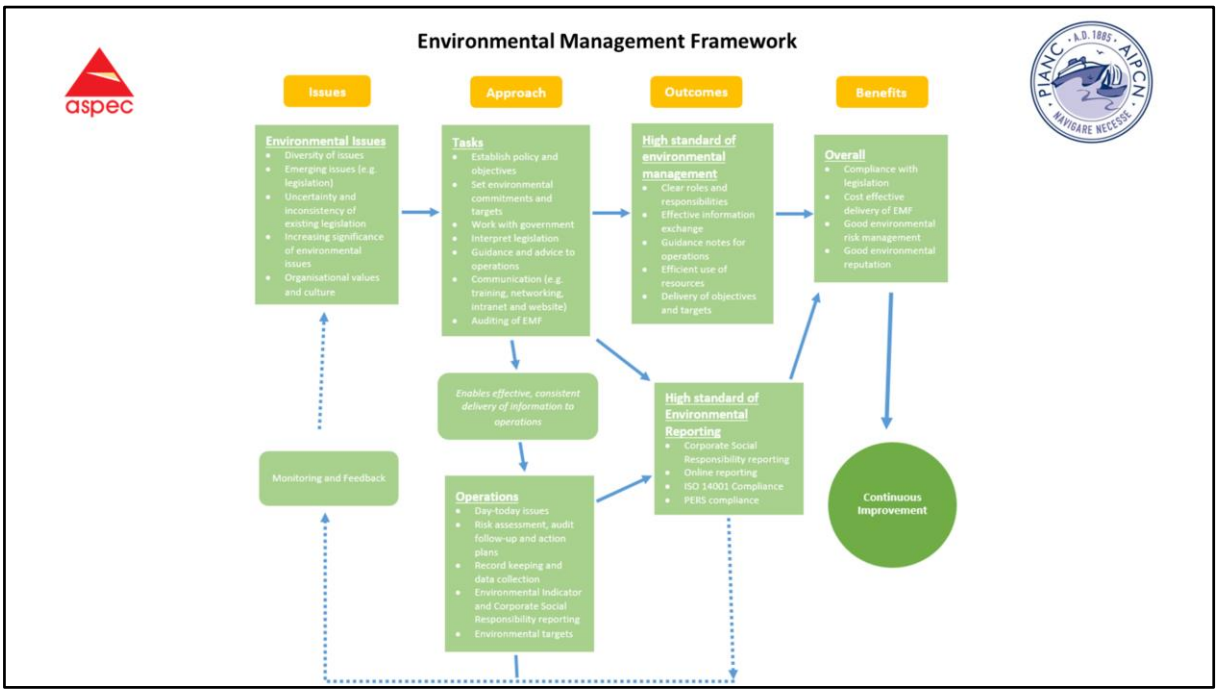
10.4 Balikpapan Coal Terminal, East Kalimantan, Indonesia

10.5 A Grain Terminal, North America

10.6 Gijon Port, Spain

Chapter 9 looks at environmental challenges and social concerns relevant to port development and bulk handling terminals.
The report covers general principles that an owner would be looking for to meet the requirements of modern ports. Each country will have specific requirements for approval process. Depending on the country, environmental considerations can be a huge driver for project timelines and budgets.

The environmental section of the report has been thus written in a broad manner due to the varying circumstances of bulk terminals. For example, import or export, commodity type, country regulations etc.



However, a general approach to consider the environment in bulk operations is to use an Environmental Management Framework called EMF. The framework has 4 stages: Issues, Approach, Outcomes and Benefits.

Environmental issues are first determined and tasks are set as ‘approaches to issues’ and are executed down to specific concerns. Methods for achieving outcomes are then translated into operational procedures. Overall benefits include compliance with legislation, cost effective delivery, good environmental risk management and good environmental reputation.

Finally, the EMF is focused on feedback and continuous improvement.

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Lastly, WG184 has built a separate chapter for case studies. Chapter 10 will show an overview of different types of bulk ports in different countries. The group aims to visit the sites considered for this case study chapter.

Case Study – Port of Gijón

EBHI =
European Bulk
Handling Instalation

Situated at the center of the North Atlantic Coast of Spain, in Asturias

During the second international meeting in Spain, September 2016, the working group visited Port of Gijon, which is situated at the center of the North Atlantic Coast of Spain, in Asturias.

Case Study – Port of Gijón

The current bulk handling terminal at Gijon port was built in 1991 and primarily provides services to the Arcelor-Mittal steelworks. It is operated by EBHISA, a company with a majority ownership by the Port Authority of Gijon, plus a steelmaking group, (Arcelor-Mittal), an energy group (EDP Energía) and a cement Group (Industria Masaveu).

Case Study – Port Hedland

The second case study will be the FMG facility at Port Hedland.
The Port of Port Hedland is the world's largest bulk export port and is located in the East Pilbara region of WA, about 1,650 kilometres north of Perth. Trade through the port mostly consists of iron ore exports.

The port became the first in Australia to exceed 100 million tonnes in the 2005/06 financial year, and since then the demand for iron ore has continued to drive port growth exponentially. The arrival of iron ore exporters Fortescue Metals Group (FMG) and Atlas Iron saw the total throughput increase and reach record highs in the 2014/15 financial year in excess of 447 million tonnes (Mt).

Case Study Table

Table 1: Terminal Overview Parameters

Case Study Info	Parameter
Bulk material(s)	
Import/export	
Greenfield/brownfield	
Transshipment	
Landward connection for bulk	
Environmental project drivers – planning & construction	
Environmental project drivers - ongoing	
Safety	
Social/community project drivers	

Table 2: Terminal Staging Parameters

Info / Stage (& berth no.)	1	2	3
Stage Throughput Capacity (MTpa)			
Total Throughput Capacity (MTpa)			
Year Completed			
No. of Berths (per stage)			
No. of Berths (total)			
Max. Design Vessel DWT (T) [11]			
Berth Design Draft (m) [11]			
Max. Design Vessel LOA (m) [11]			
Max. Design Vessel Beam (m) [11]			
Max. Sailing Tide level (mCD)			
Min. Sailing Tide level (mCD)			
Max. no. of sailings per day (no.)			
Berth Utilisation (%)			
No. of Shiploaders (per stage)			
No. of Shiploaders (total) [3]			
No. of Stackers (per stage)			
No. of Stackers (total) [3]			
No. of Reclaimers (per stage)			
No. of Reclaimers (total) [3]			
Stockyard Capacity – Live (Mt)			
Stockyard Capacity – Dead (Mt)			
Port Conveyor belt length (km)			
Train – Unloaders (per stage)			
Train – Unloaders (total) [3]			
Train – Total Capacity (Mt)			
Trains per day (no.)			
Avg. Train Cycle Time, Pit - Port (h)			
Train – Total Length (m)			
Train – No. of wagons (no.)			
Train – Wagon size (t)			

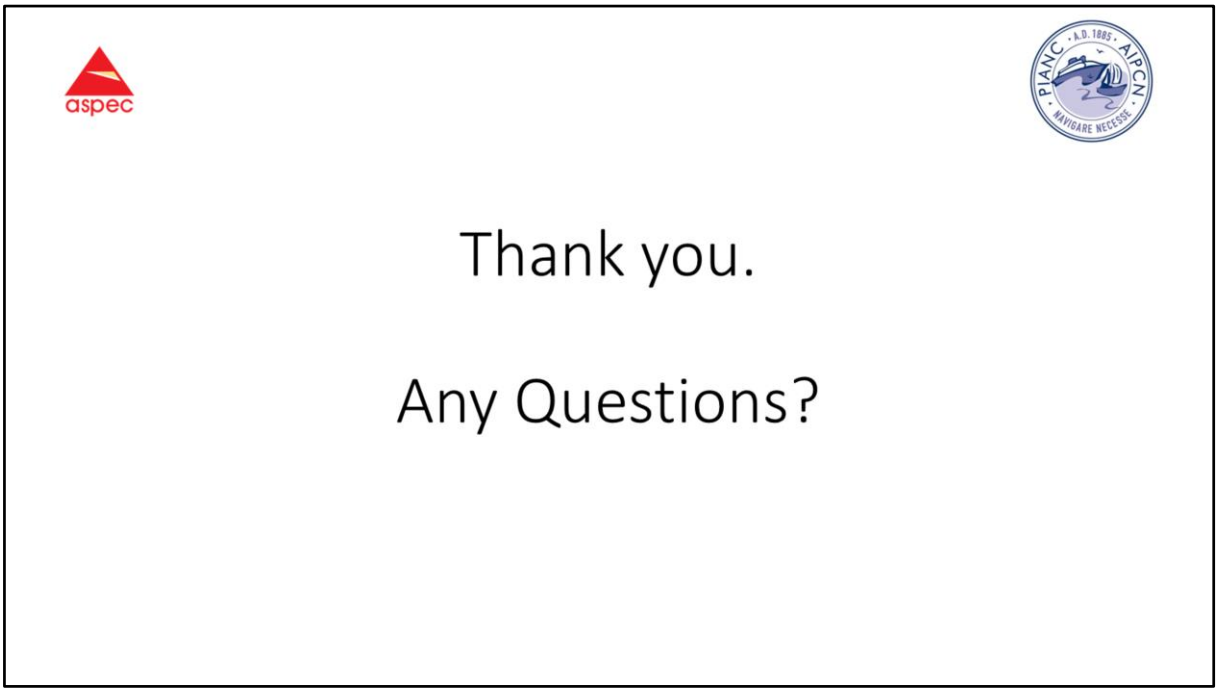
In the Case Study chapter, data will be included on case studies in the form of tables as shown here.
Table 1 will outline terminal overview parameters such as bulk materials, use of trans-shipment and social/community project drivers.

To better understand the history of terminal operations, terminal staging parameters will also be detailed in Table 2. You will be able to find stage information including stage throughput capacity, no. of materials handling machines, stockyard capacity etc.

Three Takeaways

- WG184 report (Design principles for Dry Bulk Marine Terminals) will be released in ***late 2018***.
- The document aims to summarise ***current knowledge*** and ***best practice***.
- The document will be a very ***useful reference*** for those involved in all phases of bulk materials handling terminals.

Overall, the WG184 report comprises 11 chapters that aim to summarise current knowledge and best practice in designing dry bulk terminals. The report will be released in late 2018 and it will be a very useful reference for those involved in all phases of bulk materials handling terminals. The report can act as a checklist for both clients and consultants implementing bulk terminal projects.


aspec
PIANC
A.D. 1885
AIPCN
NAVIGARE NECESSE
Thank you.
Any Questions?

Thank you.