

GENERAL SPECIFICATION

CIVIL WORKS

GS EP CIV 203

Design of harbour

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1. Scope

This general specification is to define marine facilities for TOTAL E&P Oil & Gas harbour.

The harbour, which is dealt with in this specification, shall be used by the Company for its sea or river installations and possibly to ensure commercial traffic, after agreement has been reached between the Company and the government of the country in question.

Engineering Contractor scope of work is provided following project schedule.

This specification may be subject to modification or addition if the Company so considers

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the Contract.

When local national standards, regulations and codes exist, all design, engineering, materials and construction shall conform to their latest requirements, which complete or modify the present specifications.

In case of lack of obligatory local national standards, international norms and standards will be applied.

In case of lack of international norms and standards, national norms and standards listed hereafter will be applied.

In all cases the system adopted shall be coherent, i.e. the various texts shall present no incompatibility. Any dispute shall be resolved by basing works on the most stringent text for Engineer and at his expense.

The list of specifications and norms quoted is not exhaustive: Engineer shall respect the secondary standards and regulations, which cover the works described in the present specification.

Certain specifications and norms may be indicated with an issue date. This is for information only and on the understanding that the most recent issue shall be used.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
California code of Regulation (CCR)	Chapter 31F [For SLC] Marine Oil Terminals
EN ISO 28460	Installation and equipment for liquefied natural gas - Ship-to-shore interface and port operations
ISO 19906	Arctic offshore structures

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Reference	Title
PIANC Report 116	Aspects Affecting the Berthing Operations of Tankers to Oil and Gas Terminals (2012)
PIANC Report 124	Dredging and Port Construction: Interactions with Features of Archaeological or Heritage Interest (2014)
PIANC Report 153	Recommendations for the Design and Assessment of Marine Oil and Petrochemical Terminals (2016)
Rock Manual	The use of rock in hydraulic engineering (2007)
ROSA	French Recommendations « Recommandations pour les Ouvrages en Site Aquatiques 2000 »
US Army Corps of Engineer	Coastal Engineering Manual, EM1110-2-1100

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Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP CIV 102	Dredging and Reclamation Works
GS EP ENV 112	Environmental baseline and monitoring studies: Offshore and Nearshore Sites
GS EP ENV 120	Environmental impact assessment of E&P activities
GS EP GEO 501	Meteorological and Oceanographic Survey
GS EP GEO 504	Comprehensive evaluation of metocean conditions
GS EP GEO 505	Monitoring of Metocean Conditions for Offshore Units

3. Harbour layout and interfaces

Typical harbor for TOTAL E&P project may include:

- Jetty(ies), berth(s) and trestle(s) with loading or off-loading facilities
- Tug harbor with facilities
- Breakwater when necessary
- Channel and turning basin.

For logistics issues, a Marine Off-loading Facilities (MOF) could be required to bring material, modules, people and goods. The main difference will be on water depth and wave agitation at berth/quay (see dedicated chapter in this document).

Various berth alternatives may be assessed for accommodating project requirements regarding different kind of ships, downtime targets, cost efficiency for CAPEX or OPEX, environmental regulations and safety issues.

All port plans represent a set of compromises and each activity required an evaluation to address the most efficient from the open sea, through the approach channel, the harbor basin, the berth and the terminal.

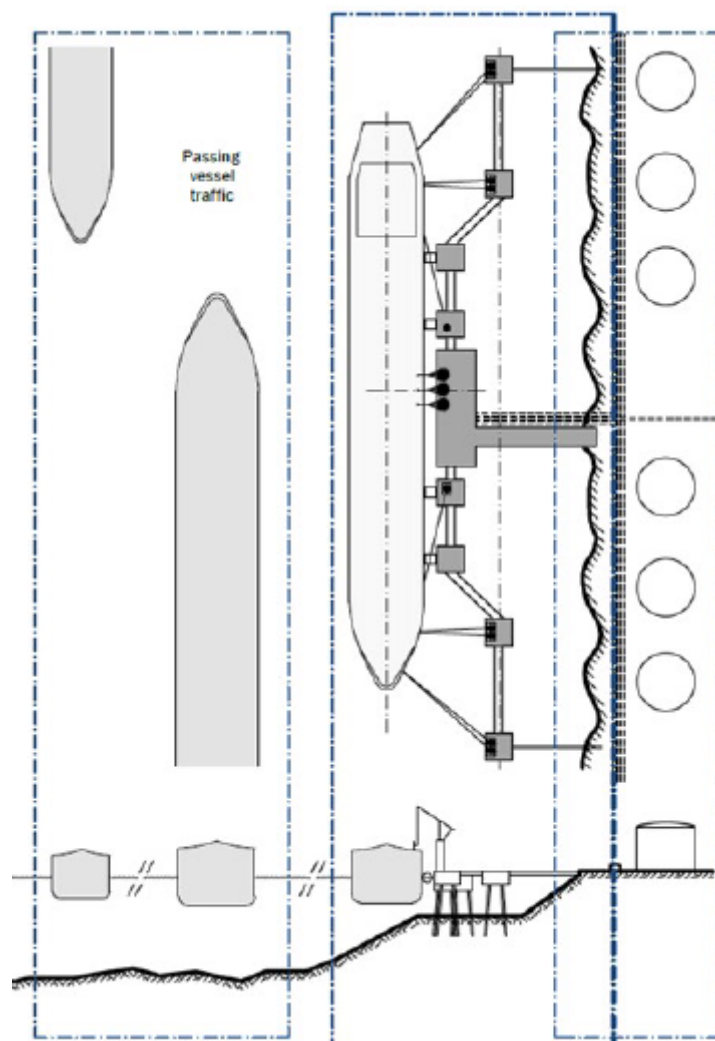
Figure 1: typical E&P harbour layout with jetty, berth, trestle and MOF.



Battery limits of the project shall be drawn and responsibility matrix developed to define responsibilities of each parties involved in the design and later in operation.

Typical interfaces are proposed in Figure 2.

Figure 2: typical interfaces (drawing from [PIANC Report 153](#)) from channel (to the left) to plant/terminal (to the right)



It's strongly recommended to contract Marine Consulting Engineers (Engineer) perform harbour studies as soon as possible in the Project process as this topic could have a major cost and schedule impact, as it's a costly works but provide an easy access point to supply the site for construction phases.

In order to perform a planning of harbour, several items shall be provided to Engineer by Company taken into account pioneer access to operation phase,:

- Scope of the overall project with functional requirements
- Types and specifications of ships with traffic expected
- Coastal and maritime conditions
- Berth and land area requirements
- Growth factors

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- Impacts studies
- Site evaluations from existing areas to potential areas taking into account neighbours
- Typical plan
- Economics
- Schedule.

It's recommended to perform such list phase by phase of the project to avoid over design (with temporary facilities) or bottleneck of operating tasks.

These items are the purpose of the Engineer studies and outlined in the following section of this GS in order to describe closer studies and assessments required in connection with proper harbour planning.

The main output expected from Engineer on the first phase shall be the Basis of Design with applicable codes and standards, service design life, operations thresholds.

3.1 Input data (Project's needs)

In the following section, Company will find items that have to be addressed in order to clearly define functionalities and requirements of the harbour of the project that will be included in the Statement Of Requirement (SoR) of the project.

Local contexts, either environmental, weather or administrative conditions are part of input data required to perform studies and provide the proper layout.

Typically, an E&P project of harbour will address following facilities:

- Harbour master control, technical block (e.g. electrical, instrumentation)
- Safety, fire-fighting and rescue building
- Workshop/garage
- Electricity generator installations
- Potable water installations and networks
- Bunkering
- Internal road system
- Fire water from the sea networks, electricity and telephone networks
- Housing accommodation and general living quarters
- Customs office and/or police station with customs storage area
- Fence and guardhouse.

In case of a methane carrier berth, the following shall be added:

- LNG tanks
- Piping for connecting vessels to the various parts of the facilities
- Gas pour recovery system

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- Circuit for LNG intake with pumps
- Regasification unit
- Flare and utilities such as nitrogen and inert gas units
- Buildings such as control room and terminal control required for the operation of the facilities.

3.1.1 Operating conditions

Company shall provide operating conditions of channel and harbour for approaches, berthing, and operations of loading/offloading, departure, stand-by, and maintenance.

In case an agreement need to be reached between the Company and the Authorities, the Company shall provide to Engineer all the information related to the traffic that will use Company's harbour (commercial, fishing, customs, etc.).

3.1.2 Type of harbour and berth structures

From open sea to full protected area (behind a breakwater), Company has to determine drivers of choice.

One of the firsts decision will be to determine if the harbour will be use as a refuge for vessel in surrounding area in case of storm. Usually, it's dealing with the local authorities. This choice could drive the requirement or not of a breakwater and other facilities.

An operation principle is needed to establish how the facility is expected to be rrn and that could drive some technical choice (unmanned, tug assistance mandatory, etc.).

Mainly, traffic expected will provide a key parameter through the acceptable downtime for process and economics concerns. In open sea, weather and wave motion will impact the berth availability with a lower CAPEX while with a breakwater the traffic could be increased where ships will always find good conditions to dock.

Preliminary study (chapter 6.3) will estimate ship berth downtime considering open berth solution (without breakwater) based on the wind and wave time series at each site and using preliminary wind and wave thresholds for ship operations.

Another item will be local geography of potential sites. Protected area from wave with enough water depth as close as possible to the shore will be the target. Chapter 4 addresses site condition assessments, but it's recommended to perform topographic and bathymetric survey as early stage of the project even they could be done with different level of accuracy.

3.1.3 Traffic statistics

Procedures, tonnages and volumes, frequency, time of loading and discharging have to be provided by Company to address downtime study.

3.1.4 Typical ships

At early design phases, data provided in [PIANC Report 116](#) and [PIANC Report 153](#) can be used. But, before screening study, Company shall provide dimensions of expected vessels.

From TOTAL database, additional aids are provided in annexe to help Engineer to catch the right requirements and thresholds for the project and the future.

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Engineer will size the new harbour and the construction phases based on the actual and future types of vessels.

3.1.5 Platforms and Trestles

Loading platform and trestle functional requirements shall be provided by Company:

- Operating envelope for loading arms and other equipment
- Ship/shore access
- Pedestrian and/or vehicular traffic access
- Mooring/berthing equipment requirements
- Provision for power, potable water and other utilities
- Firefighting resources, availability and reliability (water and foam)
- Service and tug vessel requirements
- Design wave philosophy (e.g. deck/dolphin elevations, over topping, air gap)
- Durability philosophy (e.g. corrosion protection, coatings, wraps, etc.)
- Differential elevation (e.g. gravity flow, pumping rates, valves).

3.1.6 Cargo transfers and pipelines

Cargo transfer and pipeline systems/functional requirements shall be provided by Company:

- Characteristics of products (e.g. temperature, flammability, specific weight, viscosity, toxicity, etc.)
- Design conditions for the loading/unloading
- Number and size of product lines
- Fire water lines
- Number and size of loading arms/loading hoses
- Powered Emergency Release Coupling (PERC) requirements/loading hoses with break-away couplings
- Oil drainage facilities and containment
- Utilities (e.g. nitrogen, inert gas and natural gas lines)
- Color coding of pipelines (e.g. red for fire water lines).

3.1.7 Coastal and maritime conditions

A harbour plan should include information about:

- General conditions concerning navigation between open sea and berths facilities
- Length, width and depth of access channel and basin area and depth alongside if any
- Recording of submarine point of interest such as cable, corals, pipe, etc.

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- Recording of aerial obstruction (bridge, high voltage lines, etc.)
- In harsh environment, need for shelter
- Requirements regarding pilot services, safety zones, tugboat assistance
- Possible restriction regarding berthing and departure times.

3.1.8 Land area requirements

At early stage, it is advisable to divide the harbor into activity zones with connections required to perform space planning study

To determine land area required, the following inputs are needed:

- Plant location
- Maritime traffic
- Location, number and size of berths
- Land areas for storage, access road, restricted area
- Demand for auxiliary services and installations
 - Electricity, water, telecom, lighting
 - Mooring facilities and fenders
 - Waste disposal
 - Fire fighting equipments
 - Oil protection equipment
 - Water and fuel bunkering
 - Maintenance
- Local authorities' demands

All along project phases, these inputs will be adjusted with Engineer studies results to full fill the operating thresholds and fit for purpose design philosophy.

In E&P project, for construction strategy issues, marine off-loading facilities could be required. During operations, marine buildings and facilities for tugs assistance are mandatory.

Project must evaluate with Engineer opportunities to transform the MOF in Marine facilities.

3.1.9 Growth factors

Project will try to provide traffic growth during operation phase and industrial developments expected or possible.

Environmental problems could be addressed also as a kind of growth factor (sedimentation issues for example)

3.1.10 Maximum unit loads to be handled

Company shall inform Engineer of the maximum unit loads to be handled.